PERMIT SUMMARY SHEET
Division of Mineral Resources Management

Permit Number: D-425

Application Number: D-0425-5

See permit cover sheet for specific conditions and hydrologic monitoring requirements.

Inspector's Note:
This summary is designed only to advise you of important provisions of a permit that require your attention and monitoring. Your familiarity with requirements and permitted activities will insure that mining and reclamation occurs as was intended and approved at the time of permit issuance. Please take the time to review relevant provisions of the permit carefully and thoroughly. Should you have questions about this or any permit, please do not hesitate to contact the application manager within the Permitting Section.

Items marked are applicable to this permit:

- ☐ Auger Mining (attachment 18)
- ☐ Alternate Resoiling Material (attachment 19)
- ☐ Blasting Plans
- ☐ Buffer Zone Variance Request (BZVR)
- ☐ Coal Waste Disposal (attachment 28)
- ☐ Delay in Contemporaneous Reclamation
- ☐ Excess Spoil Disposal
- ☐ Experimental Mining Practices
- ☐ Federal Lands
- ☐ Mountain Top Removal
- ☐ MSHA Impoundment
- ☐ AML No-Cost Area
- ☐ Prime Farmlands (attachment 15)
- ☐ Remining (attachment 33)
- ☐ Remining (Modified effluent)
- ☐ Special handling of acid-forming/toxic material
- ☐ Beneficial Use of CCB's (Att. 34)
- ☐ Public Road Permit (attachment 9)
- ☐ Small Area Drainage Exemption (SADE)
- ☐ Steep Slope Mining
- ☐ Slurry Impoundment
- ☑ Test Hole Variance
- ☐ Variance from AOC
- ☐ Wetlands Affectment/Avoidance
- ☐ Within 500' of active UG mine
- ☑ Within 500' of abandoned UG mine
- ☐ Within 100' of a cemetery
- ☐ Within 300' of occupied dwelling (attachment 10)
- ☐ Within 300' of public building, church, school, community or institutional building or public
- ☐ Within 1000' of wild, scenic or recreational river
- ☐ OEPA 401/COE 404 permits needed for wetlands or stream affectment and/or reconstruction
- ☐ Tree Planting in Reclamation Plans

Application Manager: Scott Stiteler, Application Manager **Date:** 8-4-05

OPERATOR

F103 Rev: 07/01/2001

OHIO DEPARTMENT OF NATURAL RESOURCES
MINERAL RESOURCES MANAGEMENT

COAL MINING AND RECLAMATION PERMIT

REVISED 3-7-06 RSS

Issued To: AMERICAN ENERGY CORP
43521 Mayhugh Hill Rd.
Twp Hwy 88
Beallsville, OH 43716

Telephone: (740) 926-9152

Permit Number: D-425
Application Number: D-0425-5
Acreage: 0
Underground Acreage: 3605.5

Effective: 08/04/2005
Expires: 10/21/2009

REVISED 4-17-07

Type of Operation: Underground (Longwall)

CONDITIONS

CONDITION TYPE	DESCRIPTION
Archeology	No planned subsidence mining may occur (except for the three northern most panels which do not contain historic structures) until the division and the Ohio Historic Preservation Office has approved the historic architectural survey report.
Subsidence	~~No planned subsidence operations may be conducted (except for the three northern most panels) until a subsidence control plan has been submitted and approved through an APP.~~ 4-17-07

The issuance of this permit means only that the application to conduct a coal mining operation meets the requirements of Chapter 1513 of the Revised Code, and as such DOES NOT RELIEVE the operator of any obligation to meet other federal, state or local requirements.

This permit is issued in accordance with and subject to the provisions, conditions, and limitations of Chapter 1513 of the Revised Code and Chapters 1501:13-1, 1501:13-3 through 1501:13-14 of the Administrative Code.

The water monitoring plan for this permit shall be:

Quality: See Page 26, F3 of the Permit Application
Quantity: See Page 26, F3 of the Permit Application

Note: These monitoring requirements are separate from NPDES monitoring requirements.

Signature: Michael Sponsler by [illegible] **Date:** 08/04/2005
Chief, Mineral Resources Management

OPERATOR

F46 Rev: 07/01/2001

COAL MINING AND RECLAMATION PERMIT APPLICATION TO REVISE A PERMIT (ARP)

Issued To: AMERICAN ENERGY CORP
43521 Mayhugh Hill Rd.
Twp Hwy 88
Beallsville, OH 43716

Telephone: (740) 926-9152

ARP Type:
Remove a Condition of Permit
Revise Subsidence Control Plan

Permit Number: D-425
Application Number R-425-17

Effective: 04/17/2007
Expires: 10/21/2009

The issuance of this ARP means only that the application to conduct a coal mining operation meets the requirements of Chapter 1513 of the Revised Code, and as such DOES NOT RELIEVE the operator of any obligation to meet other federal, state or local requirements.

This ARP is issued in accordance with and subject to the provisions, conditions, and limitations of Chapter 1513 of the Revised Code and Chapters 1501:13-1, 1501:13-3 through 1501:13-14 of the Administrative Code.

The approved water monitoring plan for this ARP is:

Quality: N/A
Quantity: N/A

Note: Any previous condition(s) imposed on this permit, or subsequent adjacent areas, also apply to this ARP unless noted otherwise.

Signature: Scott R Kell **Date:** 04/17/2007
Chief, Mineral Resources Management

OPERATOR

F100 Rev: 07/01/2001

_____ New Submittal
_____ Revised Submittal R- 42

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

APPLICATION TO REVISE A COAL MINING PERMIT

Note: Refer to the division's "General Guidelines for Processing ARPs" and "Requirements for Specific Types of Common ARPs" for guidance on submitting and processing ARPs.

1. Applicant's Name **American Energy Corporation**

   Address **43521 Mayhugh Hill road**

   City **Beallsville** State **Ohio** Zip **43716**

   Telephone Number **740.926.9152**

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MAR 2 0 2007
DIVISION OF MINERAL RESOURCES MANAGEMENT

2. Permit Number **D-0425**

3. Section of mining and reclamation to be revised:

   Subsidence Mitigation Part 3,K(5) (6) (7)

4. Describe in detail the proposed revision and submit any necessary drawings, plans, maps, etc:

   To lift the subsidence condition of D 425-5

5. Describe in detail the reason for requesting the revision:

   To obtain permission to subside structures in the shadow area by submitting a report from Dr.Yi Luo.

6. Will this revision constitute a significant alteration from the mining and reclamation operations contemplated in the original permit? ☐ Yes, ☒ No.
   (**Note:** refer to paragraph (E)(2) of 1501:13-04-06 of the Ohio Administrative Code to determine if a revision is deemed significant.)

   If "yes," complete the following items 7 through 9.

7. In the space below, give the name and address of the newspaper in which the public notice is to be published.

   NA

8. In the space below, give the text of the public notice that is to be published. (Include the information required by paragraph (A)(1) of 1501:13-05-01 of the Ohio Administrative Code.)

   NA

Revised 03/06
DNR-744-9003

OPERATOR

7. In the space below give the name and address of the newspaper in which the public notice is to be published.

8. In the space below give the text of the public notice that is to be published. (Include the information required by paragraph (A)(1) of 1501:13-05-01 of the Ohio Administrative Code.)

9. In the space below give the name and address of the public office where this application is to be filed for public viewing.

I, the undersigned, a responsible official of the applicant, do hereby verify the information contained in this revision request is true and correct to the best of my information and belief.

JAMES R TURNER, JR
Print Name

Date 10-24-05

Signature

Title TREASURER

Sworn before me and subscribed in my presence this 24th day of October, 2005

NOTARIAL SEAL STATE OF OHIO

BARBARA L. RUSH
NOTARY PUBLIC, STATE OF OHIO
MY COMMISSION EXPIRES 9-09-09

Barbara L. Rush
Notary Public

FOR DIVISION USE ONLY

APPROVED

This request is hereby _____.

Scott R Fell
Chief, Division of Mines and Reclamation

Date 4-17-07

OPERATOR

I attest that the methodology and findings presented in this report are based upon the currently accepted principles of mining engineering. Specifically, the subsidence prediction and modeling methods used in the report have been developed and calibrated through years of research and applications on similar structures.

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MAR 2 3 2007
DIVISION OF MINERAL
RESOURCES MANAGEMEN

Yi Luo, Ph.D., P.E.
Associate Professor
Department of Mining Engineering
College of Engineering and Mineral Resources
West Virginia University
Morgantown, WV 26506

Under temporary authorization (based on application to register by comity in the State of Ohio, dated January 11, 2007) which will expire on March 19, 2007.

Signature: _____ January 24, 2007

YI LUO
REGISTERED
15073
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Registration No. and Seal: WV 15073.

State of Ohio: Temporary Permit Granted on January 19, 2007

OPERATOR

Assessment and Mitigation of Subsidence Influences on Tower Structures Affected by Longwall Mining Operations

By

Yi Luo, *Ph.D., P.E., Research Associate Professor*
Syd S. Peng, *Ph.D., Professor and Chairman*
Department of Mining Engineering
West Virginia University

INTRODUCTION

In the new permit area of the American Energy Corporation's Century Mine (Permit application No.: D-0425-5), the planned longwall mining operations will be conducted under a number of municipal and industrial structures. These structures include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for telecommunications. The first author visited the sites on July 19, 2005 and obtained the necessary mine maps.

This report presents the methods for assessing and mitigating the potential subsidence influences on these tower structures caused by the planned longwall operations in the permit area.

SITE AND STRUCTURES

Surface and Mine Layout

Figure 1 shows the site where the main structures are located. The water tower and a larger communication tower are located on the top part of the figure while the smaller cell tower and the power transmission line are on the lower part of the figure. At the time of the site visit, the mining company has also considered to lay out the longwall panels in a different way to place some of the main structures (i.e., water towers, and guyed telecommunication towers) over the central portions of the longwall panels so that they will not subject to permanent surface deformations caused by the mining operations.

OPERATOR

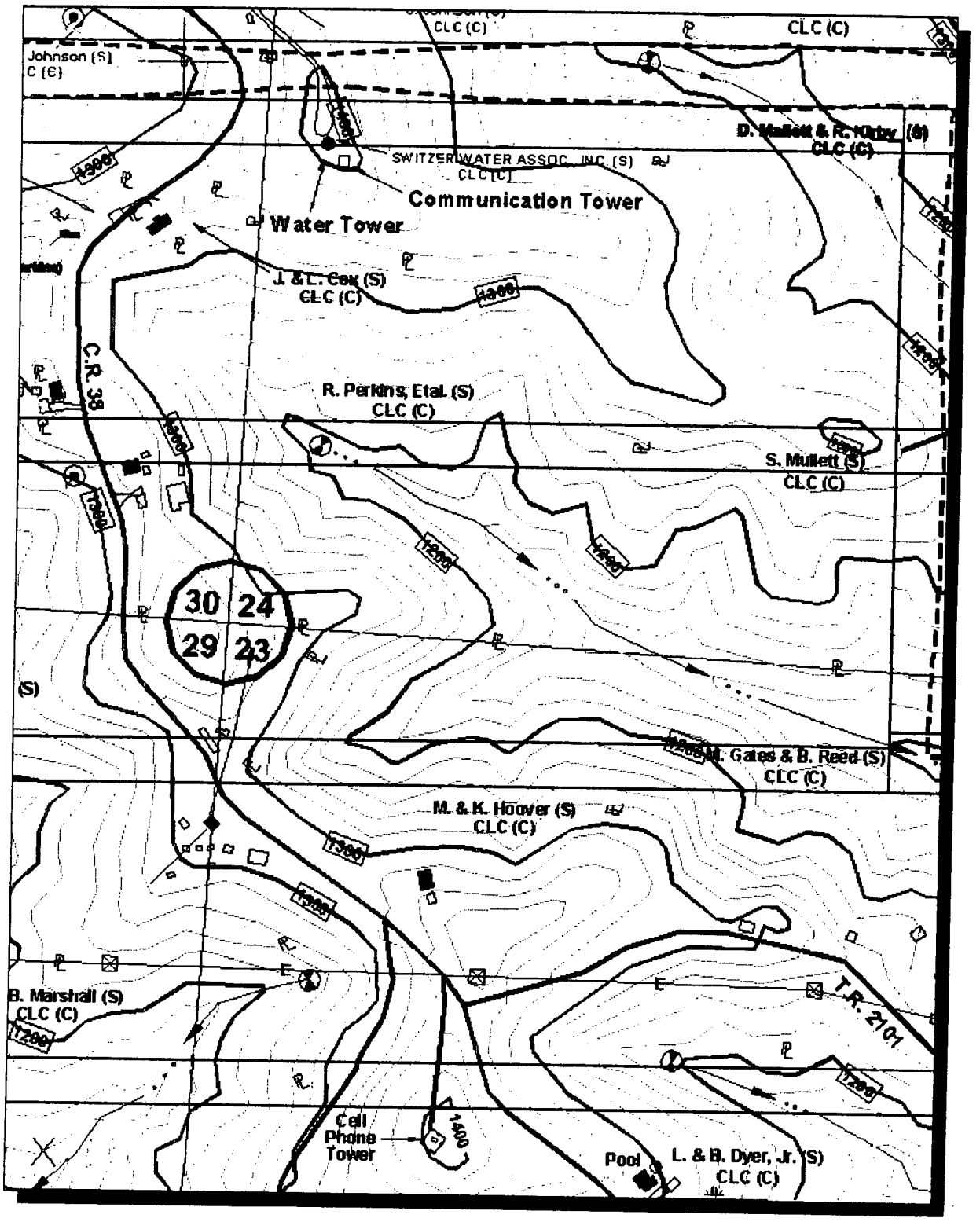

Fig. 1 Area with the Main Structures

The gentle hilly surface topography in the area is also shown in Fig. 1. The overburden depth at the locations of the tower structures ranges from 460 ft to 745 ft. The rib-to-rib width of the longwall panels is 920 and the width of the three-entry chain pillar system between adjacent longwall panels is about 140 ft.

Main Structures

The main structures in the permit area include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for wireless telecommunications.

Figure 2 shows the water tower. It is located on the top of a gentle hill. The tower is a steel cylindrical structure sitting on a concrete base. The cylindrical tank is about 50 ft tall and 14 ft in diameter and has a holding capacity of 54,000 gallons. The concrete base under the tank is about 15 ft in diameter and between 3 and 4 ft thick (Fig. 3). The outer layer of the steel sheet that was used to construct the water tank is about 3/16" thick.

Figure 4 shows the larger communication tower. It is located a short distance away from the water tower on a gentle slope. The height of the tower is about 300 ft. The tower is a guyed steel lattice tower with the guy wires tied at five different levels on the tower. Three guy wires are used at each tie level. Therefore, guy wires permit the main tower structure to rotate in the horizontal plane to certain degree. The base on the tower (Fig. 5) is bolted to the concrete foundation with one bolt to allow horizontal rotation. The guy wires are tied to the ground at three anchor locations (Fig. 6) that are spaced 120° apart from the base. Pole type antennae are mounted on the top of the tower.

Figure 7 shows the small cell phone tower located on the top of another gentle hill. It is also a guyed steel tower and is about 150 ft high. The guy wires are tied to the main tower structures at three different levels. At the lower two levels, three guy wires are used at each tie level. On the top level, six guy wires, two on each direction, are used to restrict the horizontal rotation of the tower structure (Fig. 8). The base of the tower is the same of the larger tower. On the ground, three anchors are buried about 120° apart from the tower base. Four dish type antennae are mounted on the top of the tower and another dish antenna at middle level.

Fig. 2 Municipal Water Tower

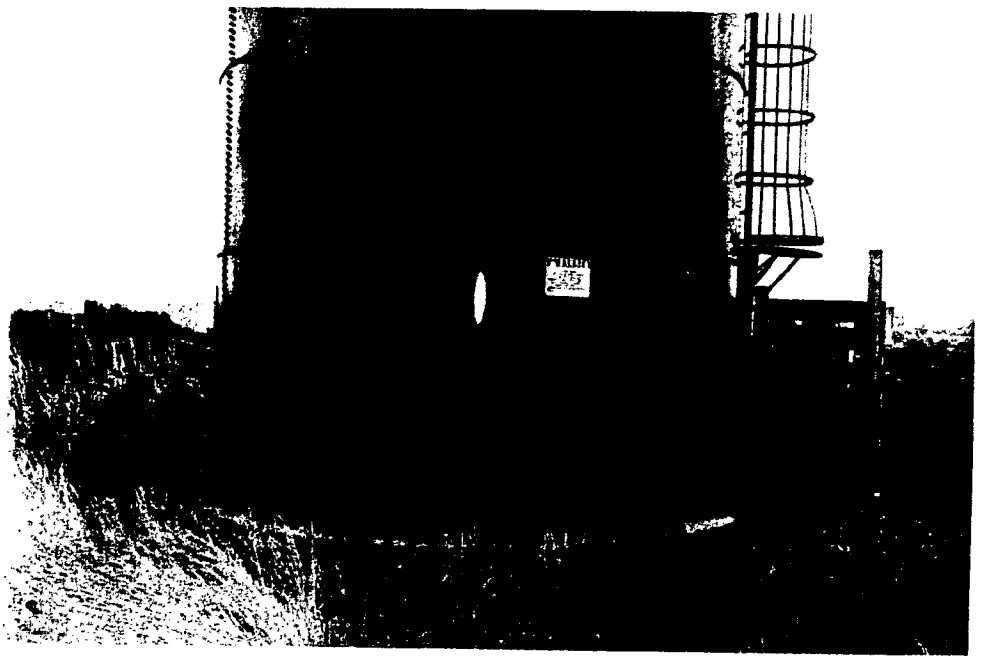

Fig. 3 Base of the Water Tower

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Fig. 3 Larger Communication Tower

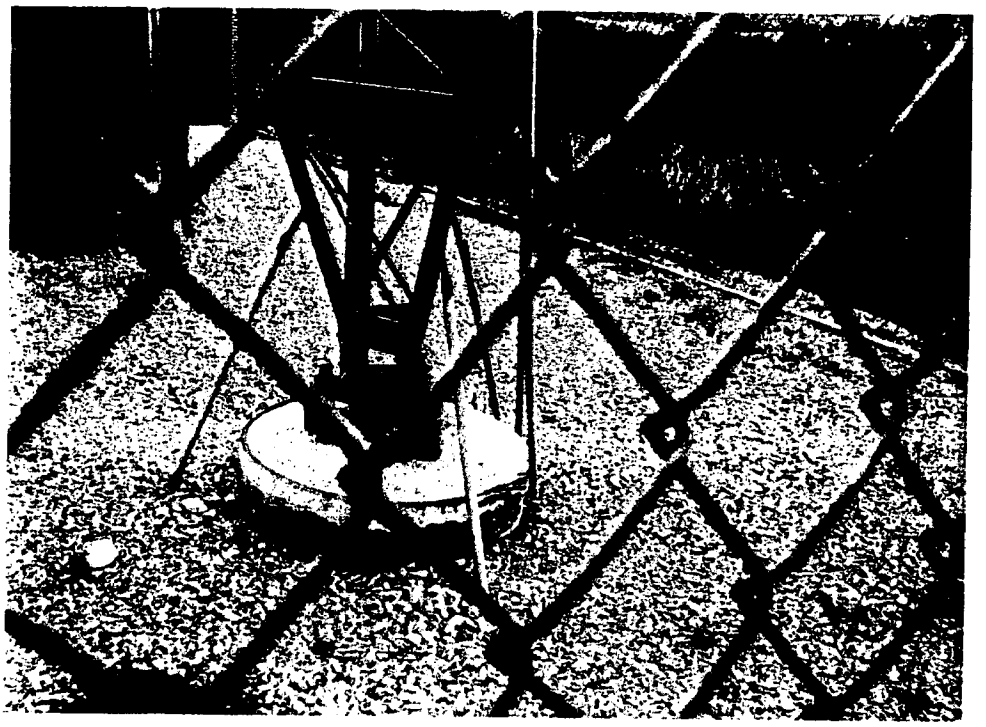

Fig. 5 Base of the Large Communication Tower

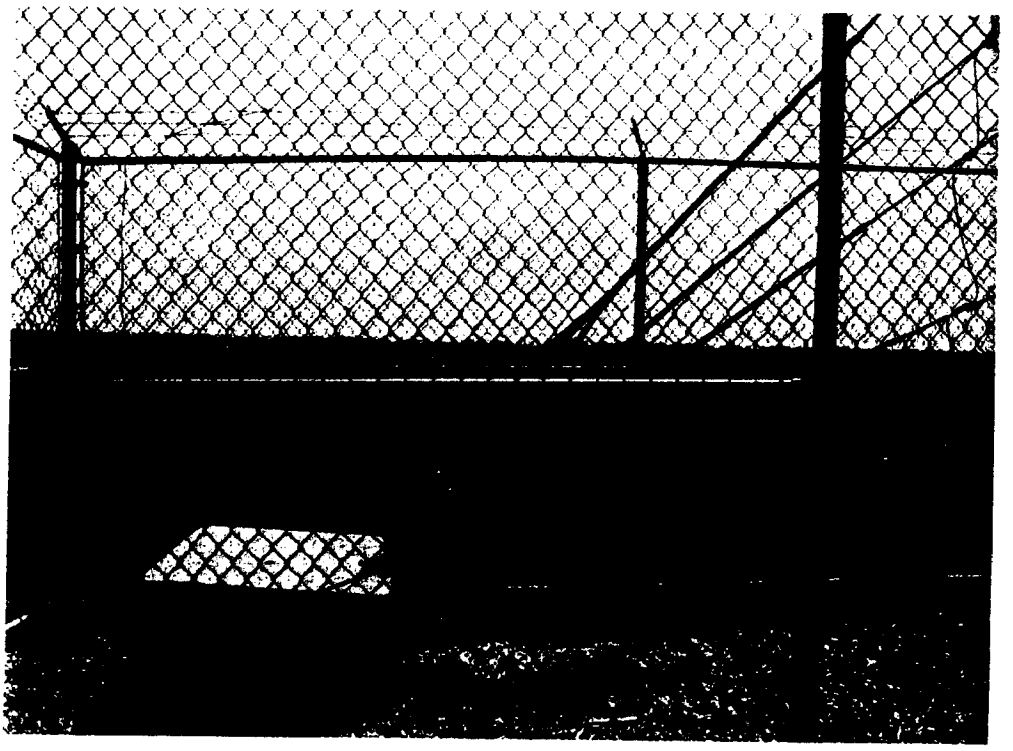

Fig. 6 One of the Three Anchors for the Large Communication Tower

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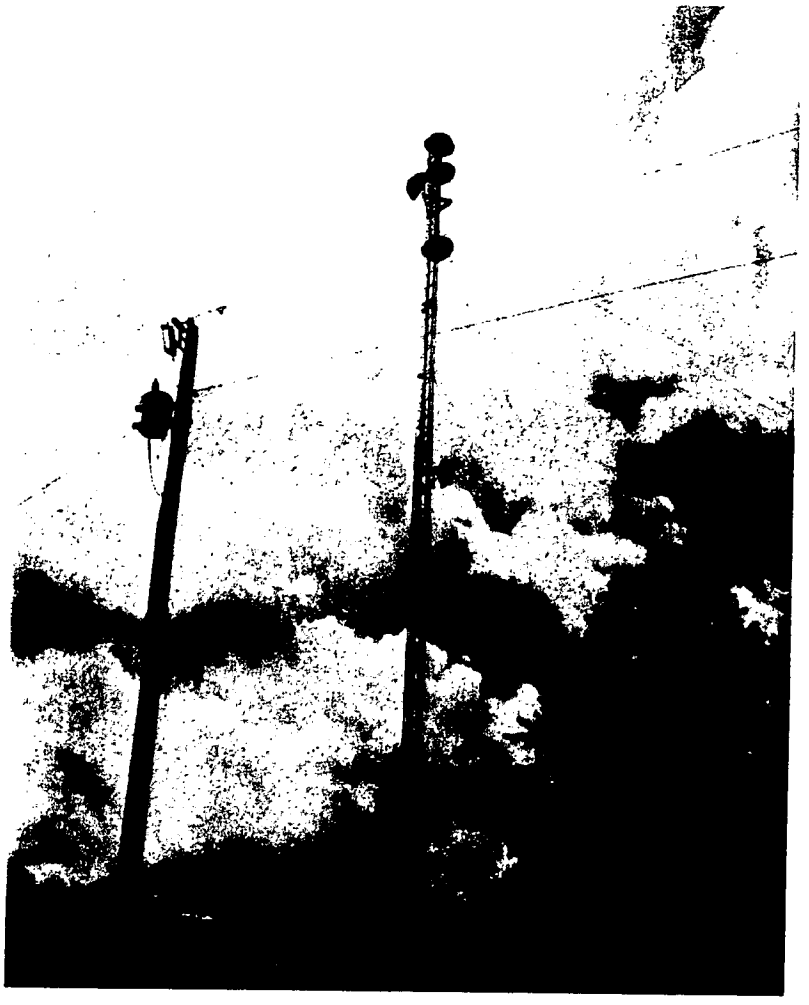

Fig. 7 Small Cell Phone Tower

Fig. 8 Directional Control Guy Wires Tied at the Top Level

One of the power transmission towers is shown in Fig. 9. All 14 power tower share the same structural design. The steel lattice tower has four legs bolted to their concrete bases. The side distance is about 28.5 ft. The tower is about 75 ft tall and the transmission lines are hung at two levels. The main load-bearing members of the tower are made of 5-inch angle steels while smaller bars or angle steels are used for the other members. The lowest restrictive horizontal bars are located about 20 ft above the ground surface.

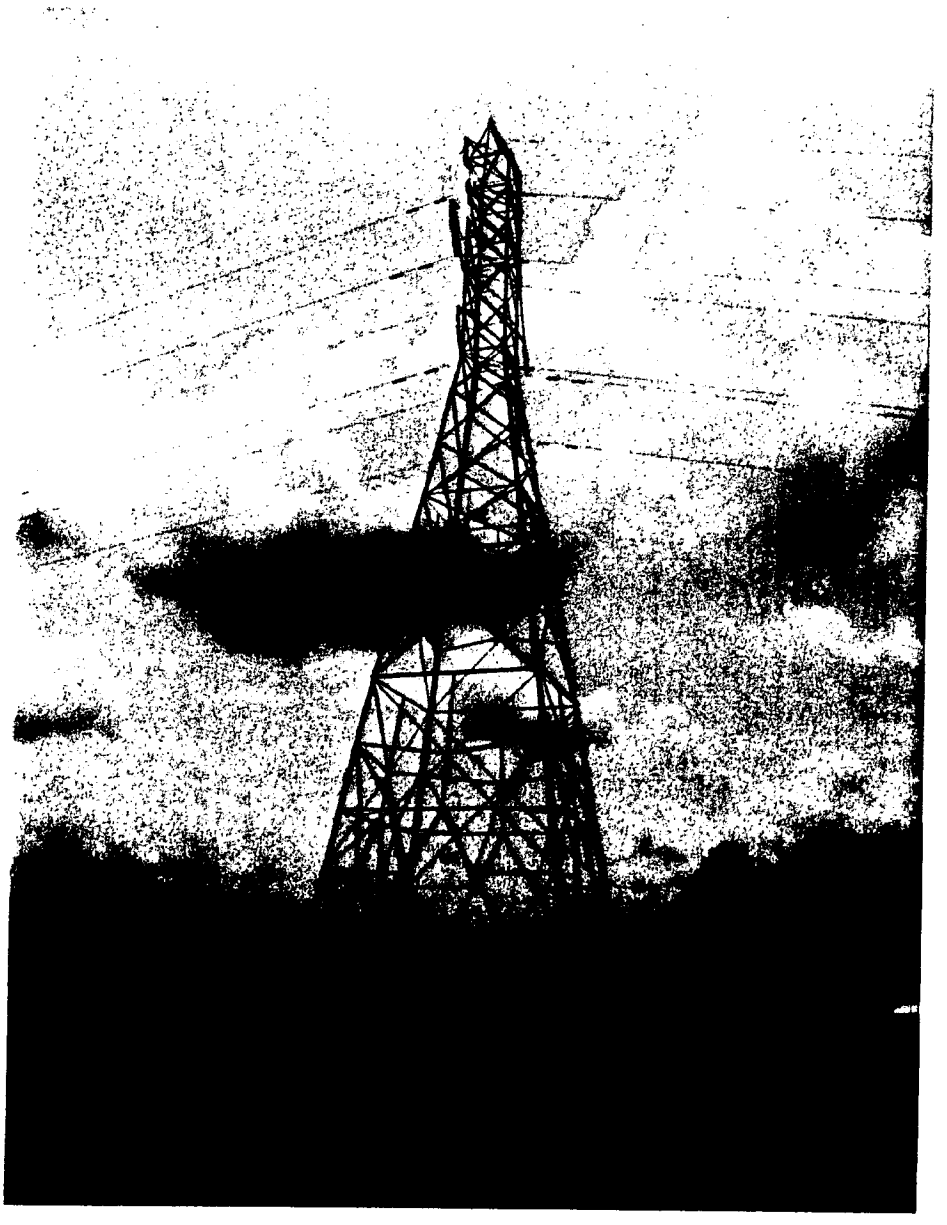

Fig. 9 Power Transmission Tower

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ASSESSMENT AND MITIGATION OF THE SUBSIDENCE INFLUENCES

In this section, the potential subsidence influences on the water tower has been assessed and the mitigation measure for it has been recommended. In assessing the potential subsidence influences, the structural integrity, stability and functionality of the structures should be assessed. For the two communication towers, the methods for assessing and mitigating the influences are mentioned. Surveys to locate the anchors should be performed before the detailed analysis can be performed. Among the 14 transmission towers, eight of them could experience subsidence influences. The subsidence influences could be dependent on many factors and should be assessed one by one.

Influences on and Mitigation Measures for Water Tower

In order to assess the potential subsidence influences to the water tower, the final and dynamic surface movements at the location of the tower have been predicted. The subsidence prediction program CISPM version 2.01 is used. The development of the prediction package is based on the influence function method that is widely adopted in the major mining countries including US coal mining industry and a large amount of collected subsidence data. Most of subsidence cases are collected over longwall panels mining in the Pittsburgh coal seam. This subsidence prediction program package has been successfully applied in various subsidence projects and proven accurate.

The overburden depth at the location is about 745 ft and the center of the tower is located 325 ft inside the panel edge according to the new panel layout. A mining height of 6.0 ft is used in the prediction. The predicted final subsidence profile across a longwall panel with the minimum (460 ft) and maximum (745 ft) overburden depths are plotted in Fig. 10. The location of the water tower, as well as the two guyed telecommunication towers, is also shown in the figure. It shows that the tower is located near the flat bottom portion of the final subsidence basin to be formed over the longwall panel and the predicted final subsidence at the center of the tower is about 3.43 ft. Since the water tower is located on the top of a high hill with its elevation much higher than its customers in the adjacent area. The reduction on water head due to mining subsidence (only about 7% of the tower height) will be too insignificant to reduce its ability for serving the cus-

tomers. The predicted final surface slope, strain and curvature are 0.31%, -5.2×10^{-3} ft/ft (compression) and -6.4×10^{-5} 1/ft (concave). Due to its small foot size, the water tower is very unlikely to be affected by these final deformations.

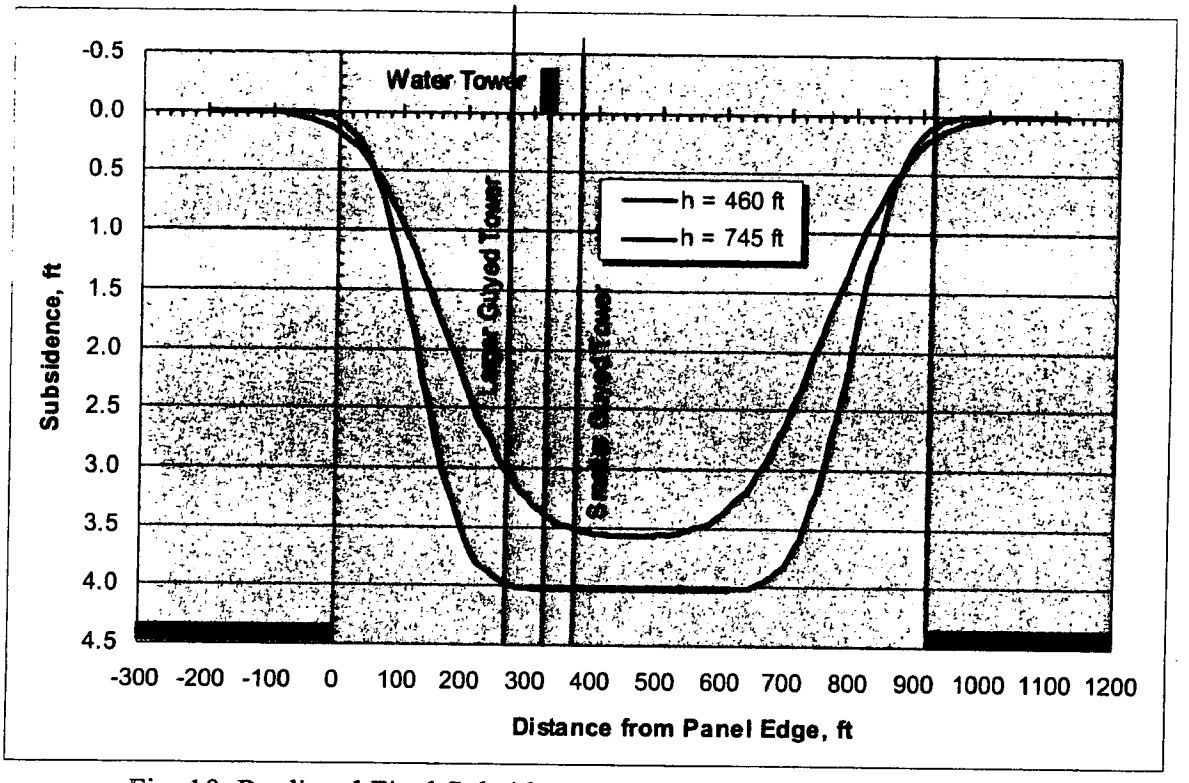

Fig. 10 Predicted Final Subsidence Along a Transverse Cross-section

Before the water tower finally settles down, it will experience a dynamic subsidence process. Figure 11 shows the predicted dynamic subsidence development curves at the location of the tower. Face advance rates in a large range of 20, 40, 60 and 80 ft/day have been used in the dynamic subsidence predictions. It shows the faster the face advances, the longer and gentler is the subsidence development curve. The tower is to experience the dynamic subsidence when the longwall face is about 50 ft inby and 700 ft outby the tower with the most active subsidence precess occurring when the longwall face is between 270 and 330 ft past the tower. Due to its small base and large height, the structural stability under the influence of dynamic subsidence process might be a concern. To assess the stability, the predicted dynamic slope development curves are shown in Fig. 12. The maximum dynamic slopes are 1.0%, 0.89%, 0.79% and 0.72% for the four ad-

vance rates used. Such small dynamic slopes are even barely noticeable without pri. These maximum slopes would occur when the longwall face has passed the center of the tower a distance between 250 and 290 ft. Even when the water tank is operated at full level as the worst case, the center of the gravity of the water tower is located about 25 ft above the ground surface. Using the predicted maximum dynamic slope of 1.0%, the center of gravity of the tilted tower will only move a horizontal distance of 0.25 ft (3 inches) away from its original base center. Compared to the 7-ft radius of the tower base, the relocation of the center of gravity of the tower is very insignificant (3.6%). Therefore, the stability of the water tower will not be affected by the dynamic subsidence process at all.

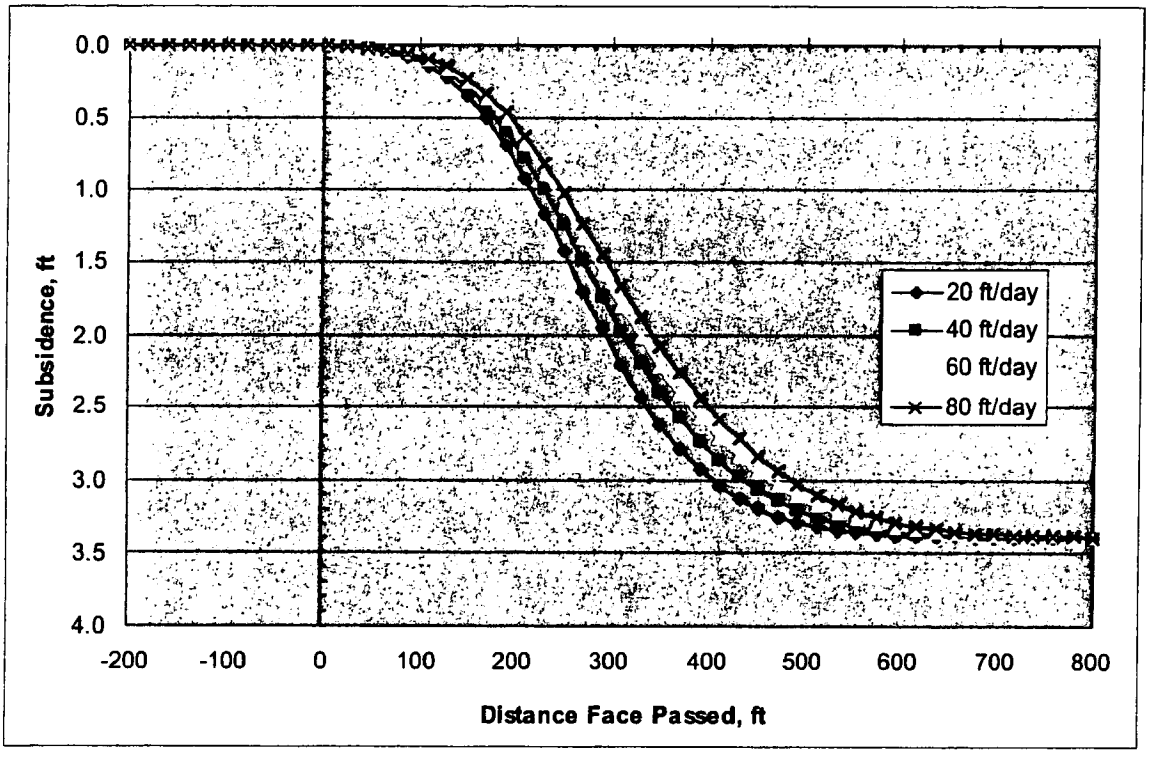

Fig. 11 Predicted Dynamic Subsidence Development Curves at the Water Tower with Various Face Advance Rates

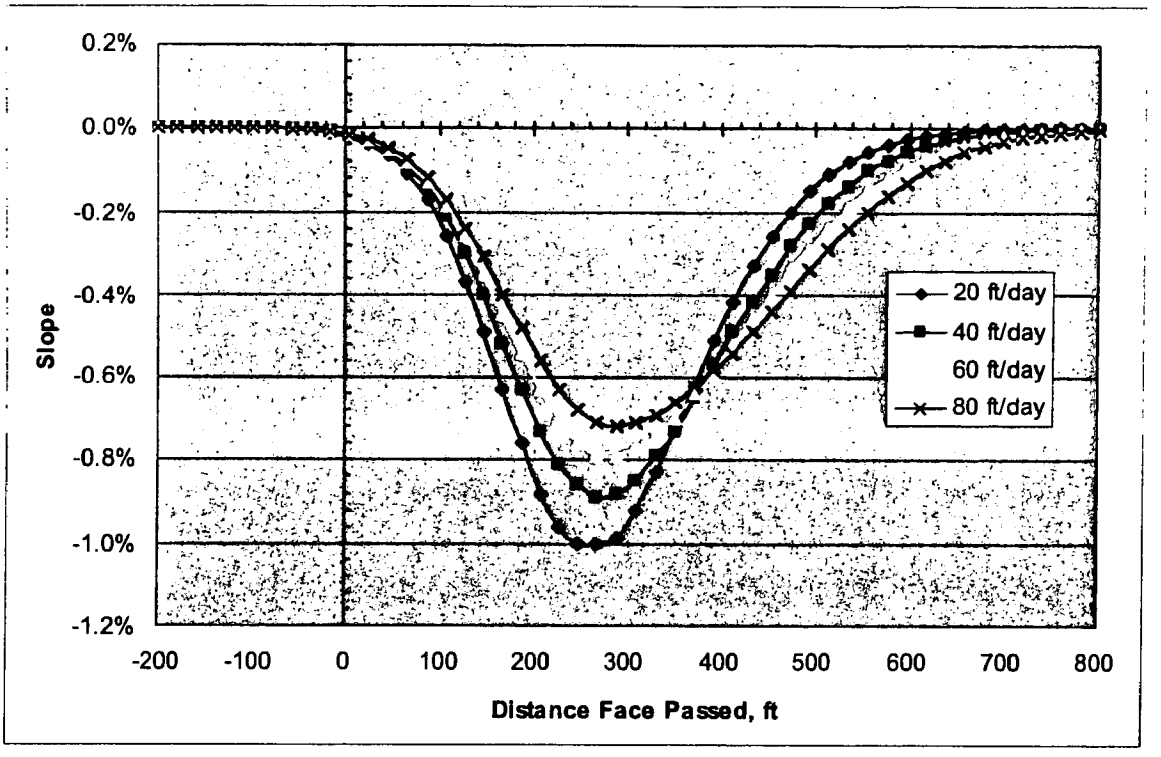

Fig. 12 Predicted Dynamic Slope Development Curves at the Water Tower

The predicted maximum dynamic tensile strains (not shown) for the ranges of face advance rates range from 3.46×10^{-3} to 5.51×10^{-3} ft/ft occurring at 165 ft behind the longwall face. The maximum dynamic tensile strain might be able to create some hair-line cracks on the concrete base of the water tower. The maximum dynamic convex curvatures will be in the range from 4.19×10^{-5} to 6.67×10^{-5} 1/ft, too small to cause any problems to the water tower structures.

In order to prevent the concrete base of the water tower from being cracked by the dynamic tensile strain, it is recommended to wrap the concrete base with two steel tension cables. New 3/4 –inch steel wire cables should be used. The cables should be placed about 4-inches below the top surface of the concrete base and each cable should be tensioned to 4-tons (8,000 lbs). The cables should be installed when the longwall face is still 200 ft to the tower and can be released after the face has passed the tower a distance of 1,000 ft.

Influences on and Mitigation Measures for the Telecommunication Towers

The locations of the two telecommunication towers with respect to the edges of the longwall panel are also plotted along with the predicted final subsidence profiles in Fig. 10. The smaller tower is located in the central and flat bottom portion of the subsidence basin with the final subsidence at its base being about 3.6 ft. The larger tower is located in the concave portion of the final subsidence basin and the final subsidence at its base is about 3.0 ft.

The assessment of subsidence influences on the guyed towers is much more complicated than that for the water tower. The authors have developed the assessment techniques and successfully applied them to one guyed tower that was similar to the two towers in this study and used for signal relay of cellular phone services. Based on the assessment, simple and inexpensive mitigation measures were recommended and mitigated. That tower was successfully protected and its services was never been affected despite of severe winter weather while mining was conducted under the tower. The publication (Luo et al, 2003) detailing the assessment techniques and mitigation measures is attached as an appendix. In assessing the influences, the following design and operating parameters of the towers are required:

- Coordinates and elevations of the tower base and ground anchors
- Elevations of the guy wire ties on the towers
- Sizes of guy wires
- Ranges of the tensions in the guy wires

We request these necessary design and operating parameters be provided before the detailed analyses on the potential subsidence influences on the guyed towers are performed. The predicted final and dynamic movements at the base and the anchors will be used in addition to other input information in assessing the subsidence influences on the guyed towers.

However, it is anticipated based on our past experience that the tensions in the guy wires could increase in the first half of the dynamic subsidence process and decrease in the second half of the process. If the guy wire tensions increase too much, they place a significant additional load on the lower members of the tower structure and potentially

leads to problems to the tower base, the guy wires and the anchors. If the guy wire tension decreases too much, it could cause slacking condition to the guy wires which reduces lateral restraints to the main tower structure. The significant differential ground movements in both vertical and horizontal directions at the tower base and ground anchors will also cause vertical and horizontal rotations that could lead functionality problems to the towers.

However, as mentioned previously, we have developed and successfully applied some mitigation measures for such guyed towers. The mitigation measures could include: (1) periodical monitoring the tensions in the guy wires (i.e., 2 to 3 times a day during the active dynamic subsidence period) and adjusting the tensions in the guy wires if needed, and (2) monitoring the plumb of the main tower structures from two orthogonal directions (i.e., parallel and perpendicular to the mining direction) and adjust the guy wires as needed. These mitigation measures are relatively simple and inexpensive to implement.

Influences on and Mitigation Measures for the Power Transmission Towers

The 14 power transmission towers are located over two longwall panels according to the latest mine layout. Among them, three are located beyond the panel setup entries or recovery lines expecting no or very minor subsidence influences. Eight towers are located over or near the chain pillar system between two adjacent longwall panels. These towers are to experience a small amount of final subsidence but some of them may be subject to high final tensile strains. The remaining three power towers are located in the "central" portion of one longwall panel and expecting to experience strong dynamic subsidence process. Therefore, the power transmission towers located over the chain pillars system and within the panel edges may be affected by the proposal longwall mining operations. The severity of the potential subsidence influences to each of the tower could be different depends on their relative locations to the longwall panels, surface topography, the design and construction of the towers, etc. At the time of this writing, the design information of the power towers have not been provided for us to performed detailed analyses.

However, it should be noted that the authors have previously performed assessments on the subsidence effects and monitored the stress on a number of power transmis-

sion towers similar to the ones in this permit area. That study found that the longwall subsidence process would have very little effects on the stability even when the lateral load by the strongest wind was applied on the subsided tower. That study also considered the additional tension or sagging conditions when two adjacent towers are subject to differential lateral movements and slopes during and after the subsidence process. It was found that such additional tension was insignificant to affect the power transmission lines. However, the differential movements, especially differential horizontal displacements, among the legs of each tower could cause bending and twisting to the steel members at the lower level.

In another study, the authors studied a very important and large 4-leg telecommunication tower located on the top of a very steep mountain peak (Luo and Peng, 1997). The tower was responsible for sending and receiving signals to telecommunication satellite for a national telephone company. It experienced two subsidence processes when two adjacent longwall panels were mined. The analyses on the stability, functionality and structural integrity were performed. It was found that the differential movements at the legs could cause problems to the lower parts of the tower. In order to reduce the severity of the anticipated subsidence influences, mitigation measures, including a compensation trench and bracing methods, were recommended and implemented for this tower. The mitigation was very successful. No damages were found on the tower structure despite that ground cracks were observed nearby. The services were never been interrupted. Based on the experiences with 4-leg towers, we believe that the same or similar mitigation measures can be applied in protecting these power transmission towers. In order to perform detailed analyses of the structures, design information from the power company is needed.

CONCLUSIONS

A preliminary study has been performed for three types of tower structures located in an area where the mining permit is in application process. It is concluded that among the three types of the structures:

AEC 05984

1. The stability and functionality of the water tower would not be affected by the dynamic subsidence process according to the new mine layout. The dynamic strain could cause some minor cracks on the concrete base of the tower but the anticipated problem can be controlled using tension cable method.
2. The potential subsidence influences on the two guyed telecommunication towers can be assessed using the techniques developed by the authors. Based on our previous experience, relatively simple and inexpensive mitigation measures can be applied to protect these two structures.
3. The subsidence influences on 4-leg steel towers for electrical power transmission can be assessed and mitigated using proven techniques.

REFERENCES

Luo, Y. and S.S. Peng, 1997, "Subsidence Prediction, Influence Assessment and Damage Control," *Proc. 16th Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, West Virginia University, WV, pp. 50-57.

Luo, Y., S.S. Peng and B. Miller, 2003, "Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study," *Proc. 22nd Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, C. Mark and A.W. Khair, pp. 360-366.

AEC 05985

APPENDICES

Two publications by the authors
on assessing and mitigating subsidence influences
on tower structures.

AEC 05986

22nd International Conference on Ground Control in Mining

Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study

Yi Luo, *P.E., Research Associate Professor*
Syd S. Peng, *C.T. Holland Professor and Department Chairman*
Department of Mining Engineering
West Virginia University
Morgantown, WV, USA

Brad Miller, *Division Land Representative – Coal East*
RAG Emerlad Resources, LP
Waynesburg, PA, USA

ABSTRACT

The potential influences of mining subsidence on structural stability, integrity and functionality of guyed tower structures have not been systematically studied before. This paper presents a case study where a guyed steel tower of a telecommunication company was mined under by a longwall operation. Prior to mining, every aspect of the subsidence influences to this structure was studied. The pre-mining assessment indicated that the structure could experience vibration problem in the second half of the dynamic subsidence process. Based on the study, a simple mitigation measure was recommended and implemented and the structure was successfully protected.

INTRODUCTION

Guyed tower structures have been frequently employed to elevate objects (e.g., radio or TV transmitters, wind turbines, etc.) high above ground surface because of their low construction cost and great stability. A guyed steel tower is consisted of a tall and slim steel lattice structure restrained laterally by a number of steel guy wires from different directions.

Mining in a longwall panel with a fairly large overburden was conducted under a guyed steel tower used for wireless phone service. Assessment of the influences of the subsidence process on this structure has been performed using the methods developed in this study prior to the longwall mining operation. The assessment concluded that the stability, integrity and functionality of this tower structure would not be affected by the subsidence process. However, the lateral restraint to the steel tower by the guy wires would be reduced, possibly causing vibration of the structure under gusty wind conditions, in the second half of the dynamic subsidence process. The only mitigation measure for this tower was to monitor and to maintain proper tensions on the guy wires. The structure was successfully protected and its services had never been affected.

This paper presents the methods for assessing the subsidence influences on the guyed tower at various stages of the subsidence process.

LONGWALL PANEL AND TOWER STRUCTURE

The portion of the longwall panel over which the transmission tower is located is shown in Fig. 1. The longwall panel was 874 ft wide (rib-to-rib) and the mining height in the Pittsburgh coal seam is between 6.5 and 7.0 ft. The base of the tower is located near the central portion of the longwall panel. The tower sits in a flat area on the top of a steep hill. The overburden depth at the tower base is about 1,017 ft.

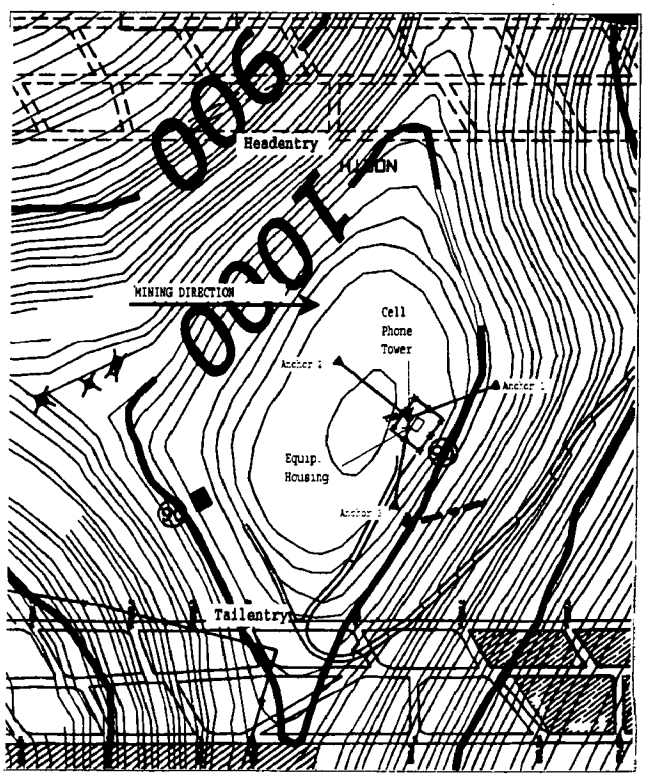

Fig. 1 Overview of the Site

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The tower (Fig. 2), belonging to one of largest wireless phone companies in the nation, serves as a relay station to transmit cellular phone signals between two similar towers located more than 20 miles away in the tri-city area in the northern West Virginia and southwestern Pennsylvania. The steel lattice tower is about 180 ft tall and laterally restrained by 12 steel guy wires. These guy wires are installed in three vertical planes that are separated from each other by about a 120° horizontal angle. Along each plane, the lower ends of the four wires are tied to a concrete anchor block (Fig. 3) and the upper ends are tied to the tower at three different levels. The turnbuckle on each guy wire makes it possible to make necessary adjustment for regular maintenance. The anchors were located about 160 ft away from the tower base. The concrete anchor blocks, 2' (H) x 3' (W) x 7'-6" (L), were buried about 6 ft below the ground surface.

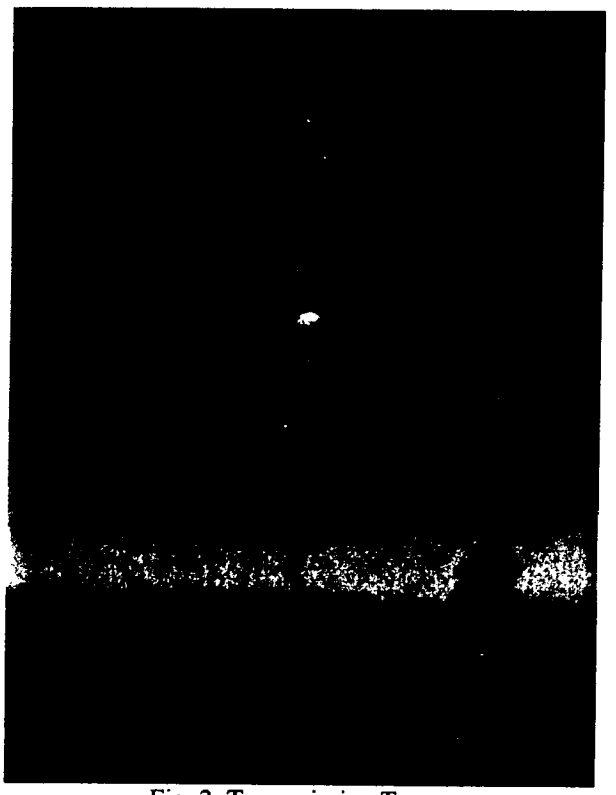

Fig. 2 Transmission Tower

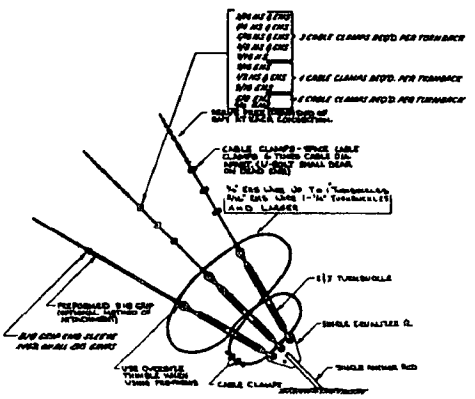

Fig. 3 Method to Tie the Guy Wires to the Anchor Block

Table 1 shows the pre-mining coordinates and elevations of the points of interest on the tower structure (i.e., base, anchors and ties). A local coordinate system is used for the structure. The datum of the elevation of the local coordinate system is set at the base of the tower ($z = 0$ ft at the base). It should be noted that the anchors are not on the same elevation as the tower base. The x-direction of the coordinate system follows the mining direction with $x = 0$ at the tower base. The y-axis points from the panel tailentry to the headentry with $y = 0$ at the panel tailentry.

Table 1 Local Coordinates of the Tower Base and Anchors

Point of Interest	x	y	z*
Base (0)	0	369	0
Anchor 1	149	427	-12
Anchor 2	-123	469	-6
Anchor 3	-23	215	-1
Tie 1	0	369	60
Tie 2	0	369	123
Tie 3	0	369	173

* elevations are expressed in relation to tower base

The tower super-structure is tied to its foundation with one steel bolt (ϕ =15/16"). The reinforced concrete foundation is constructed in two sections. The lower section is a square one with side length being 4'-6" and the thickness being 1'-6". The upper section is cylindrical with its diameter and height being 2 and 4 ft, respectively. The foundation is buried with only the top 6 inches being exposed above the ground surface.

In each of the three guy wire planes, one guy wire (ϕ = 3/8") is used at the lower level located about 60 ft above the tower base (referred as Tie 1). Two guy wires (ϕ = 7/16") are tied to the tower at the middle level (123 ft above the tower base) to resist the possible rotation of the tower structure (Tie 2). The top of the tower is tied with one guy wire (ϕ = 7/16") at the elevation of 173 ft above the tower base (Tie 3). At lower and top tie levels, breast type of ties are used to provide lateral restrain to the tower only while the middle tie is a torque type to provide both lateral and rotational restrains to the tower as shown in Fig. 4. The guy wires have been pre-tensioned with the tensions ranging from 1,250 lbs at the lower level to 1,975 lbs at the top level.

SUBSIDENCE PREDICTION

In order to assess the potential subsidence influence on the tower structures, dynamic subsidence prediction is performed at four surface points of interest, the tower base and the three anchors, using the subsidence prediction program CISPM version 2.01 (Peng and Luo, 1992). Mining height of 7.0 ft and an advance rate of 80 ft/day were used in the predictions.

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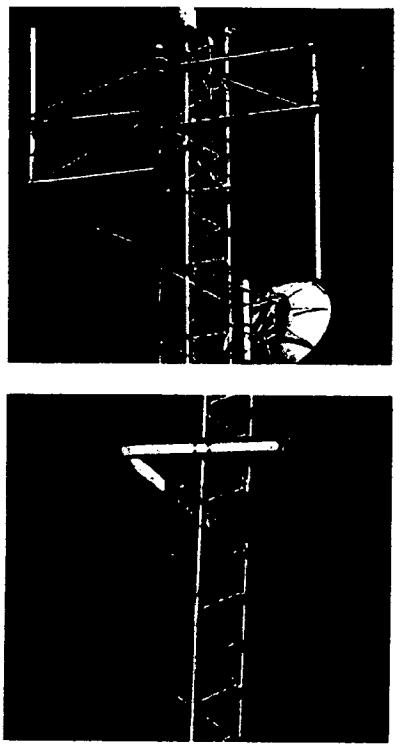

Fig. 4 Breast Type (Top) and Torque Type (Bottom) Ties

The predictions was performed at different time stages ranging from when the longwall face was from 300 ft inby to 1,700 ft outby the tower base. These time stages are chosen to cover the entire active dynamic subsidence process. The prediction for the last time stage (i.e., the face has passed the tower base for a distance of 1,700 ft) should be considered as the final subsidence. The predicted surface subsidence (S) and the two components of horizontal displacement (U_x and U_y along the x and y directions, respectively) at these specified time stages are plotted in Figs. 5, 6 and 7, respectively.

Figure 5 shows the predicted subsidence development curves at the tower base and anchors. Insignificant amount of subsidence would be experienced by the tower structures when the longwall face was directly under the tower base. The subsidence process would be most active when the face was between 300 and 400 ft passed the tower base. The ground begin to regain stability after the face has passed the tower base a distance of 1,000 ft. The final prediction shows that anchor 1 will subside the most (3.06 ft) while anchor 3 the least (1.62 ft). There is no significant differential subsidence among the base, anchors 1 and 2 after the subsidence process is over.

The predicted development curves of horizontal displacements along the mining direction are plotted in Fig. 6. The negative values shown in the figure indicate that the movements were against the mining direction. The maximum movements along the mining direction ranged from 0.43 to 0.54 ft when the longwall face was between 300 and 700 ft passed the tower base.

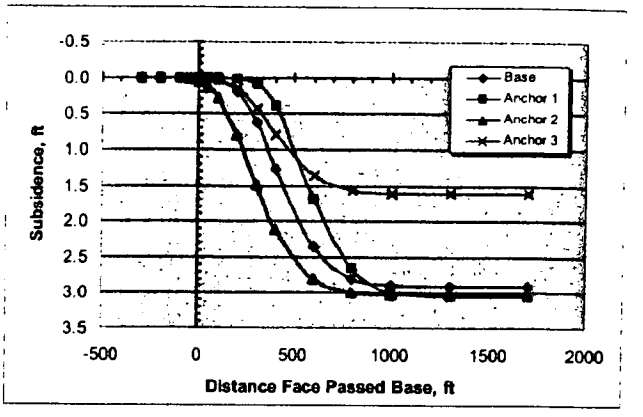

Fig. 5 Predicted Dynamic Subsidence

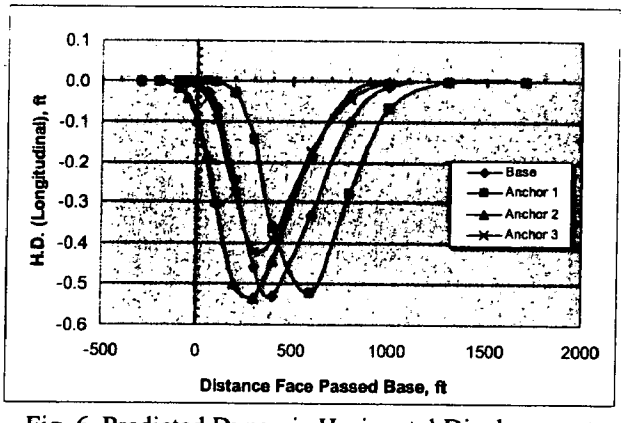

Fig. 6 Predicted Dynamic Horizontal Displacement Along Mining Direction

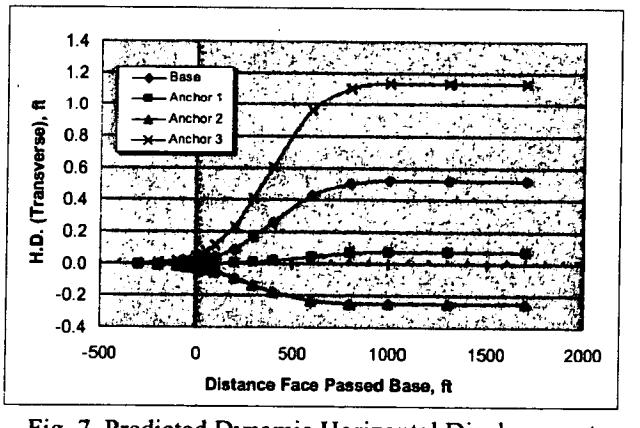

Fig. 7 Predicted Dynamic Horizontal Displacement Along Panel Transverse Direction

The predicted development curves of horizontal displacements along the panel transverse direction are plotted in Fig. 7. A positive value indicates movement from the panel tailentry to headentry. It shows that the base and anchors 1 and 3 would move toward the panel headentry side while anchor 2 would move toward the panel tailentry side. Among these four points, anchor 3 will have the largest movement (1.15 ft) while anchor 1 will have the least movement (0.07 ft) when the subsidence process is over.

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ASSESSMENT OF SUBSIDENCE INFLUENCES

Based on the predicted dynamic surface movements at the tower base and three anchors as well as the structural characteristics of the tower, the movements and deformations of the tower structure can be determined. Subsequently, the following three aspects of potential influences that the ground subsidence process could cause to the tower structures can be assessed.

- *Structural stability*: Since the tower structure is tall and sits on the hill top, its stability during and after the subsidence process was a concern.
- *Structural integrity*: The subsidence process could induce some additional forces on various parts of the tower structures. If strong enough, these forces could cause structural damages to some of the structural parts.
- *Functionality*: If the tilting and rotation of the transmission tower induced by the subsidence process exceed certain critical values, they could cause blockage and alignment problems to the paths of the signal transmission resulting in disruption or degradation of the cellular phone services.

Assessment of Structural Stability

Stability analysis is normally required for tall structure with small bases such as transmission tower to assess the potential for the structure to be toppled by external lateral forces. Because of their designs, the guyed towers are a type of very stable tower structures that can sustain high winds, earthquakes and extreme weather. The stability of the guyed tower could only be jeopardized when some of the guy wires, especially those tied to the upper levels of the towers, break under some extreme forces. The determination of the subsidence-induced forces in the guy wires to be induced for this case is presented in the next section. That analysis indicated that the subsidence-induced tensions in the guy wires were insignificant compared to pretensions in these wires and to their ultimate breaking loads of the steel cables. Therefore, the ground subsidence process associated with the longwall mining operation will not affect the stability of this particular transmission tower.

Assessment of Structural Integrity

As the ground subsides, the relative spatial locations of the tower base and the anchors, the ground-contacting points of the guyed tower structure, will change. Such changes in elevations and coordinates of these ground-contacting points could induce additional tensions or slacking condition in the guy wires and additional loads in the tower structure.

Determination of Tower Equilibrium State

In determining the subsidence-induced tensions and loads, the predicted dynamic surface movements at the tower base and the anchors at a time stage are imposed on their respective original coordinates and elevations listed in Table 1. The most important task is to determine the coordinates of the ties on the tower when a new equilibrium is developed in the tower structure for that time stage. Since the guy wires tied to each of the three ties on the tower are of the same size (3/8" for wires connected to tie 1, and 7/16" to ties 2 and 3), the following conditions should be satisfied when a new equilibrium at each tie position is reached.

$$\begin{cases} \sum_{i=1}^{3} \varepsilon_i \cos\beta_i \cos\alpha_i = 0 \\ \sum_{i=1}^{3} \varepsilon_i \sin\beta_i \cos\alpha_i = 0 \end{cases} \quad (1)$$

In Equation 1, ε_i is the subsidence-induced strain developed in the guy wire connected between anchor i and the tie of interest. The horizontal angle between this guy wire and the mining direction is β_i while the slope angle is expressed as α_i. The subsidence-induced strain in this guy wire is determined as:

$$\varepsilon_i = \frac{\sqrt{(x_i - x_o)^2 + (y_i - y_o)^2 + (z_i - z_o)^2} - L_o}{L_o} \quad (2)$$

In equation 2, x_i, y_i, and z_i are the coordinates and elevation of ground anchor i at a given time stage. The coordinates and elevation at a given tie on the tower are x_o, y_o, and z_o. The original length of the guy wire is L_o. In setting up equations 1 and 2, the following two reasonable assumptions are made:

- The vertical deformation of the tower structure is insignificant. Therefore, the new elevation at a tie position z_o is equal to the elevation of the subsiding tower base plus the original height of this tie.
- The ability for the tower structure itself at the tie levels to resist lateral displacement is insignificant.

By solving the two simultaneous nonlinear equations (Eq. 1), the coordinates, x_o and y_o, of each of the three ties can be determined when the new equilibrium of the tower structures is reached at a given time stage. A computer program was developed for solving the simultaneous nonlinear equations involved in this task. Using the program repeatedly, the coordinates for the three ties and the horizontal displacements (x-component, y-component and principal, Δx, Δy and ΔU) of these three ties relative to the tower base were determined and the results are shown in Figs. 6, 7 and 8, respectively. It is apparent that the upper part of the tower would displace with respect to its base more than the lower part.

Changes in Guy Wire Tensions

Using these determined coordinates of the ties and the anchors, the subsidence-induced strains in the guy wires on the tower base can be determined. In converting the subsidence-induced strain (Eq. 2) to the subsidence-induced tension, the stiffness (S) of each of the two types of the steel wire ropes should be determined based on the average value of 6-strand and 8-strand steel wire ropes as:

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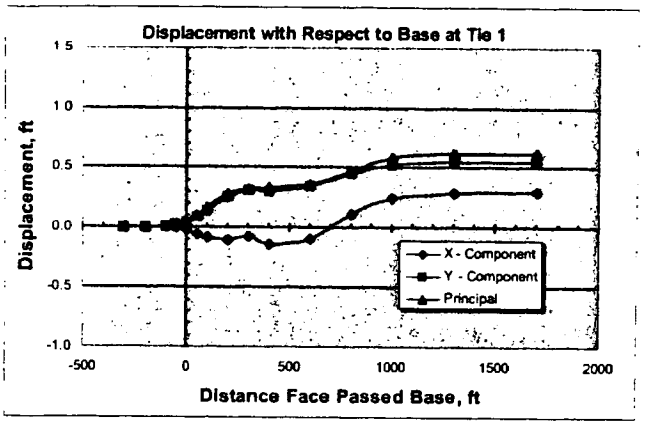

Fig. 6 Horizontal Displacements of Tie 1

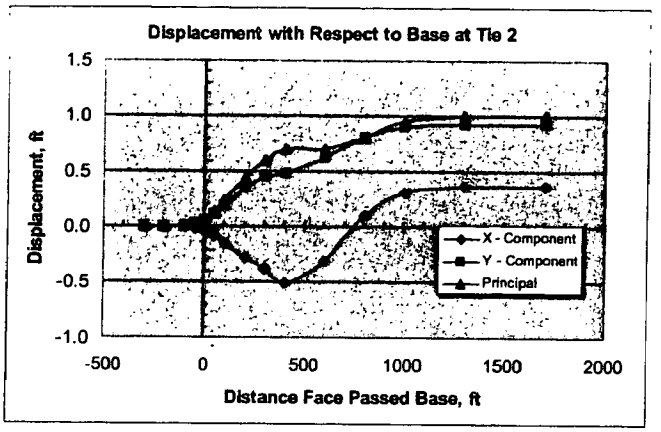

Fig. 7 Horizontal Displacements of Tie 2

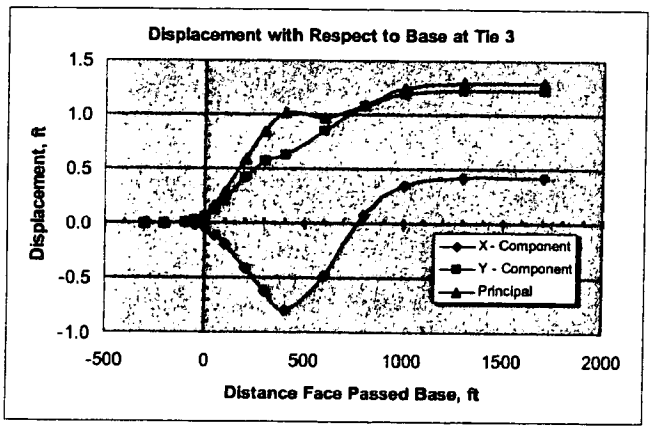

Fig. 8 Horizontal Displacements of Tie 3

$$S = 10x10^6 A \qquad \text{lbs} \qquad (3)$$

In Eq. 3, A is the cross-sectional area of the wire rope. The stiffness values used in the conversion are 1,104,466 and 1,503,301 lbs ft/ft for the 3/8" and 7/16" guy wires, respectively. The average tensions in the guy wires induced by the ground subsidence process associated with the longwall operation are plotted in Fig. 9. A positive value indicates that an additional tension has been induced in the guy wire by the subsidence process while a negative value shows that the existing tension in the guy wire observed before mining will be reduced. A negative force is only meaningful when its magnitude is smaller than the pre-mining tension in the guy wire. Figure 9 shows that tensions would develop in the guy wires when the longwall face is between 50 ft inby and 300 ft outby the tower base. The maximum subsidence-induced tension was about 780 lbs for guy wires tied to the level 3 of the tower when the longwall face is about 200 ft passed the tower base. Such additional tensions are smaller than the pre-mining tensions ranging from 1,250 to 1,975 lbs and are insignificant compared to the ultimate breaking strengths of the guy wires (10,600 lbs for 3/8" wire rope and 14,400 lbs for 7/16" wire rope). Therefore, the subsidence-induced tensions were incapable of causing breakage of the guy wires.

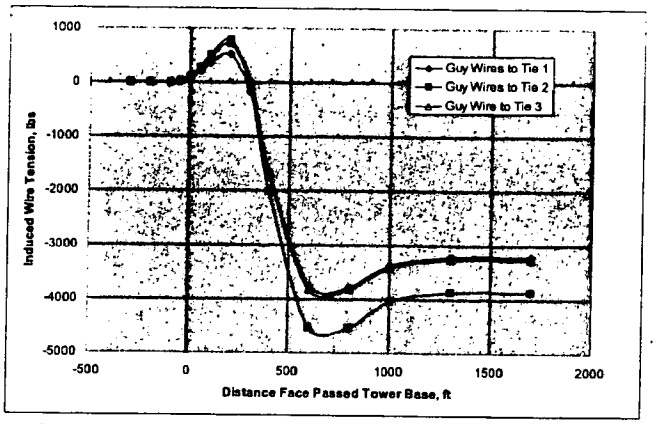

Fig. 9 Subsidence-Induced Tensions in the Guy Wires

However, after the longwall face has passed the tower base a distance 350 ft, the tensions in the guy wires become nonexistent (The magnitudes of the negative values are larger than the pre-mining wire tensions). Under such condition, the guy wires would slack and the tower would be no longer effectively restrained laterally by the guy wires within certain small range. The lack of effective lateral restraint makes it possible for the tower, especially its upper sections, to vibrate under strong gushing winds.

Additional Load to the Tower

The subsidence-induced tensions in the guy wires also induce additional loads to the tower structure, especially in the section near the tower base. The additional load in the lower section at a given time stage is the summation of the vertical components of the tensions in all of the guy wires. The calculations show that additional loads can be induced in the first half of the dynamic subsidence process until the longwall face has passed the tower base a distance of 350 ft. The maximum subsidence-induced load on the tower base would be 4,947 lbs when the face was 200 ft past the base. Such additional load was also insignificant compared to the weight of the steel tower structure and the load from the pre-mining wire tensions (about 12,000 lbs). Therefore, the subsidence-induced load to the tower base would not cause any structural integrity problems to the tower.

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Bending Curvature on the Tower

The differential lateral displacements between the base and the three ties would create a bending condition in the tow lattice structure. The calculation shows that the lower part of the tower was bent laterally more severely than the upper part. However, the maximum bending curvature, 5.5×10^{-5} 1/ft in the lower part when the longwall face was about 300 ft passed the tower base, was still insignificant for the tower steel lattice structure. Therefore, the bending developed on the tower structure would have no effect on its structural integrity.

Assessment of Structural Functionality

The assessment of subsidence influences on the functionality of the transmission tower is to assess whether the ground subsidence process is to disrupt or degrade the ability of the transmitters on the tower to relay phone signals to and from the transmission towers in the other two cities. Such ability could be potentially affected by: the blockage of the signal path, and (2) the incorrect alignment of the signal path. This section assesses the possibilities for such two potential problems to occur during and after the ground subsidence process.

Possibility of Signal Path Blockage

The cellular phone company was concerned with the vertical subsidence at the location of the tower base that would place the tower a few feet (2.9 ft as predicted and shown in Fig. 5) lower than its original elevation. It was thought that such lowering of tower elevation could make high obstacles (such as large trees) to intrude into the signal path between the transmission towers causing signal blockage.

However, it should be noted that the transmission tower was located on the top of one of the highest hills, if not the only highest hill, in a large area around and the transmitters were also located high above the ground on the tower. The ground subsidence process would not only lower the tower but also the surrounding surface area to certain extent. Therefore, the signal paths are impossible to be blocked by any local obstacles around this transmission tower.

Another fact was that the other two transmission towers were located about 23.5 miles (air distance) away from this transmission tower. The predicted 2.9 ft elevation lowering at this transmission tower would only change the signal path by a minor angle of 4.84 seconds. Such insignificant change in signal path would make it impossible for any obstacles located close to the other towers to intrude into the signal paths, either. Therefore, the possibility for the subsidence process to cause blockage of the signal paths was none.

Possibility of Misalignment of Signal Paths

During and after the subsidence process, some minor inclination and rotation will develop on the tower structure. Such inclination and rotation, if large enough, could affect the alignment of the signal paths between the transmitters. According to the cellular phone company, any inclination away from the vertical direction or rotation in the horizontal plane of the tower larger than one degree could affect the alignment of the signal paths.

Based on the determined coordinates and elevations of the tower base and the ties, the inclinations of the tower structures away from the vertical direction at each time stage were determined for each section and the entire height of the tower. The results include inclinations along x and y directions as well as the principal one. The principal inclination of the tower would increase as the dynamic subsidence process with the maximum being reached when the ground regains its stability. The maximum inclinations would be 0.59°, 0.36° and 0.35° for the lower, middle and top sections, respectively. The maximum inclination for the entire tower is about 0.43°.

The rotation of the tower structure is determined using the coordinates of the anchors and tie 2 because torque type tie at this level were designed to provide rotational restraint to the tower lattice structure. The maximum tower rotation, 0.56°, would occur when the dynamic subsidence process was over.

The analysis indicated that both the maximum inclination and the maximum rotation of the tower are smaller than their critical values. Therefore, the alignments of the signal paths would not be affected by the ground subsidence process associated with the longwall mining operation, either.

MITIGATION MEASURE AND RESULTS

Based on the analyses performed, it was concluded that the only possible problem is the vibration of the tower under strong gushing winds due to the lack of effective lateral restraint by the guy wires. Such condition would occur in the second half of the dynamic subsidence process starting at the time when the longwall face is 300 ft outby the tower base.

In order to prevent the condition for potential vibration from occurring, it was recommended that the tensions in the guy wires were to be monitored daily when the longwall face is between 0 and 1,000 ft past the tower base. Necessary adjustments should be made by loosening or tightening the turnbuckles (Fig. 3) on the guy wires near the anchor blocks to maintain the needed tension levels. During the time period when the face is between 300 and 750 ft passt the tower base, multiple adjustments should be made daily to compensate the anticipated large reduction of tensions in the guy wires. When making these adjustments, the plumbing of the lattice structure should be also checked to avoid over-adjustments.

Mining under the tower started in the early January, 2003. The recommended mitigation measure was implemented. The dynamic subsidence process in the area of the transmission tower was over by the end of that month. Despite severe winter weathers in the first two to three months of this year, the tower was successfully protected and no complaints about the phone services were made.

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CONCLUSIONS

This paper presents a case study where a telecommunication transmission tower was subsided by a longwall operation. The potential subsidence influences on the structure were carefully assessed based on the predicted surface movements in the dynamic subsidence process and the structural information of the tower using a systematic approach.

The assessment indicated that structural stability, integrity and functionality of this tower would not be significantly affected by the subsidence event. However, a vibration condition could develop in the second half of the dynamic subsidence process because of the slack of the guy wires.

Based on the assessment, a simple mitigation measure, monitoring and tension adjustment was recommended and implemented. The project was successful as evidenced by the continued quality service carried by this transmission tower.

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Peng, S.S. and Y. Luo, 1992, "Comprehensive and Integrated Subsidence Prediction Model - CISPM (V2.0)," *Proc. 3rd Workshop on Surface Subsidence Due to Underground Mining*, Ed. S.S. Peng, West Virginia University, Morgantown, WV, pp. 22-31.

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Subsidence Prediction Influence Assessment and Damage Control

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ABSTRACT

An extensive subsidence research program conducted by the authors has greatly improved the accuracy and the capabilities of subsidence prediction under complicated mining and surface conditions. The techniques developed for assessing and mitigating subsidence influences on various surface structures have been applied in numerous cases with a very good record of success.

INTRODUCTION

Total extraction of a coal seam using longwall mining or room-and-pillar mining with pillar extraction tends to disturb the overburden strata and causes immediate surface subsidence. Depending on various factors, such subsidence events may or may not have the potential to cause problems to surface structures. Surface subsidence research conducted by the authors has demonstrated that in order to effectively and efficiently minimize the subsidence influences on surface structures, the following techniques should be applied systematically:

- *Methods for accurately predicting surface subsidence under varying mining and surface conditions.* Success in dealing with the issues of subsidence depends primarily on the accurate prediction of the magnitude, distribution and timing of surface subsidence. By studying the subsidence basins produced by different mining plans, the possible subsidence effects on surface structures can be greatly reduced.
- *Techniques for assessing the subsidence influences on surface structures.* The probability and severity of subsidence influences on a structure of interest need to be assessed before it is undermined. Due to the large differences in types, design, material and construction of the structures as well as variations of movements and deformations to be experienced by the structures, the different assessment techniques are required.
- *Techniques for mitigating subsidence influences.* If the assessment indicates that the subsidence influences on a structure exceed the structure's tolerable level in terms of its integrity, stability and functionality, proper mitigation techniques should be designed and implemented to reduce the subsidence influences on the structure.

This paper describe the efforts and results of a subsidence research program conducted by the authors.

SUBSIDENCE PREDICTION

Accurate prediction of surface subsidence caused by underground mining is required for assessment of the subsidence influences and is the basis for the design of effective and efficient mitigation measures. In the past a great majority of subsidence research have been concentrated on the prediction of final subsidence over a single longwall panel with a relatively flat surface. The prediction models produced by those researches have limited value for practical applications because of varying and complicated mining, geological and topographical conditions. In order to improve the prediction accuracy, the authors have collected more than 200 longwall subsidence cases all over the US coal fields through an intensive subsidence monitoring program and from various other sources. These data were used to continuously refine and improve a PC-based program package, CISPM (Comprehensive and Integrated Subsidence Prediction Model) developed previously by the authors (Peng and Luo, 1992). This program package has a unique and rich set of capabilities for meeting nearly all of the subsidence prediction requirements in underground coal mining employing high or total extraction methods in the US. It is very user-friendly requiring neither particular skills in computer operations nor in-depth knowledge of subsidence theory. It has been proven fairly accurate according to the feedback from its domestic and international users and according to our own

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subsidence monitoring data. The following important findings from our subsidence research program have been incorporated into the current version of CISPM program package:

- *Dynamic subsidence process associated with longwall mining operations.* As underground mining progresses, a surface point will experience a fairly complicated dynamic subsidence process before it becomes stable again. During the dynamic subsidence process, the magnitudes, natures and directions of the subsidence movements and deformations at the surface point change with time and their influences to structures are also time dependent. Very often the dynamic subsidence process plays a more important role in assessing and mitigating subsidence influences than final subsidence. Mathematical models have been developed to predict the entire dynamic subsidence process associated with longwall mining operations (Luo and Peng, 1992).
- *Final subsidence basin over a single and multiple longwall panels.* Most of the subsidence prediction methods have been developed for mining of a single panel only. They are unsuitable for the prediction of subsidence over multiple panels such as the longwall panels separated by chain pillar systems as normally practiced in the US. A mathematical model has been developed to predict the final subsidence basin over multiple longwall panels (Luo and Peng, 1990, 1991). This model is based on the finding that the convergence of the chain pillar systems between the longwall panels could contribute a very significant amount of subsidence in the area over and near the chain pillars.
- *Final subsidence caused by high extraction room-and-pillar mining method.* If the recovery ratio in a room-and-pillar panel is 70% or higher by partially or fully extracting the pillars in a room-and-pillar panel, immediate surface subsidence (versus the unpredictable subsidence events over low extraction room-and-pillar mines often seen as the abandoned mine subsidence) will be induced. The existing methods which have been derived from subsidence data collected over longwall panels are not suitable for subsidence prediction over high extraction room-and-pillar mines. Based on the available subsidence data collected over room-and-pillar panels, a method has been developed for the prediction of the final subsidence basin over high extraction room-and-pillar panels (Luo and Peng, 1993).
- *Studies of subsidence parameters.* The two basic components of a subsidence prediction method are the chosen mathematical models and the parameters involved in the mathematical model. The subsidence parameters often play a very important role in the prediction accuracy. However, the reported subsidence parameters often vary in very large ranges which are of little values in practical applications. Such large variations are often resulted from the use of inconsistent definitions of the subsidence parameters and inadequate determination methods. A great effort has been made in collecting subsidence data in the US coal fields, standardizing the definitions of and determining the subsidence parameters (Peng et al., 1995). Based on this study, the ranges of a number of commonly used final subsidence parameters have been greatly narrowed.

In additional to prediction of surface subsidence, tools are provided and self improvement mechanism is built in CISPM. They include data processing for subsidence survey, determination of subsidence parameters based on mining and geological information and deduction of parameters from collected subsidence data

Numerous field observations have demonstrated that complicated surface topography and steep surface slope in hilly regions have a profound impact on the ground subsidence process, often resulting in very different characteristics of subsidence basin from that on a relatively flat surface. Effort has been made to study the surface topography effects on ground subsidence process. A method has been developed for the prediction of final subsidence basin in hilly regions (Luo and Peng, 1990). Figure 1 shows a comparison of the calculated final horizontal displacement profiles with and without considerations of the surface topography. The surface elevation is also plotted at the top for reference. A much better agreement with the measured horizontal displacement in the steepest portion of the subsidence monument line has achieved when surface natural slope was considered. It should be noted that horizontal displacement often plays a much more important role in causing damages to surface structures than subsidence (i.e., vertical settlement).

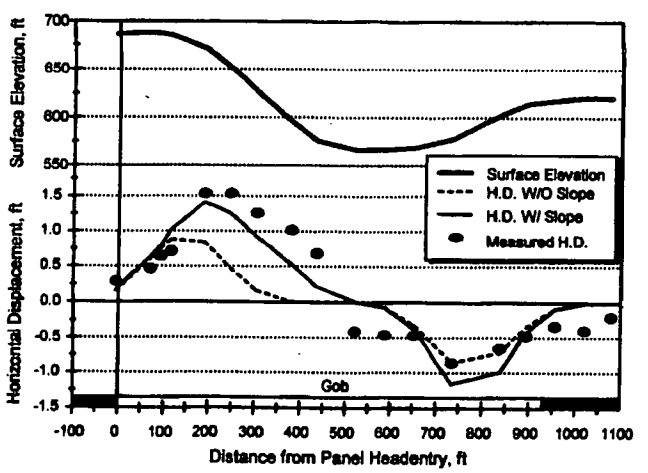

Fig. 1 Measured vs. calculated final horizontal displacement (H.D.) profiles along a cross-section over a longwall panel with relatively steep surface slope

TECHNIQUES FOR ASSESSMENT OF SUBSIDENCE INFLUENCES

Research emphasis has also been placed on monitoring the interaction between the subsiding surface and various surface structures. Based on the collected data, critical deformation values for various relatively simple structures have been

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established, techniques for assessing subsidence influences on those structures of large dimension and/or complexity have been developed.

A number of critical deformation values for typical residential structures (wood frame or brick super-structure on stone or concrete-block basement or foundation) in the northern Appalachian coal fields have been established. High surface tension and compression are generally responsible for cracks and buckling on the lower portion of the residential structures, respectively. High surface bending could causes problems to the super-structures such as sticky doors and windows, fissures on dry walls, peeling of old wall papers and paint. It is also found that a large tilting on floor could cause some inconveniences to the residents.

Ground cracks and bumps are caused by high surface tension and compression, respectively. Ground cracks as wide as 4 ft, though very rare, have been observed in certain locations over a few longwall panels. Generally ground cracks cause more problems (e.g., dewatering of surface streams or ponds) than the bumps. Criteria for initiating ground cracks on various ground surface have also been established.

For those structures of large dimensions and/or complicated design and construction, a more comprehensive and detailed assessment should be performed. However, due to the large variation of type, material, construction, dimension and functions of the structures, the techniques for assessing the subsidence influences on these types of structures vary considerably. Basic analysis should be performed to determine the nature and severity of the following three types of potential problems:

- *Structural integrity*: This is an indicator of mechanical failure of a structure of interest under the influence of subsidence. Ideally, the stress or strain field on the structures should be evaluated. The peak stress or strain are then compared to the permissible values of the structural material to determine the possibility of structural failure. For instance, a method has been proposed and successfully applied to assess the stress distribution on buried pipeline affected by subsidence (Peng and Luo, 1988). In cases where stress/strain fields are difficult or impossible to determine, the weakest components of the structure should be identified and empirical values are used to determine their integrity under the influence of surface subsidence.
- *Structural stability*: For those tall structures with small bases, the subsidence-induced slope could make them potentially unstable during or after subsidence process. Both the short and long term stability of the structure should be assessed. If the subsidence-induced slope could move the center of gravity of a structure out of its base, the structure is said to have lost its short-term stability. A structure loses its long-term stability if the strongest wind blowing in the direction of maximum slope caused by subsidence will be able to topple the structure.
- *Structural functionality*: The ability and level for the structures to perform their intended functions during and after subsidence may be affected by ground subsidence process. For example, subsidence could change the grade of a railroad well above its permissible grade. A conveyor belt could be rendered inoperable due to vertical and lateral alignment problems caused by the subsidence process.

The authors have applied the established criteria and the developed assessment techniques in various projects in assessing subsidence influences on various surface structures. Some examples of applying these assessment techniques are shown in Table 1.

TECHNIQUES FOR SUBSIDENCE MITIGATION

If the assessment indicates that a structure will be adversely affected, effective and efficient mitigation measures should be designed and implemented. The following three approaches can be used to design the mitigation measures: (1) reducing surface movements and deformations in the area of concern to an acceptable level by modifying the mining plan (e.g., leaving a support area under the structure), (2) reducing transmission of movements and deformations from ground to the structure of interest (e.g., trenching and plan-fitting), and (3) reinforcing the structure so that it can tolerate higher

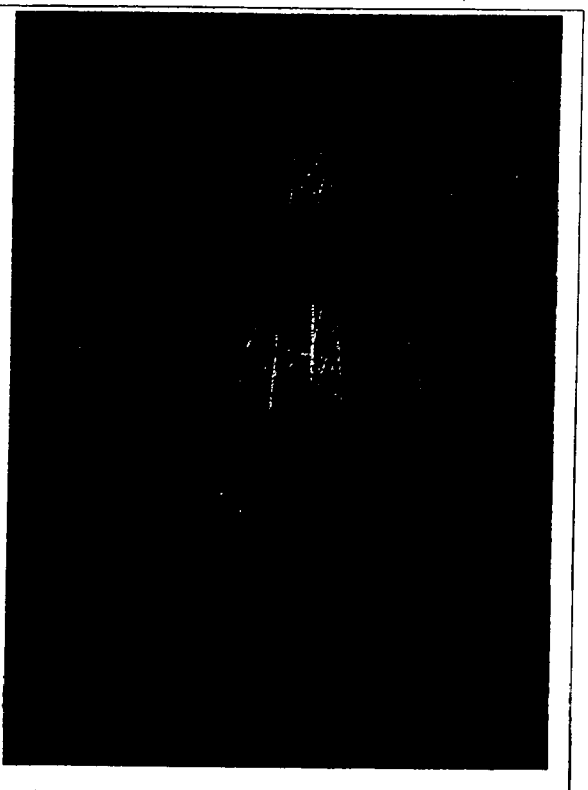

Fig. 2 This telecommunication transmission tower, about 200 ft tall, was located on a steep slope of a mountain peak. It was undermined by a longwall panel. In order to protect this tower, trench was dug around one of its legs and reinforcement beams were installed at the base. Despite of ground cracks observed nearby, there was no damage on thestructure and its service was kept open all time.

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Table 1 Some Examples of Subsidence Influence Assessments and Results

Structure or Feature	Descriptions	Major Concerns	Conculsions and Recommendations	Results
Residential Structures	More than 50 houses over or near longwall panels	Structural integrity and functionality	Verying damage potentials and mitigation measures recommended for about 30 structures	Accurate assessments and successful protection
Oil pipeline	Buried oil pipeline over 7 longwall panels	Structural integrity	Damage potential high. Mitigation measures recommended.	Feedback not available
Concrete water pipeline	Main transmission pipeline over 3 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures and alternatives recommended	Alternative plan adopted
Cast iron water pipeline	Two pipelines over 2 longwall panels	Structural integrity and functionality	Damage potential moderate. Mitigations recommended.	Not yet undermined
Steel water pipeline	Main water supply line over 4 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures recommended.	Protection successful
Plastic and steel gas pipeline	Low pressure distribution line over 3 longwall panels	Structural integrity and functionality	Damage potential for the steel pipe portions. Mitigation recomeended.	Mining in progress
Lake	A large lake over 11 planned longwall panels	Land area to be submerged by water after subsidence	About 400 acres of land will be submerged or ponded	Successfully undermined
Water ponds	2 water ponds over 2 longwall panels	Stream dewatering, potential underground mine workings flooding	Possibility of dewatering is low	Accurate assessment
Streams	3 streams over 7 longwall panels	Stream dewatering, potential underground mine workings flooding	Varying potential of stream dewatering	Accurate assessment
Mine refuse facility	Over 3 longwall panels with high embankment	Feasibility of longwall mining under	Support area recommended under the embankment, feasible to mine under pond	Successfully undermined
Mine refuse facility	Over 3 longwall panels previously mined	Feasibility of building the facility over the mined panels, long-term subsidence	Effects of long-term subsidence is very minor. Construction is feasible.	Feedback not available
Mine refuse facility	Over 3 planned longwall panels with very shallow overburden	Feasibility of longwall mining under	Safety questionable. Alternative mining plans suggested.	Not yet undermined
Railroad and bridge	A railroad over 4 longwall panels	Subsidence influences and operation safety	Influences could be strong. Monitoring and Mitigations recommended	Successfully protected
Power transmission system	3 towers (80 to 120 ft tall) and one substation over two longwall panels	Integrity, stability, functionality and operation safety	Anticipated structural problem on one tower and stability problem on another	Accurate assessment
Telecommunication transmission tower	200-ft tall tower located over a longwall panels (Fig. 2)	Integrity, stability, functionality	Strong influences. Mitigation measures recommeneded and implemented	Accurate assessment and successful protection
Highway and bridge	Highway across the end areas of 3 longwall panels	Subsidence influences	Very minor influence on highway. Questionable on bridge	Accurate assessment
Primary and secondary roads	Four roads over 8 lonwall panels	Subsidence influences	Varying degrees of influences. mitigations recommended for 2 roads	Accurate assessment

movements and deformations without being damaged (e.g., tension cable method). Mitigation measures for various structures affected by subsidence have been developed and tested in field conditions. Table 2 shows some of the structures that have been successfully protected with direct involvement of the authors.

Design of Support Area

By leaving an adequate area of coal unmined or partially mined under the structure to be protected, the surface movements and deformations in the area of the structure can be kept below the permissible level of the structure. The Pennsylvania method for designing support area is one example of applying this concept. However, the PA method over-designs the support area when mining depth is more than 350 ft. Based on a large number of collected longwall subsidence cases, a new method for designing support area has been proposed as shown in Fig. 3 (Peng and Luo, 1993) and successfully applied for two large structures (Table 2).

Mitigation Techniques for Residential Structures

A number of simple but effective mitigation measures have been frequently applied by the authors in protection of nearly 30 residential structures (Table 2). Among them, *com-*

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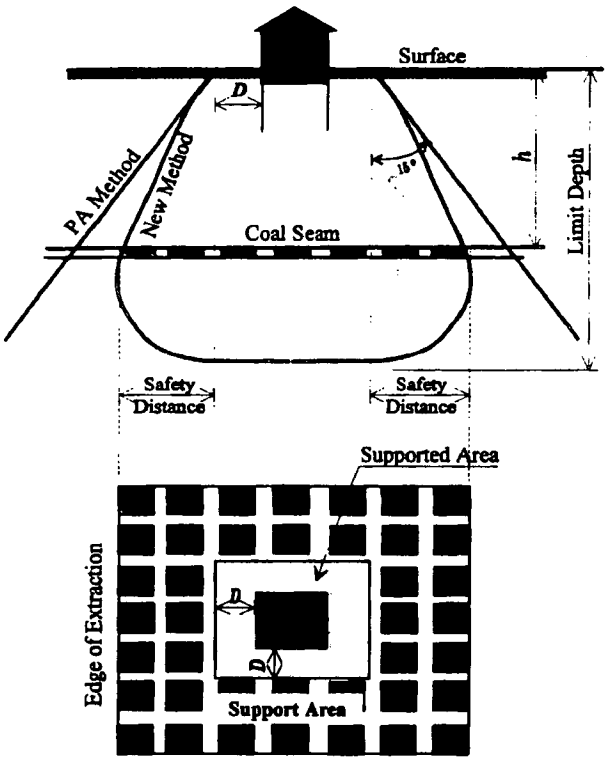

D - offset distance

Fig. 3 A method to design support area for surface structure has been developed based on the analysis of a large number of longwall subsidence cases. The support area designed using this method is usually smaller than that using PA method

pensation trench method is used to absorb surface tension or compression that could be transmitted to the structure from its surrounding ground. This method has been proven effective to reduce problems on the structural parts that have direct contact with the subsiding ground, such as basement and foundations. *Plane-fitting method* is to protect the super-structure of a house from being damaged by the bending and twisting actions associated with subsidence process. During the implementation of this method, the house super-structure is placed on a time-dependent inclined plane so that the super-structure is free of stress while the required amount of adjustments are kept minimized. *Tension cable method* is used to strengthen the structures so that they can tolerate higher surface tension and bending. Figure 4 shows a brick house that were successfully protected using a compensation trench and two tension cables.

Mitigation Measures for Buried Pipelines

Ground subsidence process often has the potential to cause damages to buried pipelines. Assessments of subsidence influences on various buried pipelines have indicated that the strain transmitted from the surrounding soil to the pipeline is always the No. 1 source of stress on the pipeline (Luo et al., 1997). Therefore, reduction of the strain transmission is the most effective method in the protection of buried pipelines. Uncovering pipeline only in the sections where the estimated stress is higher than the permissible stress of the pipeline material can greatly reduce the pipeline stress contributed by the ground strain. Such partial uncovering method has been successfully applied in the protection of a 7,800-ft section of water supply pipeline undermined by four longwall panels (Table 2).

Mitigation Measures for Railroad

Ground subsidence is capable of causing serious problems to railroads if proper cautions are not taken. A partial

Table 2 Some Examples of Successfully Protected Structures

Structures Protected	Descriptions	Mitigation Measures Employed	Results	Monitoring Performed
Residential Structures	25 houses, 2 garages and 1 swimming pool over 19 longwall panels	plane-fitting, compensation trench, tension cable, external bracing	Very good rate of success. Figure 4 is one of the examples	Subsidence
Railroad	About 11,000 ft long over 4 longwall panels	Partial lifting	It was kept operating during subsidence. Great saving in material and labor costs	Subsidence
Railroad bridge	130 ft, three sections	A 440x510 ft² support area under the bridge	Bridge not affected at all	Subsidence
Water pipeline	About 7,800 ft long 12-inch steel pipeline over 4 longwall panels	Partial uncovering	Service has never been intrrupted	Subsidence, strain
Overland conveyor belt system	About 1,400 ft long erected between 16 and 50 ft above ground level with a 300-ton transfer tower over a longwall panel	Uncovering support bases, loosening bolts at the bases, lateral stabilization	Despite of large surface movement, it required only some minor repairs before being put into operation again	Subsidence, strain, tilting
Telecommunication transmission tower	About 200 ft high located on the top of high mountain and between two longwall panels	Compensation trench, strengthening tower base	Despite of ground cracks observed nearby, no damage observed on the structure and service not interrupted	Visual observation
Coal refuse disposal facility	Large slurry pond with an embankment nearly 200 ft high.	A 1,300x1,930 ft² support area under the embankment only	The integrity, stability and functionality of the facility not affected	Subsidence

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Fig. 4 This brick house was successfully protected by a compensation trench and two tension cables. The placements of the trench and cables and the required tension in the cables were determined by subsidence simulations.

lifting method has been developed. The original elevation profile of the railroad, the predicted final subsidence profile and the permissible railroad grade are considered in determining the required adjustment along the section of railroad to be affected. This method has been applied to protect a section of railroad about 11,000 ft long undermined by four longwall panels (Table 2). The maximum subsidence at the site was about 4.5 ft. Adjustment on the railroad was only recommended in some sections much shorter than the total length of the railroad affected by subsidence with the maximum adjustment being about 2.5 ft only. As a result of implementing the partial lifting method, the subsided and adjusted railroad was kept smooth for safe railroad operation while the required adjustment was kept to a minimum.

A CASE STUDY

This section shows a case of the protection of a railroad over a longwall panel. The longwall panel was 930 ft wide mining a coal seam of about 6.5 ft thick. The overburden depth at the site was about 680 ft. The layout of the railroad over the longwall panel is shown in Fig. 5. The predicted final subsidence at the site is also plotted in this figure with the maximum subsidence being about 4.2 ft which matched very well with the measurements. The elevation profile of this section of railroad before subsidence is shown in Fig. 6. Based on the predicted final subsidence, original elevation and the permissible grade of 0.7%, the final railroad profile requiring the minimum amount of vertical adjustment was determined before it was undermined. In preparation, a large proportion of the required amount of gravel to raise the railroad was shipped to the site and spread in the sections needing the most amount of adjustment. During the active subsidence period, the railroad was monitored and vertical adjustment was made accordingly. A temporary speed limit of 5 mph was also posted as a precaution. Figure 6 shows one set of recommended adjustment during the active subsidence period and the elevation profiles of the railroad before and after the implementation of the recommended adjustment. By implementing the recommended adjustment, the maximum railroad grade was reduced from about 1.0% to the permissible 0.7% (Fig. 7). The railroad service was never interrupted during the entire subsidence process. Figure 8 shows a fully loaded coal train was passing the section of subsiding and adjusted railroad.

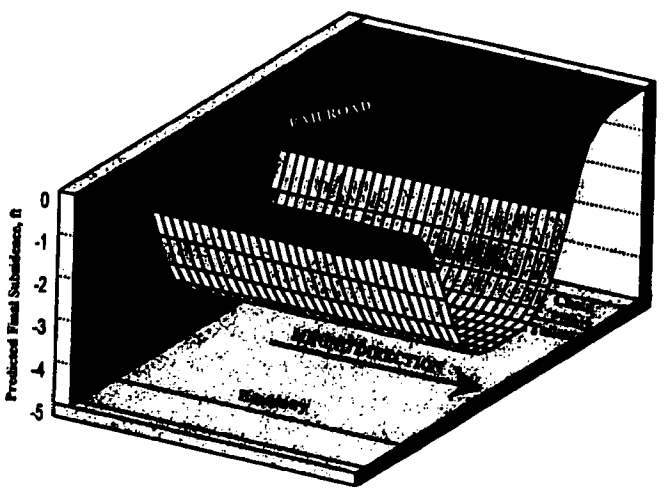

Fig. 5 Layout of the railroad over the longwall panel and predicted final surface subsidence at the site

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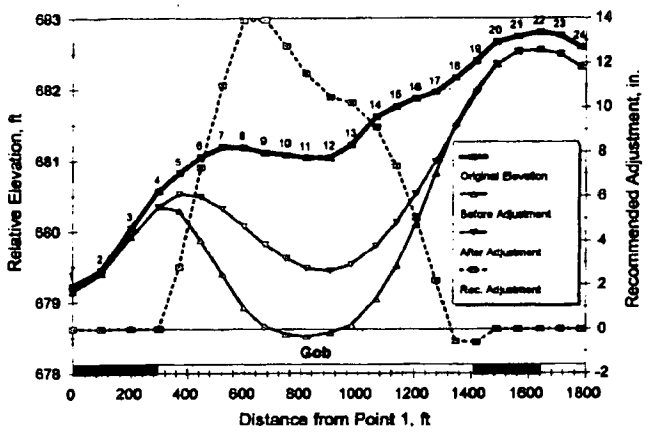

Fig. 6 Elevation profiles of the railroad and one set of recommended vertical adjustment during the active subsidence period. Using the partial lifting method, the required adjustment was kept to a minimum while the railroad was smooth.

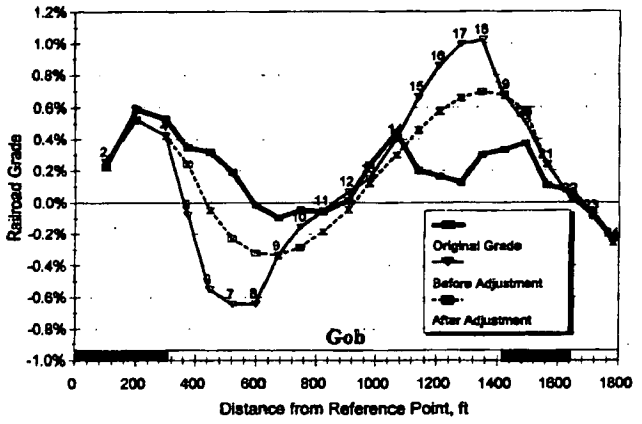

Fig. 7 Grade profiles of the subsiding railroad before and after implementing the recommended adjustement. The maximum grade of the adjusted railroad was kept within the permissible grade of 0.7%

SUMMARY

Subsidence prediction, influence assessment and damage control have come a long way. A systematic subsidence research program coupled with intensive field monitoring and extensive data collection during the past twenty years have produced vast amount of quality data and knowledge. Numerous case studies have demonstrated that using these research results, surface subsidence caused by full and high extraction mining methods and its effects can be predicted with confidence, and mitigation measures can be selected, designed and implemented successfully.

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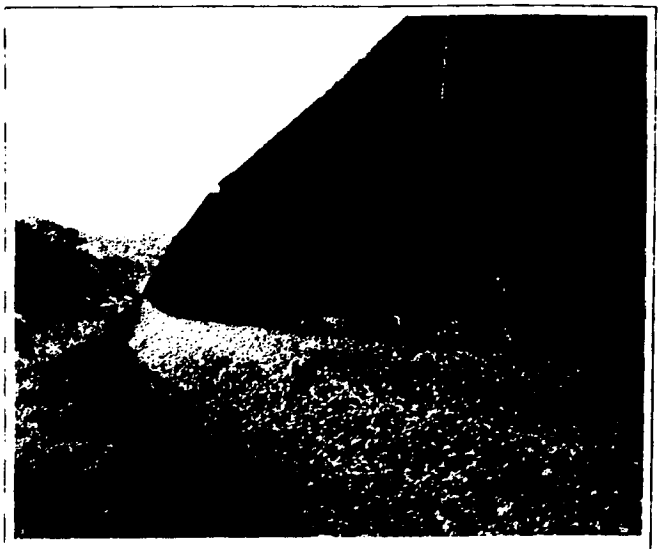

Fig. 8 This loaded coal train was passing through a section of subsiding railroad. The railroad was successfully protected using the partial lifting method.

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Ohio Department of Natural Resources

TED STRICKLAND, GOVERNOR | SEAN D. LOGAN, DIRECTOR

Division of Mineral Resources Management
Scott R. Kell, Acting Chief
2045 Morse Road – Bldg. H3
Columbus, OH 43229-6693
Phone: (614) 265-6633 Fax: (614) 265-7998

July 16, 2007

American Energy Corporation
43521 Mayhugh Hill Road
Beallsville, OH 43716

Re: Conditional Clearance Historic and Prehistoric Properties
AAA-0425-5 Permit D-0425

Dear Applicant:

This is to inform you that the Division of Mineral Resources Management has given your Proposed mining project a conditional clearance. The conditions include the following:

Prior to any surface or structural repair (on structures older than 50 years) due to mining, further coordination with the Division of Mineral Resources Management and the Ohio Historic Preservation Office is necessary.

It is your responsibility to notify the Division prior to actual affectment of the avoided historic and prehistoric properties. The Division will inform you of the necessary steps required to remove the above conditions.

If you have any questions or need additional information regarding this matter, please contact me at (614) 265-6633.

Sincerely,

Jeffrey C. Reichwein, Ph. D.
Archaeologist

JCR:my

cc: Ohio Historic Preservation Office
Jack A. Hamilton and Associates Inc.
Scott Stiteler: Cambridge District Office
John Puterbaugh: Cambridge District Office
Permit File
Archaeologist File

Ohio Department of Natural Resources

BOB TAFT, GOVERNOR

SAMUEL W. SPECK, DIRECTOR

Division of Mineral Resources Management
Michael L. Sponsler, Chief
2045 Morse Road, Bldg. H3
Columbus, OH 43229-6693
Phone: (614) 265-6633 Fax: (614) 265-7998

May 3, 2006

American Energy Corporation
43521 Mayhugh Hill Road
Beallsville OH 43716

RE: Revised Conditional Clearance Historic and Prehistoric Properties
Permit # D – 0425 - 5

Dear Applicant:

This is to inform you that the Division of Mineral Resources Management has given your proposed mining project a conditional clearance. The revised conditions include the following:

> No planned subsidence may occur, except for the three northernmost panels which do not contain historic structures, until the Division and the Ohio Historic Preservation Office has approved the historic architecture report.

It is your responsibility to notify the prior to actual affectment of the avoided historic and prehistoric properties. The Division will inform you of the necessary steps required to remove the above conditions.

If you have any questions regarding or need additional information, please contact me at (614) 265-6633.

Sincerely,

Jeffrey C. Reichwein, Ph.D.
Division of Mineral Resources Management

JCR/llc

Cc: Cambridge District Office Inspector
Ohio Historic Preservation Office
Permit File
Archeologist File

DNR 0001

I attest that the methodology and findings presented in this report are based upon the currently accepted principles of mining engineering. Specifically, the subsidence prediction and modeling methods used in the report have been developed and calibrated through years of research and applications on similar structures.

Yi Luo, Ph.D., P.E.
Associate Professor
Department of Mining Engineering
College of Engineering and Mineral Resources
West Virginia University
Morgantown, WV 26506

Under temporary authorization (based on application to register by comity in the State of Ohio, dated January 11, 2007) which will expire on March 19, 2007.

Signature: _____ January 24, 2007

YI LUO
REGISTERED
15073
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Registration No. and Seal: WV 15073

State of Ohio: Temporary Permit Granted on January 19, 2007

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Signature: _____, January 24, 2007

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State of Ohio: Temporary Permit Granted on January 19, 2007

Assessment and Mitigation of Subsidence Influences on Tower Structures Affected by Longwall Mining Operations

By

Yi Luo, *Ph.D., P.E., Research Associate Professor*
Syd S. Peng, *Ph.D., Professor and Chairman*
Department of Mining Engineering
West Virginia University

INTRODUCTION

In the new permit area of the American Energy Corporation's Century Mine (Permit application No.: D-0425-5), the planned longwall mining operations will be conducted under a number of municipal and industrial structures. These structures include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for telecommunications. The first author visited the sites on July 19, 2005 and obtained the necessary mine maps.

This report presents the methods for assessing and mitigating the potential subsidence influences on these tower structures caused by the planned longwall operations in the permit area.

SITE AND STRUCTURES

Surface and Mine Layout

Figure 1 shows the site where the main structures are located. The water tower and a larger communication tower are located on the top part of the figure while the smaller cell tower and the power transmission line are on the lower part of the figure. At the time of the site visit, the mining company has also considered to lay out the longwall panels in a different way to place some of the main structures (i.e., water towers, and guyed telecommunication towers) over the central portions of the longwall panels so that they will not subject to permanent surface deformations caused by the mining operations.

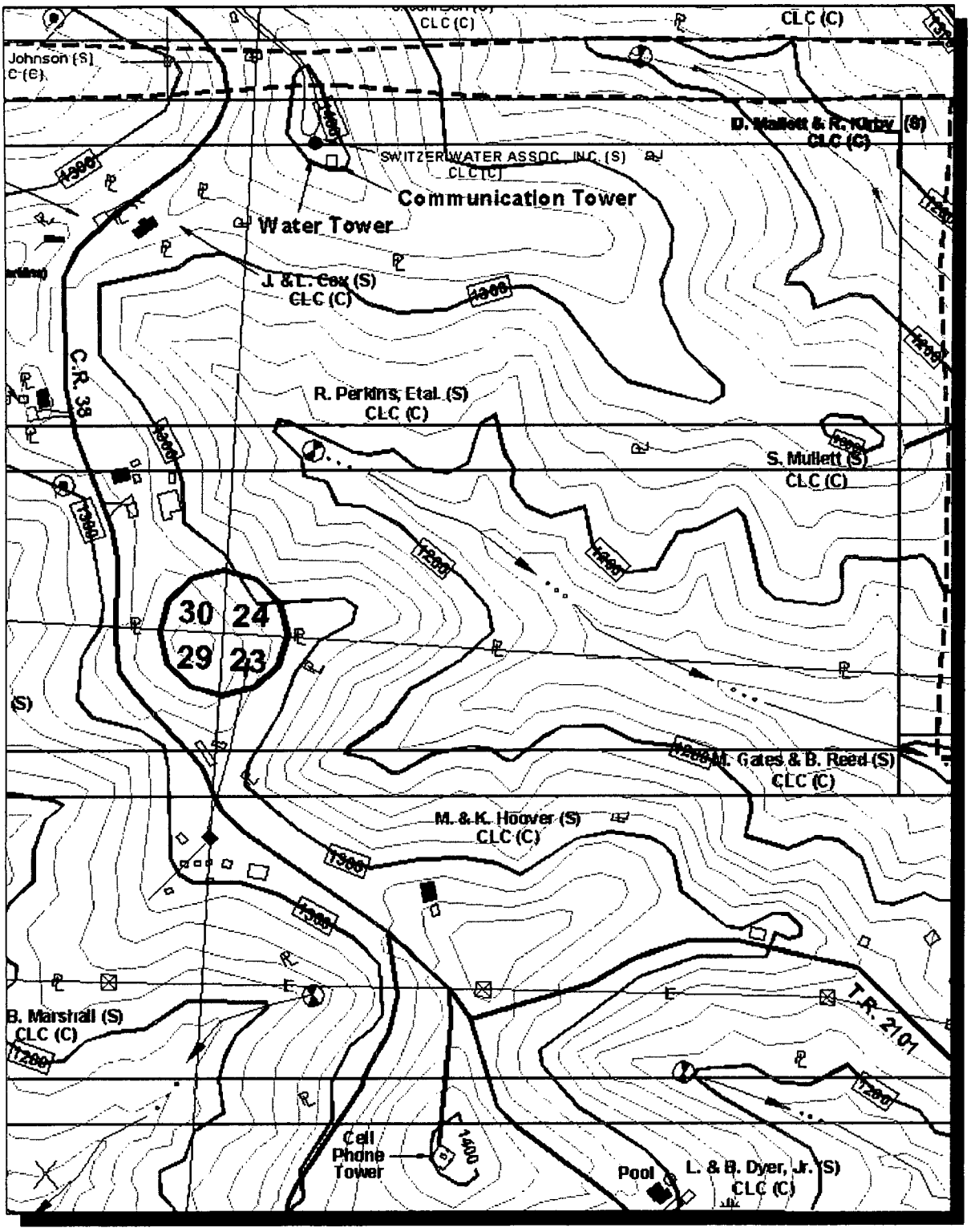

Fig. 1 Area with the Main Structures

The gentle hilly surface topography in the area is also shown in Fig. 1. The overburden depth at the locations of the tower structures ranges from 460 ft to 745 ft. The rib-to-rib width of the longwall panels is 920 and the width of the three-entry chain pillar system between adjacent longwall panels is about 140 ft.

Main Structures

The main structures in the permit area include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for wireless telecommunications.

Figure 2 shows the water tower. It is located on the top of a gentle hill. The tower is a steel cylindrical structure sitting on a concrete base. The cylindrical tank is about 50 ft tall and 14 ft in diameter and has a holding capacity of 54,000 gallons. The concrete base under the tank is about 15 ft in diameter and between 3 and 4 ft thick (Fig. 3). The outer layer of the steel sheet that was used to construct the water tank is about 3/16" thick.

Figure 4 shows the larger communication tower. It is located a short distance away from the water tower on a gentle slope. The height of the tower is about 300 ft. The tower is a guyed steel lattice tower with the guy wires tied at five different levels on the tower. Three guy wires are used at each tie level. Therefore, guy wires permit the main tower structure to rotate in the horizontal plane to certain degree. The base on the tower (Fig. 5) is bolted to the concrete foundation with one bolt to allow horizontal rotation. The guy wires are tied to the ground at three anchor locations (Fig. 6) that are spaced 120° apart from the base. Pole type antennae are mounted on the top of the tower.

Figure 7 shows the small cell phone tower located on the top of another gentle hill. It is also a guyed steel tower and is about 150 ft high. The guy wires are tied to the main tower structures at three different levels. At the lower two levels, three guy wires are used at each tie level. On the top level, six guy wires, two on each direction, are used to restrict the horizontal rotation of the tower structure (Fig. 8). The base of the tower is the same of the larger tower. On the ground, three anchors are buried about 120° apart from the tower base. Four dish type antennae are mounted on the top of the tower and another dish antenna at middle level.

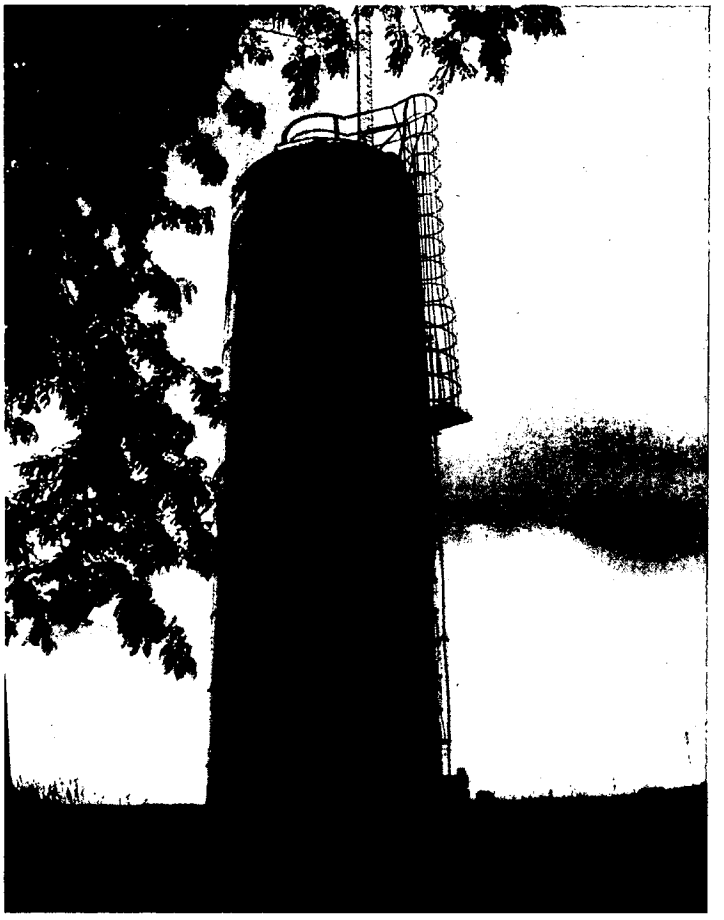

Fig. 2 Municipal Water Tower

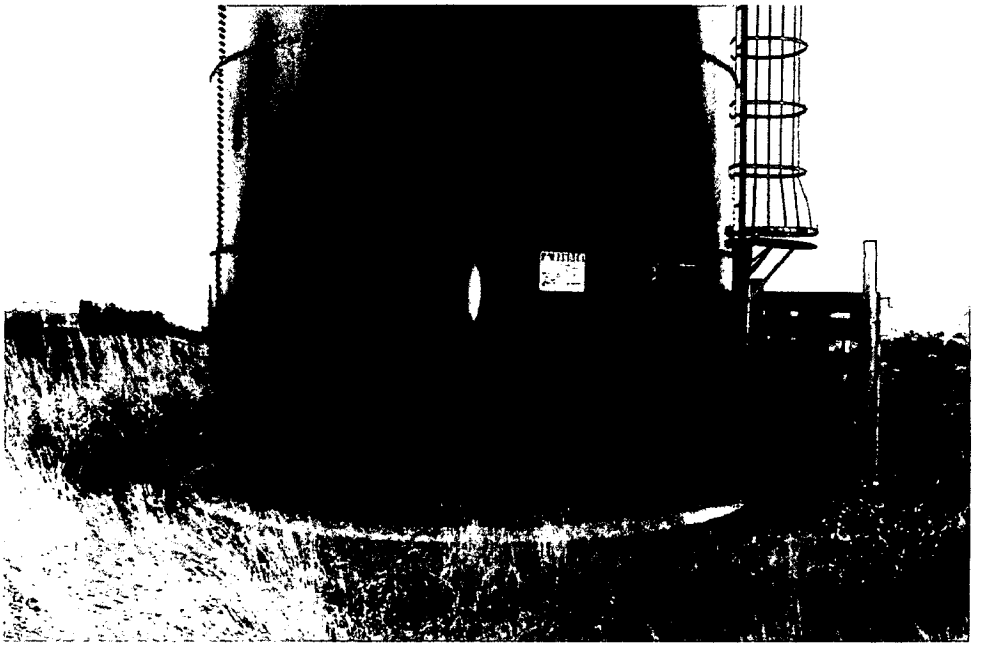

Fig. 3 Base of the Water Tower

Fig. 3 Larger Communication Tower

Fig. 5 Base of the Large Communication Tower

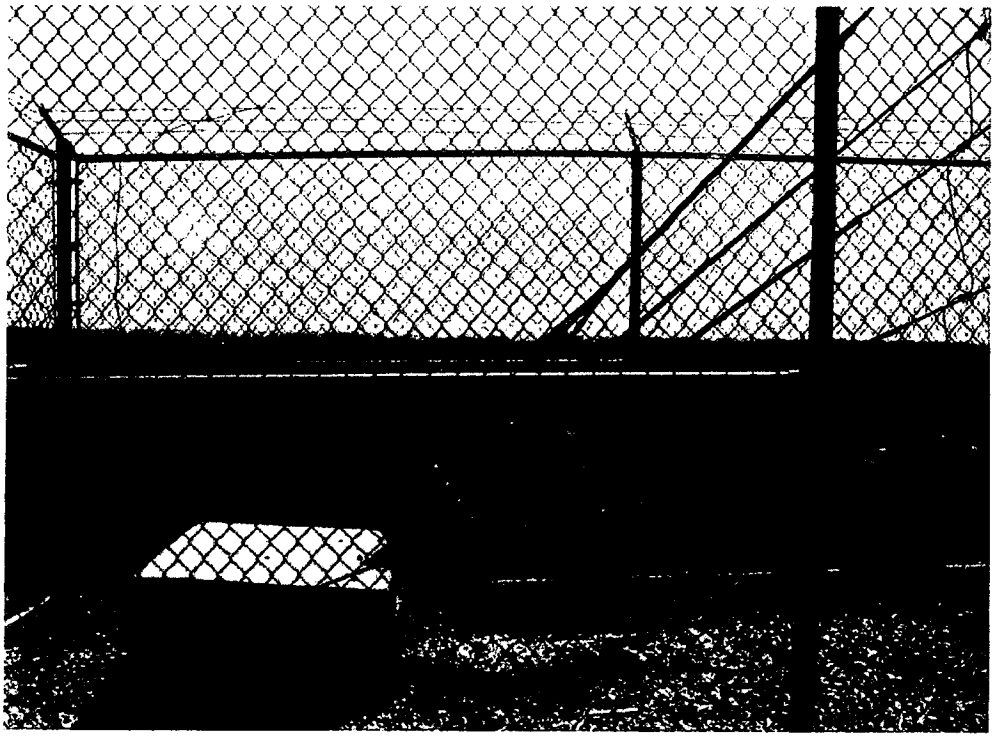

Fig. 6 One of the Three Anchors for the Large Communication Tower

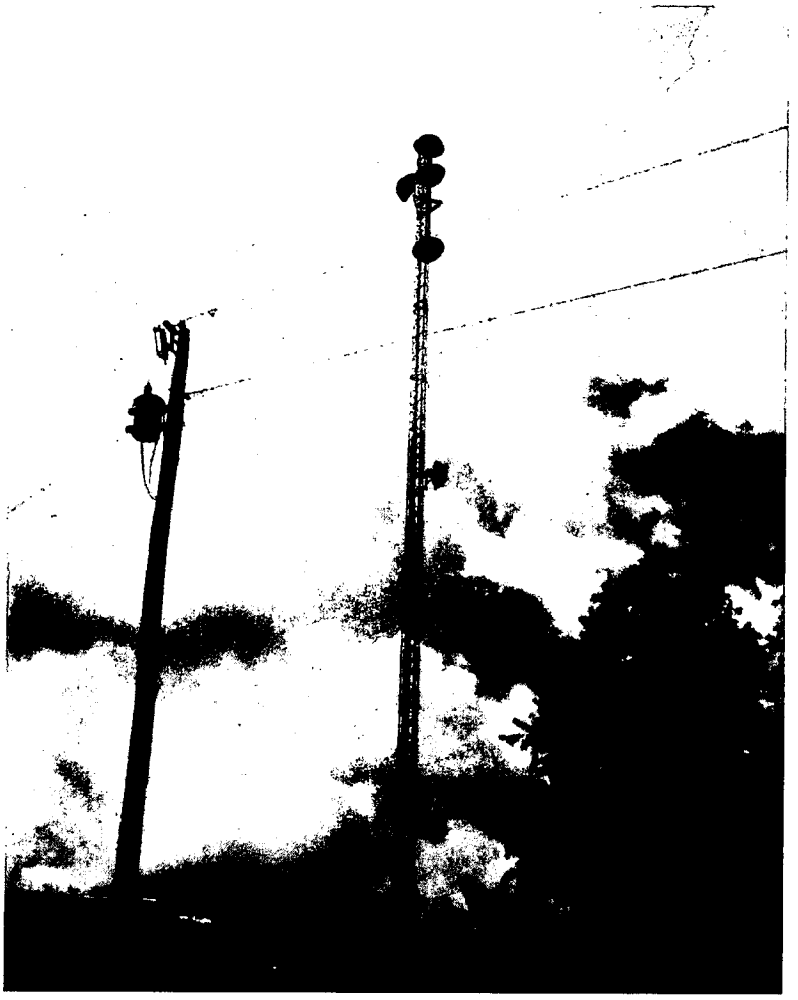

Fig. 7 Small Cell Phone Tower

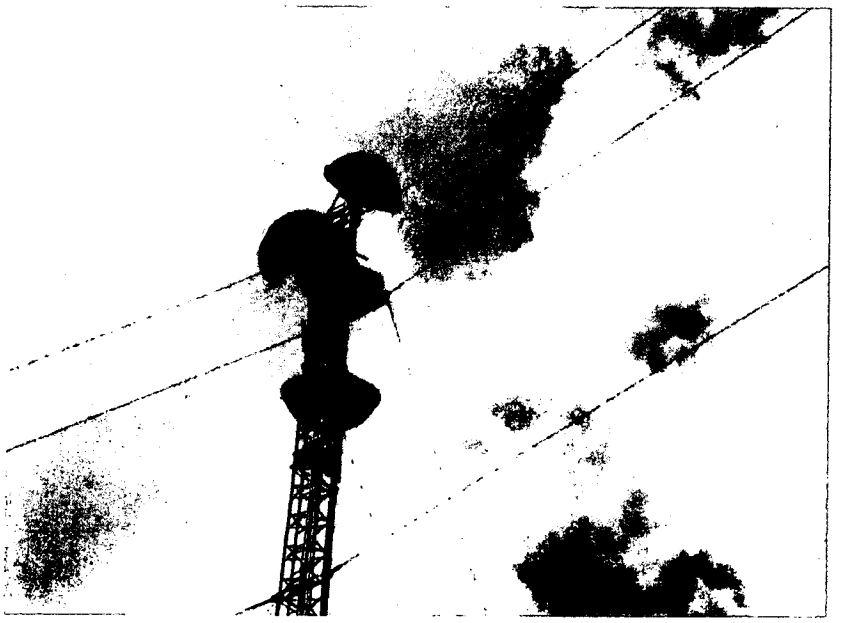

Fig. 8 Directional Control Guy Wires Tied at the Top Level

One of the power transmission towers is shown in Fig. 9. All 14 power tower share the same structural design. The steel lattice tower has four legs bolted to their concrete bases. The side distance is about 28.5 ft. The tower is about 75 ft tall and the transmission lines are hung at two levels. The main load-bearing members of the tower are made of 5-inch angle steels while smaller bars or angle steels are used for the other members. The lowest restrictive horizontal bars are located about 20 ft above the ground surface.

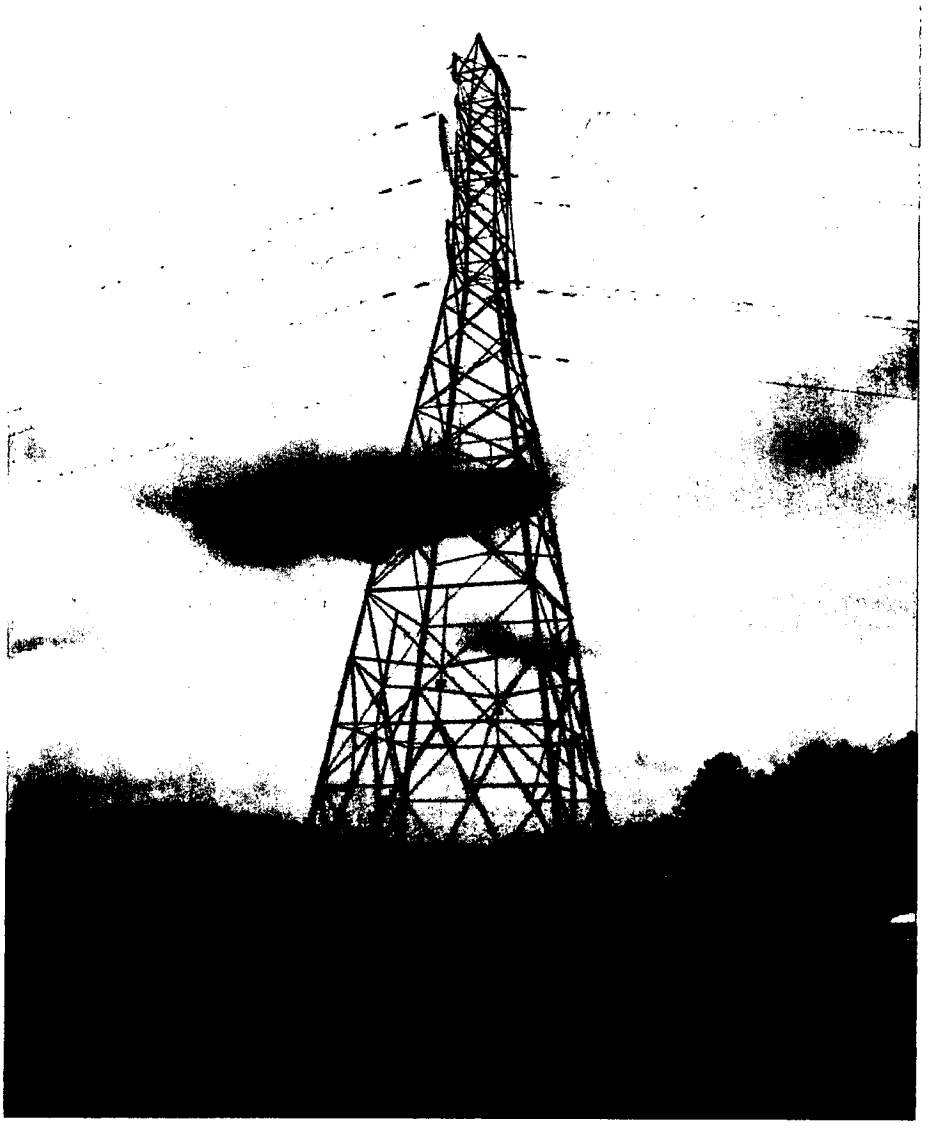

Fig. 9 Power Transmission Tower

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ASSESSMENT AND MITIGATION OF THE SUBSIDENCE INFLUENCES

In this section, the potential subsidence influences on the water tower has been assessed and the mitigation measure for it has been recommended. In assessing the potential subsidence influences, the structural integrity, stability and functionality of the structures should be assessed. For the two communication towers, the methods for assessing and mitigating the influences are mentioned. Surveys to locate the anchors should be performed before the detailed analysis can be performed. Among the 14 transmission towers, eight of them could experience subsidence influences. The subsidence influences could be dependent on many factors and should be assessed one by one.

Influences on and Mitigation Measures for Water Tower

In order to assess the potential subsidence influences to the water tower, the final and dynamic surface movements at the location of the tower have been predicted. The subsidence prediction program CISPM version 2.01 is used. The development of the prediction package is based on the influence function method that is widely adopted in the major mining countries including US coal mining industry and a large amount of collected subsidence data. Most of subsidence cases are collected over longwall panels mining in the Pittsburgh coal seam. This subsidence prediction program package has been successfully applied in various subsidence projects and proven accurate.

The overburden depth at the location is about 745 ft and the center of the tower is located 325 ft inside the panel edge according to the new panel layout. A mining height of 6.0 ft is used in the prediction. The predicted final subsidence profile across a longwall panel with the minimum (460 ft) and maximum (745 ft) overburden depths are plotted in Fig. 10. The location of the water tower, as well as the two guyed telecommunication towers, is also shown in the figure. It shows that the tower is located near the flat bottom portion of the final subsidence basin to be formed over the longwall panel and the predicted final subsidence at the center of the tower is about 3.43 ft. Since the water tower is located on the top of a high hill with its elevation much higher than its customers in the adjacent area. The reduction on water head due to mining subsidence (only about 7% of the tower height) will be too insignificant to reduce its ability for serving the cus-

tomers. The predicted final surface slope, strain and curvature are 0.31%, -5.2×10^{-3} ft/ft (compression) and -6.4×10^{-5} 1/ft (concave). Due to its small foot size, the water tower is very unlikely to be affected by these final deformations.

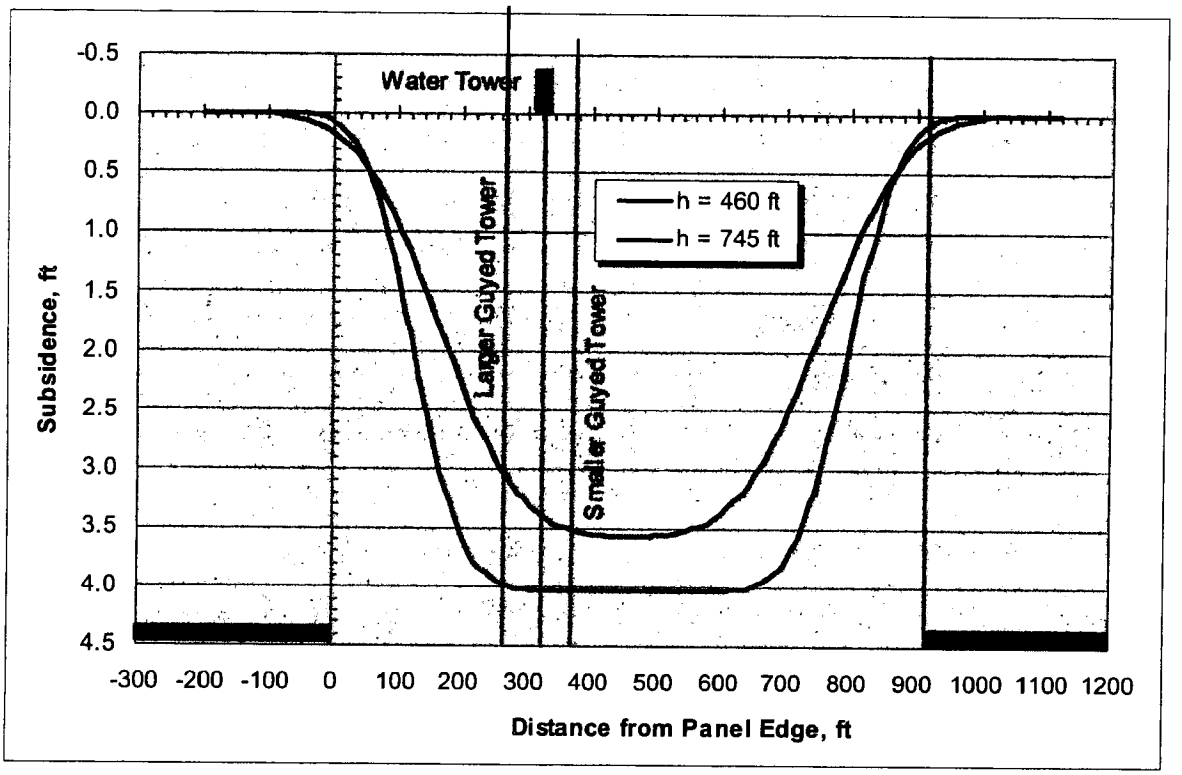

Fig. 10 Predicted Final Subsidence Along a Transverse Cross-section

Before the water tower finally settles down, it will experience a dynamic subsidence process. Figure 11 shows the predicted dynamic subsidence development curves at the location of the tower. Face advance rates in a large range of 20, 40, 60 and 80 ft/day have been used in the dynamic subsidence predictions. It shows the faster the face advances, the longer and gentler is the subsidence development curve. The tower is to experience the dynamic subsidence when the longwall face is about 50 ft inby and 700 ft outby the tower with the most active subsidence precess occurring when the longwall face is between 270 and 330 ft past the tower. Due to its small base and large height, the structural stability under the influence of dynamic subsidence process might be a concern. To assess the stability, the predicted dynamic slope development curves are shown in Fig. 12. The maximum dynamic slopes are 1.0%, 0.89%, 0.79% and 0.72% for the four ad-

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vance rates used. Such small dynamic slopes are even barely noticeable without pri. These maximum slopes would occur when the longwall face has passed the center of the tower a distance between 250 and 290 ft. Even when the water tank is operated at full level as the worst case, the center of the gravity of the water tower is located about 25 ft above the ground surface. Using the predicted maximum dynamic slope of 1.0%, the center of gravity of the tilted tower will only move a horizontal distance of 0.25 ft (3 inches) away from its original base center. Compared to the 7-ft radius of the tower base, the relocation of the center of gravity of the tower is very insignificant (3.6%). Therefore, the stability of the water tower will not be affected by the dynamic subsidence process at all.

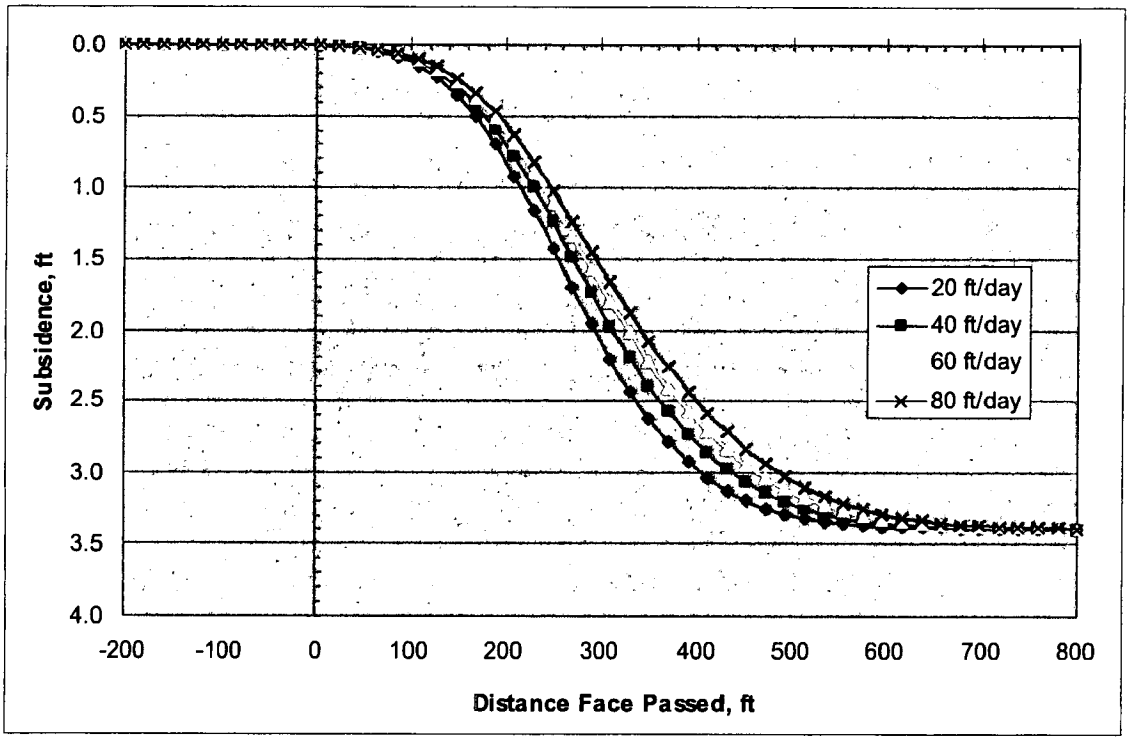

Fig. 11 Predicted Dynamic Subsidence Development Curves at the Water Tower with Various Face Advance Rates

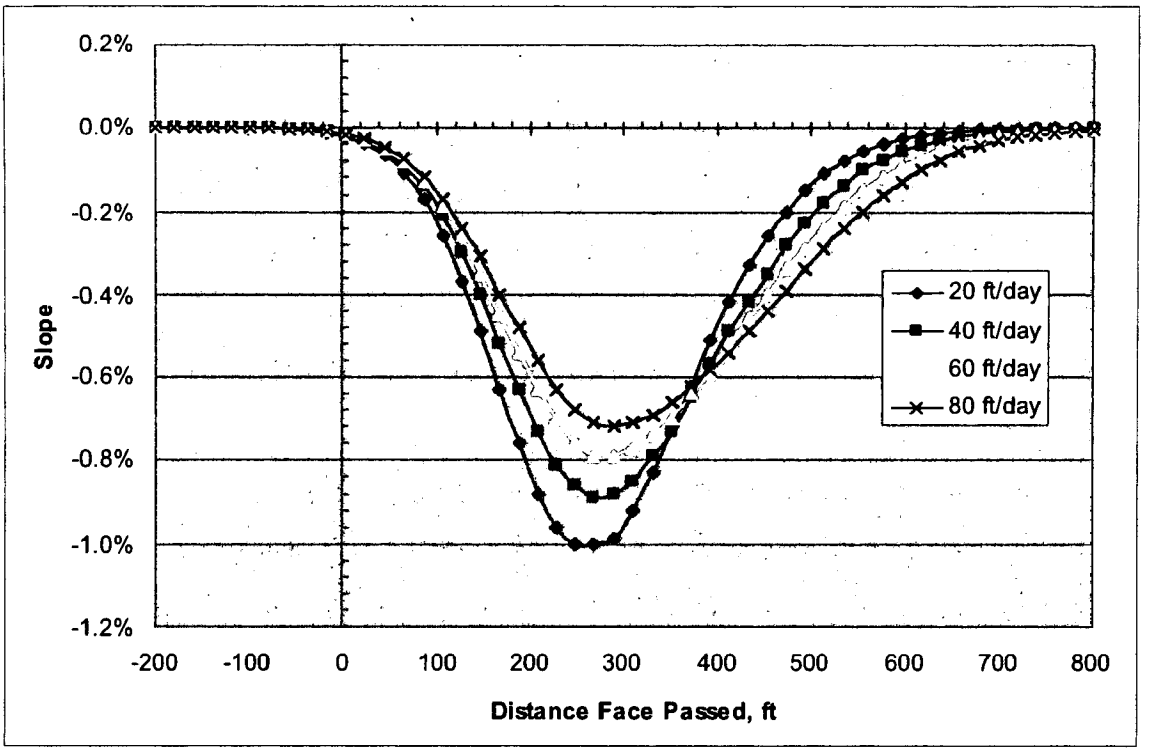

Fig. 12 Predicted Dynamic Slope Development Curves at the Water Tower

The predicted maximum dynamic tensile strains (not shown) for the ranges of face advance rates range from 3.46×10^{-3} to 5.51×10^{-3} ft/ft occurring at 165 ft behind the longwall face. The maximum dynamic tensile strain might be able to create some hair-line cracks on the concrete base of the water tower. The maximum dynamic convex curvatures will be in the range from 4.19×10^{-5} to 6.67×10^{-5} 1/ft, too small to cause any problems to the water tower structures.

In order to prevent the concrete base of the water tower from being cracked by the dynamic tensile strain, it is recommended to wrap the concrete base with two steel tension cables. New 3/4 –inch steel wire cables should be used. The cables should be placed about 4-inches below the top surface of the concrete base and each cable should be tensioned to 4-tons (8,000 lbs). The cables should be installed when the longwall face is still 200 ft to the tower and can be released after the face has passed the tower a distance of 1,000 ft.

Influences on and Mitigation Measures for the Telecommunication Towers

The locations of the two telecommunication towers with respect to the edges of the longwall panel are also plotted along with the predicted final subsidence profiles in Fig. 10. The smaller tower is located in the central and flat bottom portion of the subsidence basin with the final subsidence at its base being about 3.6 ft. The larger tower is located in the concave portion of the final subsidence basin and the final subsidence at its base is about 3.0 ft.

The assessment of subsidence influences on the guyed towers is much more complicated than that for the water tower. The authors have developed the assessment techniques and successfully applied them to one guyed tower that was similar to the two towers in this study and used for signal relay of cellular phone services. Based on the assessment, simple and inexpensive mitigation measures were recommended and mitigated. That tower was successfully protected and its services was never been affected despite of severe winter weather while mining was conducted under the tower. The publication (Luo et al, 2003) detailing the assessment techniques and mitigation measures is attached as an appendix. In assessing the influences, the following design and operating parameters of the towers are required:

- Coordinates and elevations of the tower base and ground anchors
- Elevations of the guy wire ties on the towers
- Sizes of guy wires
- Ranges of the tensions in the guy wires

We request these necessary design and operating parameters be provided before the detailed analyses on the potential subsidence influences on the guyed towers are performed. The predicted final and dynamic movements at the base and the anchors will be used in addition to other input information in assessing the subsidence influences on the guyed towers.

However, it is anticipated based on our past experience that the tensions in the guy wires could increase in the first half of the dynamic subsidence process and decrease in the second half of the process. If the guy wire tensions increase too much, they place a significant additional load on the lower members of the tower structure and potentially

leads to problems to the tower base, the guy wires and the anchors. If the guy wire tension decreases too much, it could cause slacking condition to the guy wires which reduces lateral restraints to the main tower structure. The significant differential ground movements in both vertical and horizontal directions at the tower base and ground anchors will also cause vertical and horizontal rotations that could lead functionality problems to the towers.

However, as mentioned previously, we have developed and successfully applied some mitigation measures for such guyed towers. The mitigation measures could include: (1) periodical monitoring the tensions in the guy wires (i.e., 2 to 3 times a day during the active dynamic subsidence period) and adjusting the tensions in the guy wires if needed, and (2) monitoring the plumb of the main tower structures from two orthogonal directions (i.e., parallel and perpendicular to the mining direction) and adjust the guy wires as needed. These mitigation measures are relatively simple and inexpensive to implement.

Influences on and Mitigation Measures for the Power Transmission Towers

The 14 power transmission towers are located over two longwall panels according to the latest mine layout. Among them, three are located beyond the panel setup entries or recovery lines expecting no or very minor subsidence influences. Eight towers are located over or near the chain pillar system between two adjacent longwall panels. These towers are to experience a small amount of final subsidence but some of them may be subject to high final tensile strains. The remaining three power towers are located in the "central" portion of one longwall panel and expecting to experience strong dynamic subsidence process. Therefore, the power transmission towers located over the chain pillars system and within the panel edges may be affected by the proposal longwall mining operations. The severity of the potential subsidence influences to each of the tower could be different depends on their relative locations to the longwall panels, surface topography, the design and construction of the towers, etc. At the time of this writing, the design information of the power towers have not been provided for us to performed detailed analyses.

However, it should be noted that the authors have previously performed assessments on the subsidence effects and monitored the stress on a number of power transmis-

sion towers similar to the ones in this permit area. That study found that the longwall subsidence process would have very little effects on the stability even when the lateral load by the strongest wind was applied on the subsided tower. That study also considered the additional tension or sagging conditions when two adjacent towers are subject to differential lateral movements and slopes during and after the subsidence process. It was found that such additional tension was insignificant to affect the power transmission lines. However, the differential movements, especially differential horizontal displacements, among the legs of each tower could cause bending and twisting to the steel members at the lower level.

In another study, the authors studied a very important and large 4-leg telecommunication tower located on the top of a very steep mountain peak (Luo and Peng, 1997). The tower was responsible for sending and receiving signals to telecommunication satellite for a national telephone company. It experienced two subsidence processes when two adjacent longwall panels were mined. The analyses on the stability, functionality and structural integrity were performed. It was found that the differential movements at the legs could cause problems to the lower parts of the tower. In order to reduce the severity of the anticipated subsidence influences, mitigation measures, including a compensation trench and bracing methods, were recommended and implemented for this tower. The mitigation was very successful. No damages were found on the tower structure despite that ground cracks were observed nearby. The services were never been interrupted. Based on the experiences with 4-leg towers, we believe that the same or similar mitigation measures can be applied in protecting these power transmission towers. In order to perform detailed analyses of the structures, design information from the power company is needed.

CONCLUSIONS

A preliminary study has been performed for three types of tower structures located in an area where the mining permit is in application process. It is concluded that among the three types of the structures:

1. The stability and functionality of the water tower would not be affected by the dynamic subsidence process according to the new mine layout. The dynamic strain could cause some minor cracks on the concrete base of the tower but the anticipated problem can be controlled using tension cable method.
2. The potential subsidence influences on the two guyed telecommunication towers can be assessed using the techniques developed by the authors. Based on our previous experience, relatively simple and inexpensive mitigation measures can be applied to protect these two structures.
3. The subsidence influences on 4-leg steel towers for electrical power transmission can be assessed and mitigated using proven techniques.

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Luo, Y. and S.S. Peng, 1997, "Subsidence Prediction, Influence Assessment and Damage Control," *Proc. 16th Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, West Virginia University, WV, pp. 50-57.

Luo, Y., S.S. Peng and B. Miller, 2003, "Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study," *Proc. 22nd Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, C. Mark and A.W. Khair, pp. 360-366.

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APPENDICES

Two publications by the authors
on assessing and mitigating subsidence influences
on tower structures.

22nd International Conference on Ground Control in Mining

Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study

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ABSTRACT

The potential influences of mining subsidence on structural stability, integrity and functionality of guyed tower structures have not been systematically studied before. This paper presents a case study where a guyed steel tower of a telecommunication company was mined under by a longwall operation. Prior to mining, every aspect of the subsidence influences to this structure was studied. The pre-mining assessment indicated that the structure could experience vibration problem in the second half of the dynamic subsidence process. Based on the study, a simple mitigation measure was recommended and implemented and the structure was successfully protected.

INTRODUCTION

Guyed tower structures have been frequently employed to elevate objects (e.g., radio or TV transmitters, wind turbines, etc.) high above ground surface because of their low construction cost and great stability. A guyed steel tower is consisted of a tall and slim steel lattice structure restrained laterally by a number of steel guy wires from different directions.

Mining in a longwall panel with a fairly large overburden was conducted under a guyed steel tower used for wireless phone service. Assessment of the influences of the subsidence process on this structure has been performed using the methods developed in this study prior to the longwall mining operation. The assessment concluded that the stability, integrity and functionality of this tower structure would not be affected by the subsidence process. However, the lateral restraint to the steel tower by the guy wires would be reduced, possibly causing vibration of the structure under gusty wind conditions, in the second half of the dynamic subsidence process. The only mitigation measure for this tower was to monitor and to maintain proper tensions on the guy wires. The structure was successfully protected and its services had never been affected.

This paper presents the methods for assessing the subsidence influences on the guyed tower at various stages of the subsidence process.

LONGWALL PANEL AND TOWER STRUCTURE

The portion of the longwall panel over which the transmission tower is located is shown in Fig. 1. The longwall panel was 874 ft wide (rib-to-rib) and the mining height in the Pittsburgh coal seam is between 6.5 and 7.0 ft. The base of the tower is located near the central portion of the longwall panel. The tower sits in a flat area on the top of a steep hill. The overburden depth at the tower base is about 1,017 ft.

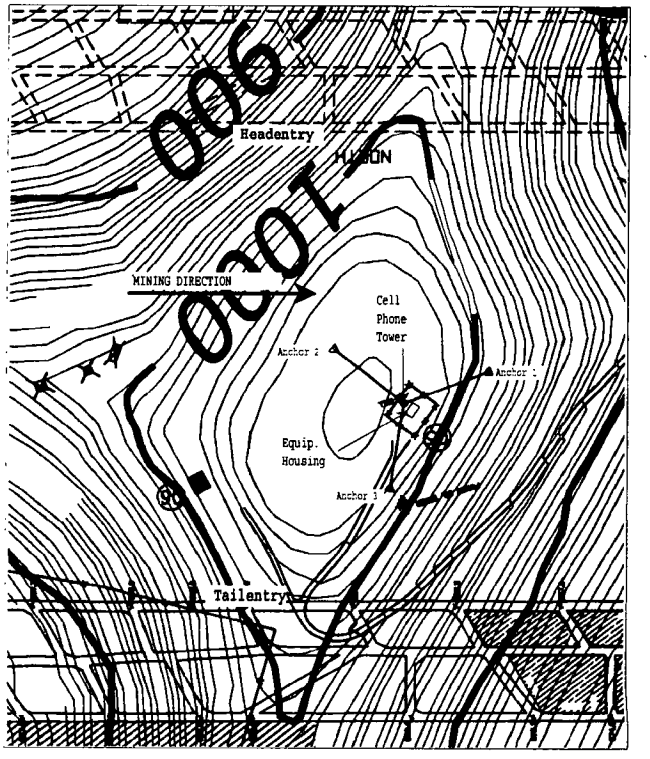

Fig. 1 Overview of the Site

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The tower (Fig. 2), belonging to one of largest wireless phone companies in the nation, serves as a relay station to transmit cellular phone signals between two similar towers located more than 20 miles away in the tri-city area in the northern West Virginia and southwestern Pennsylvania. The steel lattice tower is about 180 ft tall and laterally restrained by 12 steel guy wires. These guy wires are installed in three vertical planes that are separated from each other by about a 120° horizontal angle. Along each plane, the lower ends of the four wires are tied to a concrete anchor block (Fig. 3) and the upper ends are tied to the tower at three different levels. The turnbuckle on each guy wire makes it possible to make necessary adjustment for regular maintenance. The anchors were located about 160 ft away from the tower base. The concrete anchor blocks, 2' (H) x 3' (W) x 7'-6" (L), were buried about 6 ft below the ground surface.

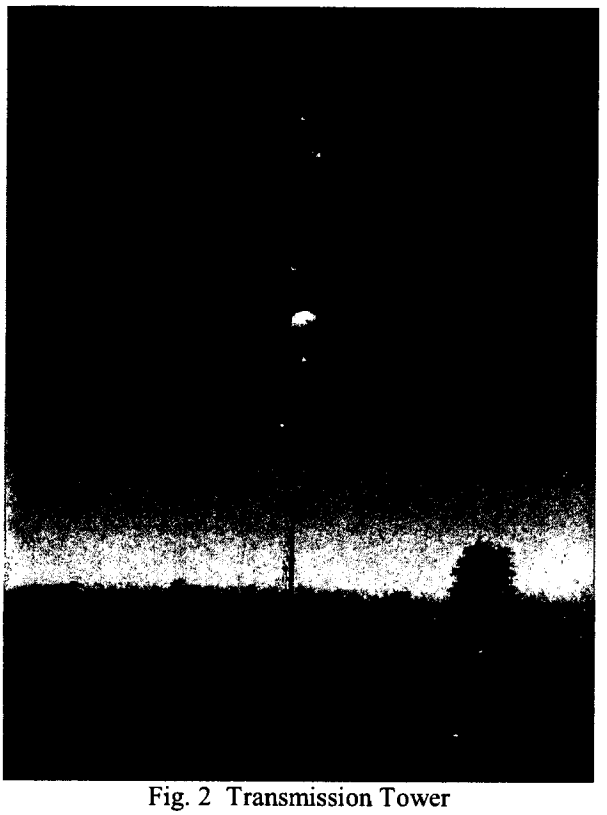

Fig. 2 Transmission Tower

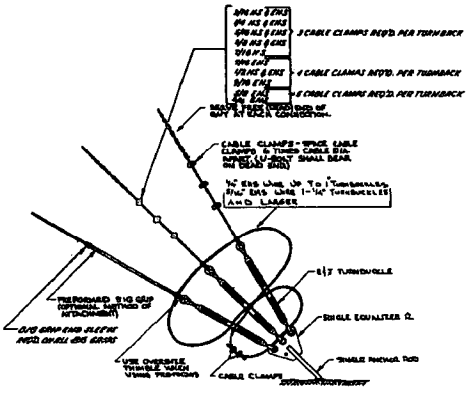

Fig. 3 Method to Tie the Guy Wires to the Anchor Block

Table 1 shows the pre-mining coordinates and elevations of the points of interest on the tower structure (i.e., base, anchors and ties). A local coordinate system is used for the structure. The datum of the elevation of the local coordinate system is set at the base of the tower ($z = 0$ ft at the base). It should be noted that the anchors are not on the same elevation as the tower base. The x-direction of the coordinate system follows the mining direction with $x = 0$ at the tower base. The y-axis points from the panel tailentry to the headentry with $y = 0$ at the panel tailentry.

Table 1 Local Coordinates of the Tower Base and Anchors

Point of Interest	x	y	z*
Base (0)	0	369	0
Anchor 1	149	427	-12
Anchor 2	-123	469	-6
Anchor 3	-23	215	-1
Tie 1	0	369	60
Tie 2	0	369	123
Tie 3	0	369	173

* elevations are expressed in relation to tower base

The tower super-structure is tied to its foundation with one steel bolt (ϕ =15/16"). The reinforced concrete foundation is constructed in two sections. The lower section is a square one with side length being 4'-6" and the thickness being 1'-6". The upper section is cylindrical with its diameter and height being 2 and 4 ft, respectively. The foundation is buried with only the top 6 inches being exposed above the ground surface.

In each of the three guy wire planes, one guy wire (ϕ = 3/8") is used at the lower level located about 60 ft above the tower base (referred as Tie 1). Two guy wires (ϕ = 7/16") are tied to the tower at the middle level (123 ft above the tower base) to resist the possible rotation of the tower structure (Tie 2). The top of the tower is tied with one guy wire (ϕ = 7/16") at the elevation of 173 ft above the tower base (Tie 3). At lower and top tie levels, breast type of ties are used to provide lateral restrain to the tower only while the middle tie is a torque type to provide both lateral and rotational restrains to the tower as shown in Fig. 4. The guy wires have been pre-tensioned with the tensions ranging from 1,250 lbs at the lower level to 1,975 lbs at the top level.

SUBSIDENCE PREDICTION

In order to assess the potential subsidence influence on the tower structures, dynamic subsidence prediction is performed at four surface points of interest, the tower base and the three anchors, using the subsidence prediction program CISPM version 2.01 (Peng and Luo, 1992). Mining height of 7.0 ft and an advance rate of 80 ft/day were used in the predictions.

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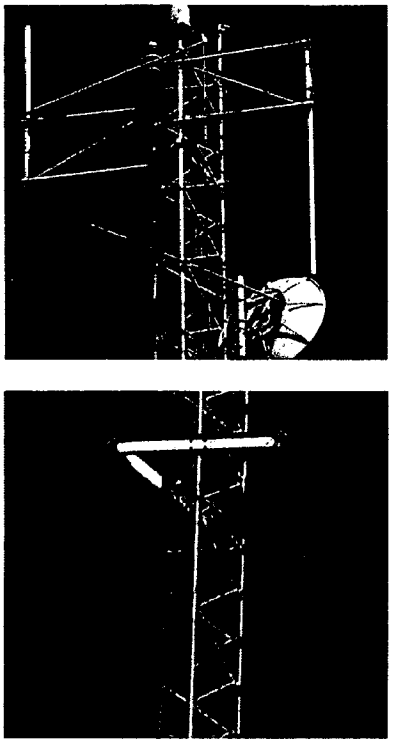

Fig. 4 Breast Type (Top) and Torque Type (Bottom) Ties

The predictions was performed at different time stages ranging from when the longwall face was from 300 ft inby to 1,700 ft outby the tower base. These time stages are chosen to cover the entire active dynamic subsidence process. The prediction for the last time stage (i.e., the face has passed the tower base for a distance of 1,700 ft) should be considered as the final subsidence. The predicted surface subsidence (S) and the two components of horizontal displacement (U_x and U_y along the x and y directions, respectively) at these specified time stages are plotted in Figs. 5, 6 and 7, respectively.

Figure 5 shows the predicted subsidence development curves at the tower base and anchors. Insignificant amount of subsidence would be experienced by the tower structures when the longwall face was directly under the tower base. The subsidence process would be most active when the face was between 300 and 400 ft passed the tower base. The ground begin to regain stability after the face has passed the tower base a distance of 1,000 ft. The final prediction shows that anchor 1 will subside the most (3.06 ft) while anchor 3 the least (1.62 ft). There is no significant differential subsidence among the base, anchors 1 and 2 after the subsidence process is over.

The predicted development curves of horizontal displacements along the mining direction are plotted in Fig. 6. The negative values shown in the figure indicate that the movements were against the mining direction. The maximum movements along the mining direction ranged from 0.43 to 0.54 ft when the longwall face was between 300 and 700 ft passed the tower base.

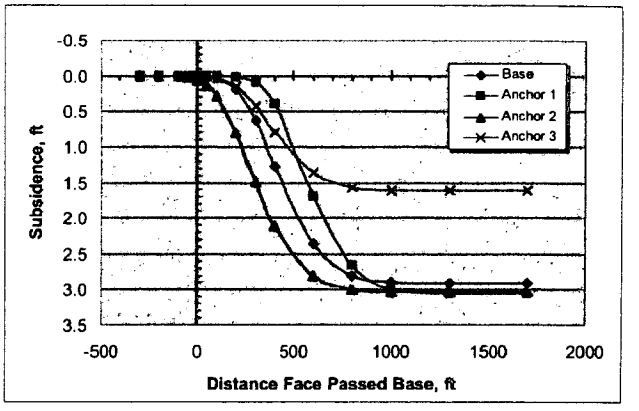

Fig. 5 Predicted Dynamic Subsidence

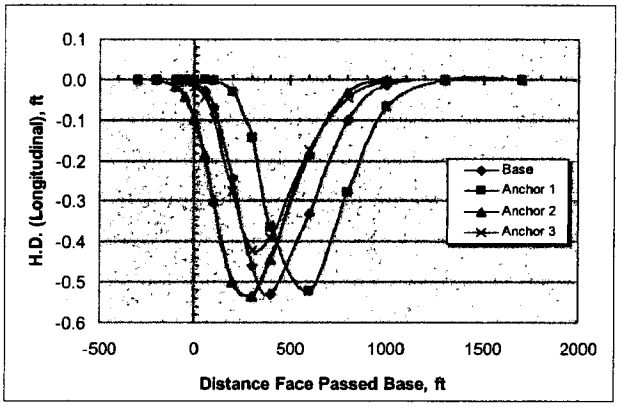

Fig. 6 Predicted Dynamic Horizontal Displacement Along Mining Direction

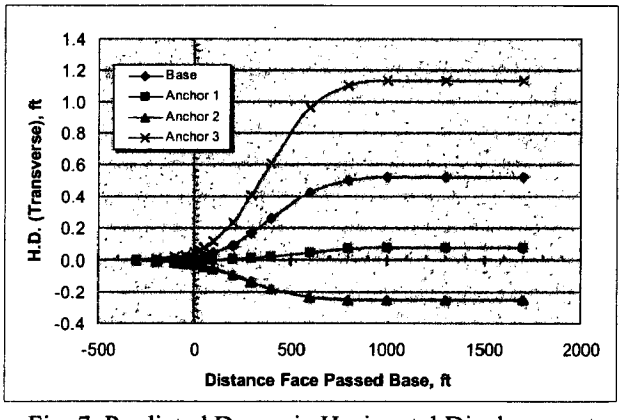

Fig. 7 Predicted Dynamic Horizontal Displacement Along Panel Transverse Direction

The predicted development curves of horizontal displacements along the panel transverse direction are plotted in Fig. 7. A positive value indicates movement from the panel tailentry to headentry. It shows that the base and anchors 1 and 3 would move toward the panel headentry side while anchor 2 would move toward the panel tailentry side. Among these four points, anchor 3 will have the largest movement (1.15 ft) while anchor 1 will have the least movement (0.07 ft) when the subsidence process is over.

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ASSESSMENT OF SUBSIDENCE INFLUENCES

Based on the predicted dynamic surface movements at the tower base and three anchors as well as the structural characteristics of the tower, the movements and deformations of the tower structure can be determined. Subsequently, the following three aspects of potential influences that the ground subsidence process could cause to the tower structures can be assessed.

- *Structural stability*: Since the tower structure is tall and sits on the hill top, its stability during and after the subsidence process was a concern.
- *Structural integrity*: The subsidence process could induce some additional forces on various parts of the tower structures. If strong enough, these forces could cause structural damages to some of the structural parts.
- *Functionality*: If the tilting and rotation of the transmission tower induced by the subsidence process exceed certain critical values, they could cause blockage and alignment problems to the paths of the signal transmission resulting in disruption or degradation of the cellular phone services.

Assessment of Structural Stability

Stability analysis is normally required for tall structure with small bases such as transmission tower to assess the potential for the structure to be toppled by external lateral forces. Because of their designs, the guyed towers are a type of very stable tower structures that can sustain high winds, earthquakes and extreme weather. The stability of the guyed tower could only be jeopardized when some of the guy wires, especially those tied to the upper levels of the towers, break under some extreme forces. The determination of the subsidence-induced forces in the guy wires to be induced for this case is presented in the next section. That analysis indicated that the subsidence-induced tensions in the guy wires were insignificant compared to pretensions in these wires and to their ultimate breaking loads of the steel cables. Therefore, the ground subsidence process associated with the longwall mining operation will not affect the stability of this particular transmission tower.

Assessment of Structural Integrity

As the ground subsides, the relative spatial locations of the tower base and the anchors, the ground-contacting points of the guyed tower structure, will change. Such changes in elevations and coordinates of these ground-contacting points could induce additional tensions or slacking condition in the guy wires and additional loads in the tower structure.

Determination of Tower Equilibrium State

In determining the subsidence-induced tensions and loads, the predicted dynamic surface movements at the tower base and the anchors at a time stage are imposed on their respective original coordinates and elevations listed in Table 1. The most important task is to determine the coordinates of the ties on the tower when a new equilibrium is developed in the tower structure for that time stage. Since the guy wires tied to each of the three ties on the tower are of the same size (3/8" for wires connected to tie 1, and 7/16" to ties 2 and 3), the following conditions should be satisfied when a new equilibrium at each tie position is reached.

$$\begin{cases} \sum_{i=1}^{3} \varepsilon_i \cos\beta_i \cos\alpha_i = 0 \\ \sum_{i=1}^{3} \varepsilon_i \sin\beta_i \cos\alpha_i = 0 \end{cases} \quad (1)$$

In Equation 1, ε_i is the subsidence-induced strain developed in the guy wire connected between anchor i and the tie of interest. The horizontal angle between this guy wire and the mining direction is β_i while the slope angle is expressed as α_i. The subsidence-induced strain in this guy wire is determined as:

$$\varepsilon_i = \frac{\sqrt{(x_i - x_o)^2 + (y_i - y_o)^2 + (z_i - z_o)^2} - L_o}{L_o} \quad (2)$$

In equation 2, x_i, y_i, and z_i are the coordinates and elevation of ground anchor i at a given time stage. The coordinates and elevation at a given tie on the tower are x_o, y_o, and z_o. The original length of the guy wire is L_o. In setting up equations 1 and 2, the following two reasonable assumptions are made:

- The vertical deformation of the tower structure is insignificant. Therefore, the new elevation at a tie position z_o is equal to the elevation of the subsiding tower base plus the original height of this tie.
- The ability for the tower structure itself at the tie levels to resist lateral displacement is insignificant.

By solving the two simultaneous nonlinear equations (Eq. 1), the coordinates, x_o and y_o, of each of the three ties can be determined when the new equilibrium of the tower structures is reached at a given time stage. A computer program was developed for solving the simultaneous nonlinear equations involved in this task. Using the program repeatedly, the coordinates for the three ties and the horizontal displacements (x-component, y-component and principal, Δx, Δy and ΔU) of these three ties relative to the tower base were determined and the results are shown in Figs. 6, 7 and 8, respectively. It is apparent that the upper part of the tower would displace with respect to its base more than the lower part.

Changes in Guy Wire Tensions

Using these determined coordinates of the ties and the anchors, the subsidence-induced strains in the guy wires on the tower base can be determined. In converting the subsidence-induced strain (Eq. 2) to the subsidence-induced tension, the stiffness (S) of each of the two types of the steel wire ropes should be determined based on the average value of 6-strand and 8-strand steel wire ropes as:

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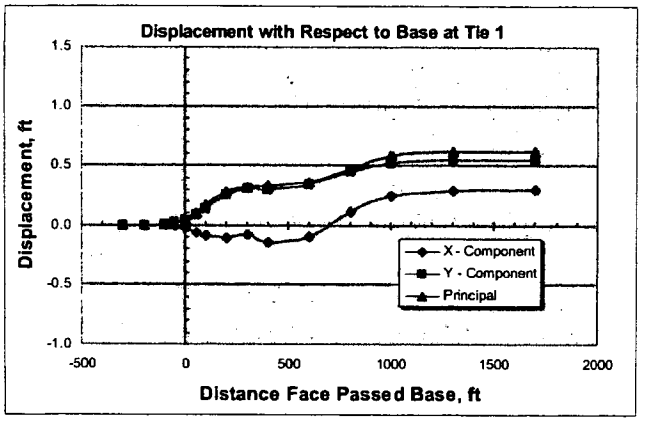

Fig. 6 Horizontal Displacements of Tie 1

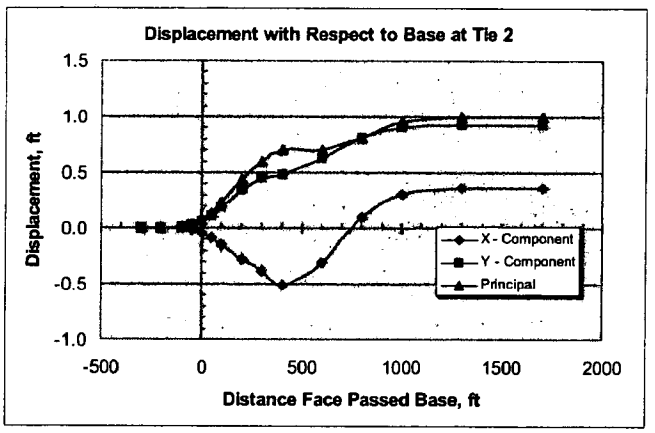

Fig. 7 Horizontal Displacements of Tie 2

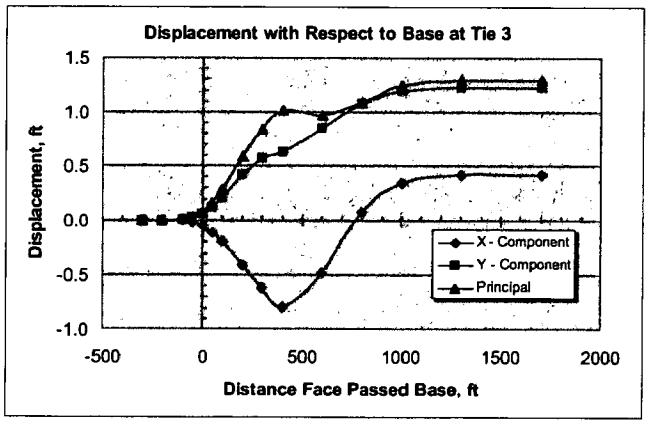

Fig. 8 Horizontal Displacements of Tie 3

$$S = 10x10^6 A \qquad \text{lbs} \qquad (3)$$

In Eq. 3, A is the cross-sectional area of the wire rope. The stiffness values used in the conversion are 1,104,466 and 1,503,301 lbs ft/ft for the 3/8" and 7/16" guy wires, respectively. The average tensions in the guy wires induced by the ground subsidence process associated with the longwall operation are plotted in Fig. 9. A positive value indicates that an additional tension has been induced in the guy wire by the subsidence process while a negative value shows that the existing tension in the guy wire observed before mining will be reduced. A negative force is only meaningful when its magnitude is smaller than the pre-mining tension in the guy wire. Figure 9 shows that tensions would develop in the guy wires when the longwall face is between 50 ft inby and 300 ft outby the tower base. The maximum subsidence-induced tension was about 780 lbs for guy wires tied to the level 3 of the tower when the longwall face is about 200 ft passed the tower base. Such additional tensions are smaller than the pre-mining tensions ranging from 1,250 to 1,975 lbs and are insignificant compared to the ultimate breaking strengths of the guy wires (10,600 lbs for 3/8" wire rope and 14,400 lbs for 7/16" wire rope). Therefore, the subsidence-induced tensions were incapable of causing breakage of the guy wires.

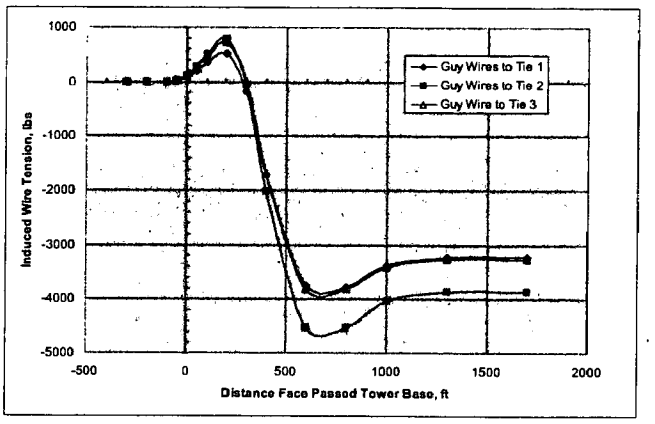

Fig. 9 Subsidence-Induced Tensions in the Guy Wires

However, after the longwall face has passed the tower base a distance 350 ft, the tensions in the guy wires become nonexistent (The magnitudes of the negative values are larger than the pre-mining wire tensions). Under such condition, the guy wires would slack and the tower would be no longer effectively restrained laterally by the guy wires within certain small range. The lack of effective lateral restraint makes it possible for the tower, especially its upper sections, to vibrate under strong gushing winds.

Additional Load to the Tower

The subsidence-induced tensions in the guy wires also induce additional loads to the tower structure, especially in the section near the tower base. The additional load in the lower section at a given time stage is the summation of the vertical components of the tensions in all of the guy wires. The calculations show that additional loads can be induced in the first half of the dynamic subsidence process until the longwall face has passed the tower base a distance of 350 ft. The maximum subsidence-induced load on the tower base would be 4,947 lbs when the face was 200 ft past the base. Such additional load was also insignificant compared to the weight of the steel tower structure and the load from the pre-mining wire tensions (about 12,000 lbs). Therefore, the subsidence-induced load to the tower base would not cause any structural integrity problems to the tower.

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Bending Curvature on the Tower

The differential lateral displacements between the base and the three ties would create a bending condition in the tow lattice structure. The calculation shows that the lower part of the tower was bent laterally more severely than the upper part. However, the maximum bending curvature, 5.5×10^{-5} 1/ft in the lower part when the longwall face was about 300 ft passed the tower base, was still insignificant for the tower steel lattice structure. Therefore, the bending developed on the tower structure would have no effect on its structural integrity.

Assessment of Structural Functionality

The assessment of subsidence influences on the functionality of the transmission tower is to assess whether the ground subsidence process is to disrupt or degrade the ability of the transmitters on the tower to relay phone signals to and from the transmission towers in the other two cities. Such ability could be potentially affected by: the blockage of the signal path, and (2) the incorrect alignment of the signal path. This section assesses the possibilities for such two potential problems to occur during and after the ground subsidence process.

Possibility of Signal Path Blockage

The cellular phone company was concerned with the vertical subsidence at the location of the tower base that would place the tower a few feet (2.9 ft as predicted and shown in Fig. 5) lower than its original elevation. It was thought that such lowering of tower elevation could make high obstacles (such as large trees) to intrude into the signal path between the transmission towers causing signal blockage.

However, it should be noted that the transmission tower was located on the top of one of the highest hills, if not the only highest hill, in a large area around and the transmitters were also located high above the ground on the tower. The ground subsidence process would not only lower the tower but also the surrounding surface area to certain extent. Therefore, the signal paths are impossible to be blocked by any local obstacles around this transmission tower.

Another fact was that the other two transmission towers were located about 23.5 miles (air distance) away from this transmission tower. The predicted 2.9 ft elevation lowering at this transmission tower would only change the signal path by a minor angle of 4.84 seconds. Such insignificant change in signal path would make it impossible for any obstacles located close to the other towers to intrude into the signal paths, either. Therefore, the possibility for the subsidence process to cause blockage of the signal paths was none.

Possibility of Misalignment of Signal Paths

During and after the subsidence process, some minor inclination and rotation will develop on the tower structure. Such inclination and rotation, if large enough, could affect the alignment of the signal paths between the transmitters. According to the cellular phone company, any inclination away from the vertical direction or rotation in the horizontal plane of the tower larger than one degree could affect the alignment of the signal paths.

Based on the determined coordinates and elevations of the tower base and the ties, the inclinations of the tower structures away from the vertical direction at each time stage were determined for each section and the entire height of the tower. The results include inclinations along x and y directions as well as the principal one. The principal inclination of the tower would increase as the dynamic subsidence process with the maximum being reached when the ground regains its stability. The maximum inclinations would be 0.59°, 0.36° and 0.35° for the lower, middle and top sections, respectively. The maximum inclination for the entire tower is about 0.43°.

The rotation of the tower structure is determined using the coordinates of the anchors and tie 2 because torque type tie at this level were designed to provide rotational restraint to the tower lattice structure. The maximum tower rotation, 0.56°, would occur when the dynamic subsidence process was over.

The analysis indicated that both the maximum inclination and the maximum rotation of the tower are smaller than their critical values. Therefore, the alignments of the signal paths would not be affected by the ground subsidence process associated with the longwall mining operation, either.

MITIGATION MEASURE AND RESULTS

Based on the analyses performed, it was concluded that the only possible problem is the vibration of the tower under strong gushing winds due to the lack of effective lateral restraint by the guy wires. Such condition would occur in the second half of the dynamic subsidence process starting at the time when the longwall face is 300 ft outby the tower base.

In order to prevent the condition for potential vibration from occurring, it was recommended that the tensions in the guy wires were to be monitored daily when the longwall face is between 0 and 1,000 ft past the tower base. Necessary adjustments should be made by loosening or tightening the turnbuckles (Fig. 3) on the guy wires near the anchor blocks to maintain the needed tension levels. During the time period when the face is between 300 and 750 ft passt the tower base, multiple adjustments should be made daily to compensate the anticipated large reduction of tensions in the guy wires. When making these adjustments, the plumbing of the lattice structure should be also checked to avoid over-adjustments.

Mining under the tower started in the early January, 2003. The recommended mitigation measure was implemented. The dynamic subsidence process in the area of the transmission tower was over by the end of that month. Despite severe winter weathers in the first two to three months of this year, the tower was successfully protected and no complaints about the phone services were made.

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CONCLUSIONS

This paper presents a case study where a telecommunication transmission tower was subsided by a longwall operation. The potential subsidence influences on the structure were carefully assessed based on the predicted surface movements in the dynamic subsidence process and the structural information of the tower using a systematic approach.

The assessment indicated that structural stability, integrity and functionality of this tower would not be significantly affected by the subsidence event. However, a vibration condition could develop in the second half of the dynamic subsidence process because of the slack of the guy wires.

Based on the assessment, a simple mitigation measure, monitoring and tension adjustment was recommended and implemented. The project was successful as evidenced by the continued quality service carried by this transmission tower.

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Subsidence Prediction Influence Assessment and Damage Control

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ABSTRACT

An extensive subsidence research program conducted by the authors has greatly improved the accuracy and the capabilities of subsidence prediction under complicated mining and surface conditions. The techniques developed for assessing and mitigating subsidence influences on various surface structures have been applied in numerous cases with a very good record of success.

INTRODUCTION

Total extraction of a coal seam using longwall mining or room-and-pillar mining with pillar extraction tends to disturb the overburden strata and causes immediate surface subsidence. Depending on various factors, such subsidence events may or may not have the potential to cause problems to surface structures. Surface subsidence research conducted by the authors has demonstrated that in order to effectively and efficiently minimize the subsidence influences on surface structures, the following techniques should be applied systematically:

- *Methods for accurately predicting surface subsidence under varying mining and surface conditions.* Success in dealing with the issues of subsidence depends primarily on the accurate prediction of the magnitude, distribution and timing of surface subsidence. By studying the subsidence basins produced by different mining plans, the possible subsidence effects on surface structures can be greatly reduced.
- *Techniques for assessing the subsidence influences on surface structures.* The probability and severity of subsidence influences on a structure of interest need to be assessed before it is undermined. Due to the large differences in types, design, material and construction of the structures as well as variations of movements and deformations to be experienced by the structures, the different assessment techniques are required.
- *Techniques for mitigating subsidence influences.* If the assessment indicates that the subsidence influences on a structure exceed the structure's tolerable level in terms of its integrity, stability and functionality, proper mitigation techniques should be designed and implemented to reduce the subsidence influences on the structure.

This paper describe the efforts and results of a subsidence research program conducted by the authors.

SUBSIDENCE PREDICTION

Accurate prediction of surface subsidence caused by underground mining is required for assessment of the subsidence influences and is the basis for the design of effective and efficient mitigation measures. In the past a great majority of subsidence research have been concentrated on the prediction of final subsidence over a single longwall panel with a relatively flat surface. The prediction models produced by those researches have limited value for practical applications because of varying and complicated mining, geological and topographical conditions. In order to improve the prediction accuracy, the authors have collected more than 200 longwall subsidence cases all over the US coal fields through an intensive subsidence monitoring program and from various other sources. These data were used to continuously refine and improve a PC-based program package, CISPM (Comprehensive and Integrated Subsidence Prediction Model) developed previously by the authors (Peng and Luo, 1992). This program package has a unique and rich set of capabilities for meeting nearly all of the subsidence prediction requirements in underground coal mining employing high or total extraction methods in the US. It is very user-friendly requiring neither particular skills in computer operations nor in-depth knowledge of subsidence theory. It has been proven fairly accurate according to the feedback from its domestic and international users and according to our own

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subsidence monitoring data. The following important findings from our subsidence research program have been incorporated into the current version of CISPM program package:

- *Dynamic subsidence process associated with longwall mining operations.* As underground mining progresses, a surface point will experience a fairly complicated dynamic subsidence process before it becomes stable again. During the dynamic subsidence process, the magnitudes, natures and directions of the subsidence movements and deformations at the surface point change with time and their influences to structures are also time dependent. Very often the dynamic subsidence process plays a more important role in assessing and mitigating subsidence influences than final subsidence. Mathematical models have been developed to predict the entire dynamic subsidence process associated with longwall mining operations (Luo and Peng, 1992).
- *Final subsidence basin over a single and multiple longwall panels.* Most of the subsidence prediction methods have been developed for mining of a single panel only. They are unsuitable for the prediction of subsidence over multiple panels such as the longwall panels separated by chain pillar systems as normally practiced in the US. A mathematical model has been developed to predict the final subsidence basin over multiple longwall panels (Luo and Peng, 1990, 1991). This model is based on the finding that the convergence of the chain pillar systems between the longwall panels could contribute a very significant amount of subsidence in the area over and near the chain pillars.
- *Final subsidence caused by high extraction room-and-pillar mining method.* If the recovery ratio in a room-and-pillar panel is 70% or higher by partially or fully extracting the pillars in a room-and-pillar panel, immediate surface subsidence (versus the unpredictable subsidence events over low extraction room-and-pillar mines often seen as the abandoned mine subsidence) will be induced. The existing methods which have been derived from subsidence data collected over longwall panels are not suitable for subsidence prediction over high extraction room-and-pillar mines. Based on the available subsidence data collected over room-and-pillar panels, a method has been developed for the prediction of the final subsidence basin over high extraction room-and-pillar panels (Luo and Peng, 1993).
- *Studies of subsidence parameters.* The two basic components of a subsidence prediction method are the chosen mathematical models and the parameters involved in the mathematical model. The subsidence parameters often play a very important role in the prediction accuracy. However, the reported subsidence parameters often vary in very large ranges which are of little values in practical applications. Such large variations are often resulted from the use of inconsistent definitions of the subsidence parameters and inadequate determination methods. A great effort has been made in collecting subsidence data in the US coal fields, standardizing the definitions of and determining the subsidence parameters (Peng et al., 1995). Based on this study, the ranges of a number of commonly used final subsidence parameters have been greatly narrowed.

In additional to prediction of surface subsidence, tools are provided and self improvement mechanism is built in CISPM. They include data processing for subsidence survey, determination of subsidence parameters based on mining and geological information and deduction of parameters from collected subsidence data

Numerous field observations have demonstrated that complicated surface topography and steep surface slope in hilly regions have a profound impact on the ground subsidence process, often resulting in very different characteristics of subsidence basin from that on a relatively flat surface. Effort has been made to study the surface topography effects on ground subsidence process. A method has been developed for the prediction of final subsidence basin in hilly regions (Luo and Peng, 1990). Figure 1 shows a comparison of the calculated final horizontal displacement profiles with and without considerations of the surface topography. The surface elevation is also plotted at the top for reference. A much better agreement with the measured horizontal displacement in the steepest portion of the subsidence monument line has achieved when surface natural slope was considered. It should be noted that horizontal displacement often plays a much more important role in causing damages to surface structures than subsidence (i.e., vertical settlement).

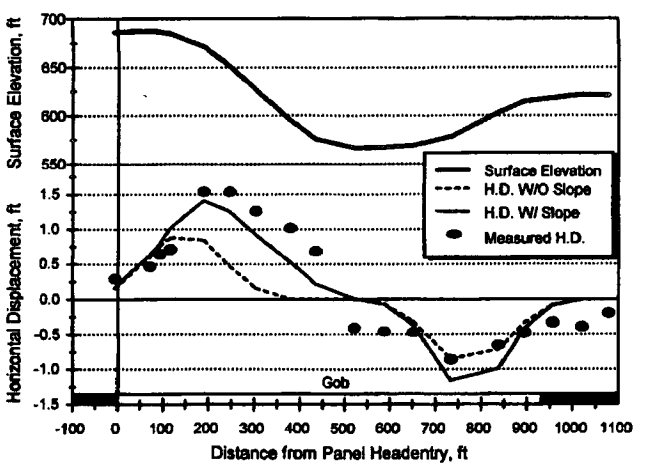

Fig. 1 Measured vs. calculated final horizontal displacement (H.D.) profiles along a cross-section over a longwall panel with relatively steep surface slope

TECHNIQUES FOR ASSESSMENT OF SUBSIDENCE INFLUENCES

Research emphasis has also been placed on monitoring the interaction between the subsiding surface and various surface structures. Based on the collected data, critical deformation values for various relatively simple structures have been

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established, techniques for assessing subsidence influences on those structures of large dimension and/or complexity have been developed.

A number of critical deformation values for typical residential structures (wood frame or brick super-structure on stone or concrete-block basement or foundation) in the northern Appalachian coal fields have been established. High surface tension and compression are generally responsible for cracks and buckling on the lower portion of the residential structures, respectively. High surface bending could causes problems to the super-structures such as sticky doors and windows, fissures on dry walls, peeling of old wall papers and paint. It is also found that a large tilting on floor could cause some inconveniences to the residents.

Ground cracks and bumps are caused by high surface tension and compression, respectively. Ground cracks as wide as 4 ft, though very rare, have been observed in certain locations over a few longwall panels. Generally ground cracks cause more problems (e.g., dewatering of surface streams or ponds) than the bumps. Criteria for initiating ground cracks on various ground surface have also been established.

For those structures of large dimensions and/or complicated design and construction, a more comprehensive and detailed assessment should be performed. However, due to the large variation of type, material, construction, dimension and functions of the structures, the techniques for assessing the subsidence influences on these types of structures vary considerably. Basic analysis should be performed to determine the nature and severity of the following three types of potential problems:

- *Structural integrity*: This is an indicator of mechanical failure of a structure of interest under the influence of subsidence. Ideally, the stress or strain field on the structures should be evaluated. The peak stress or strain are then compared to the permissible values of the structural material to determine the possibility of structural failure. For instance, a method has been proposed and successfully applied to assess the stress distribution on buried pipeline affected by subsidence (Peng and Luo, 1988). In cases where stress/strain fields are difficult or impossible to determine, the weakest components of the structure should be identified and empirical values are used to determine their integrity under the influence of surface subsidence.
- *Structural stability*: For those tall structures with small bases, the subsidence-induced slope could make them potentially unstable during or after subsidence process. Both the short and long term stability of the structure should be assessed. If the subsidence-induced slope could move the center of gravity of a structure out of its base, the structure is said to have lost its short-term stability. A structure loses its long-term stability if the strongest wind blowing in the direction of maximum slope caused by subsidence will be able to topple the structure.
- *Structural functionality*: The ability and level for the structures to perform their intended functions during and after subsidence may be affected by ground subsidence process. For example, subsidence could change the grade of a railroad well above its permissible grade. A conveyor belt could be rendered inoperable due to vertical and lateral alignment problems caused by the subsidence process.

The authors have applied the established criteria and the developed assessment techniques in various projects in assessing subsidence influences on various surface structures. Some examples of applying these assessment techniques are shown in Table 1.

TECHNIQUES FOR SUBSIDENCE MITIGATION

If the assessment indicates that a structure will be adversely affected, effective and efficient mitigation measures should be designed and implemented. The following three approaches can be used to design the mitigation measures: (1) reducing surface movements and deformations in the area of concern to an acceptable level by modifying the mining plan (e.g., leaving a support area under the structure), (2) reducing transmission of movements and deformations from ground to the structure of interest (e.g., trenching and plan-fitting), and (3) reinforcing the structure so that it can tolerate higher

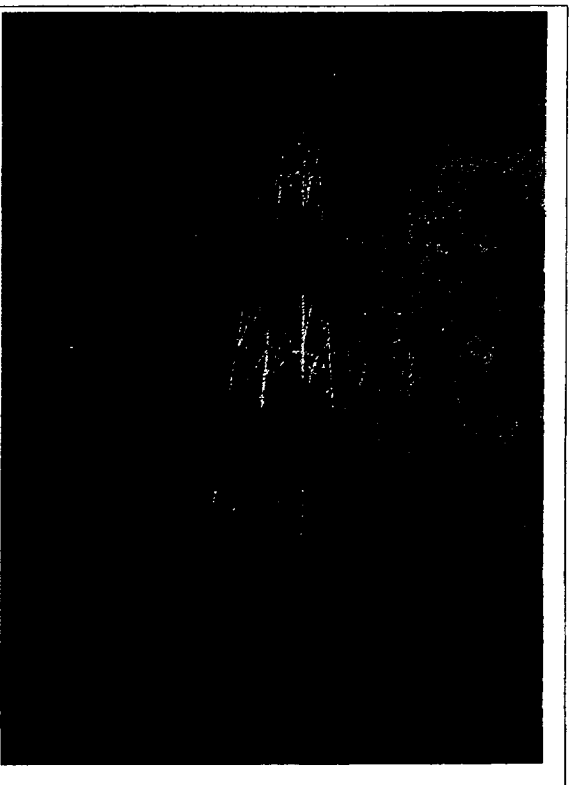

Fig. 2 This telecommunication transmission tower, about 200 ft tall, was located on a steep slope of a mountain peak. It was undermined by a longwall panel. In order to protect this tower, trench was dug around one of its legs and reinforcement beams were installed at the base. Despite of ground cracks observed nearby, there was no damage on thestructure and its service was kept open all time.

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Table 1 Some Examples of Subsidence Influence Assessments and Results

Structure or Feature	Descriptions	Major Concerns	Conculsions and Recommendations	Results
Residential Structures	More than 50 houses over or near longwall panels	Structural integrity and functionality	Verying damage potentials and mitigation measures recommended for about 30 structures	Accurate assessments and successful protection
Oil pipeline	Buried oil pipeline over 7 longwall panels	Structural integrity	Damage potential high. Mitigation measures recommended.	Feedback not available
Concrete water pipeline	Main transmission pipeline over 3 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures and alternatives recommended	Alternative plan adopted
Cast iron water pipeline	Two pipelines over 2 longwall panels	Structural integrity and functionality	Damage potential moderate. Mitigations recommended.	Not yet undermined
Steel water pipeline	Main water supply line over 4 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures recommended.	Protection successful
Plastic and steel gas pipeline	Low pressure distribution line over 3 longwall panels	Structural integrity and functionality	Damage potential for the steel pipe portions. Mitigation recomeended.	Mining in progress
Lake	A large lake over 11 planned longwall panels	Land area to be submerged by water after subsidence	About 400 acres of land will be submerged or ponded	Successfully undermined
Water ponds	2 water ponds over 2 longwall panels	Stream dewatering, potential underground mine workings flooding	Possibility of dewatering is low	Accurate assessment
Streams	3 streams over 7 longwall panels	Stream dewatering, potential underground mine workings flooding	Varying potential of stream dewatering	Accurate assessment
Mine refuse facility	Over 3 longwall panels with high embankment	Feasibility of longwall mining under	Support area recommended under the embankment, feasible to mine under pond	Successfully undermined
Mine refuse facility	Over 3 longwall panels previously mined	Feasibility of building the facility over the mined panels, long-term subsidence	Effects of long-term subsidence is very minor. Construction is feasible.	Feedback not available
Mine refuse facility	Over 3 planned longwall panels with very shallow overburden	Feasibility of longwall mining under	Safety questionable. Alternative mining plans suggested.	Not yet undermined
Railroad and bridge	A railroad over 4 longwall panels	Subsidence influences and operation safety	Influences could be strong. Monitoring and Mitigations recommended	Successfully protected
Power transmission system	3 towers (80 to 120 ft tall) and one substation over two longwall panels	Integrity, stability, functionality and operation safety	Anticipated structural problem on one tower and stability problem on another	Accurate assessment
Telecommunication transmission tower	200-ft tall tower located over a longwall panels (Fig. 2)	Integrity, stability, functionality	Strong influences. Mitigation measures recommeneded and implemented	Accurate assessment and successful protection
Highway and bridge	Highway across the end areas of 3 longwall panels	Subsidence influences	Very minor influence on highway. Questionable on bridge	Accurate assessment
Primary and secondary roads	Four roads over 8 lonwall panels	Subsidence influences	Varying degrees of influences. mitigations recommended for 2 roads	Accurate assessment

movements and deformations without being damaged (e.g., tension cable method). Mitigation measures for various structures affected by subsidence have been developed and tested in field conditions. Table 2 shows some of the structures that have been successfully protected with direct involvement of the authors.

Design of Support Area

By leaving an adequate area of coal unmined or partially mined under the structure to be protected, the surface movements and deformations in the area of the structure can be kept below the permissible level of the structure. The Pennsylvania method for designing support area is one example of applying this concept. However, the PA method over-designs the support area when mining depth is more than 350 ft. Based on a large number of collected longwall subsidence cases, a new method for designing support area has been proposed as shown in Fig. 3 (Peng and Luo, 1993) and successfully applied for two large structures (Table 2).

Mitigation Techniques for Residential Structures

A number of simple but effective mitigation measures have been frequently applied by the authors in protection of nearly 30 residential structures (Table 2). Among them, *com-*

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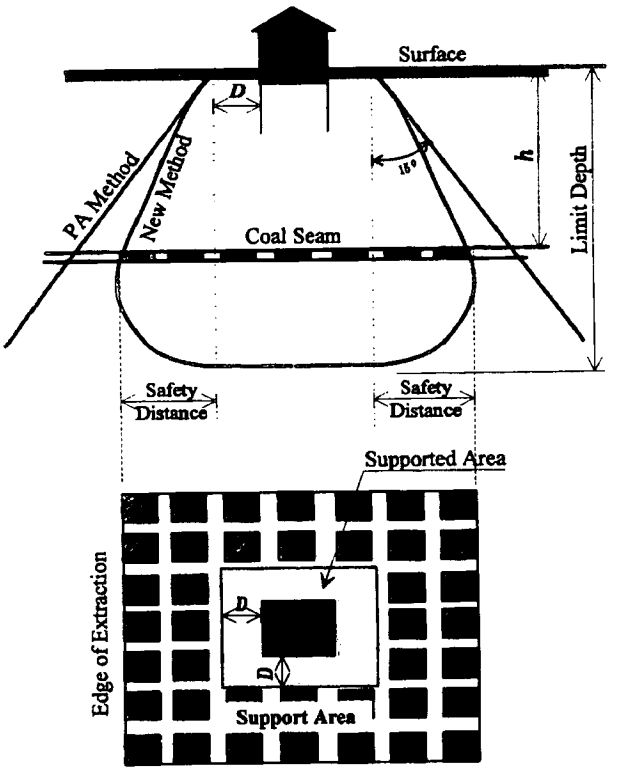

D - offset distance

Fig. 3 A method to design support area for surface structure has been developed based on the analysis of a large number of longwall subsidence cases. The support area designed using this method is usually smaller than that using PA method

pensation trench method is used to absorb surface tension or compression that could be transmitted to the structure from its surrounding ground. This method has been proven effective to reduce problems on the structural parts that have direct contact with the subsiding ground, such as basement and foundations. *Plane-fitting method* is to protect the super-structure of a house from being damaged by the bending and twisting actions associated with subsidence process. During the implementation of this method, the house super-structure is placed on a time-dependent inclined plane so that the super-structure is free of stress while the required amount of adjustments are kept minimized. *Tension cable method* is used to strengthen the structures so that they can tolerate higher surface tension and bending. Figure 4 shows a brick house that were successfully protected using a compensation trench and two tension cables.

Mitigation Measures for Buried Pipelines

Ground subsidence process often has the potential to cause damages to buried pipelines. Assessments of subsidence influences on various buried pipelines have indicated that the strain transmitted from the surrounding soil to the pipeline is always the No. 1 source of stress on the pipeline (Luo et al., 1997). Therefore, reduction of the strain transmission is the most effective method in the protection of buried pipelines. Uncovering pipeline only in the sections where the estimated stress is higher than the permissible stress of the pipeline material can greatly reduce the pipeline stress contributed by the ground strain. Such partial uncovering method has been successfully applied in the protection of a 7,800-ft section of water supply pipeline undermined by four longwall panels (Table 2).

Mitigation Measures for Railroad

Ground subsidence is capable of causing serious problems to railroads if proper cautions are not taken. A partial

Table 2 Some Examples of Successfully Protected Structures

Structures Protected	Descriptions	Mitigation Measures Employed	Results	Monitoring Performed
Residential Structures	25 houses, 2 garages and 1 swimming pool over 19 longwall panels	plane-fitting, compensation trench, tension cable, external bracing	Very good rate of success. Figure 4 is one of the examples	Subsidence
Railroad	About 11,000 ft long over 4 longwall panels	Partial lifting	It was kept operating during subsidence. Great saving in material and labor costs	Subsidence
Railroad bridge	130 ft, three sections	A 440x510 ft^2 support area under the bridge	Bridge not affected at all	Subsidence
Water pipeline	About 7,800 ft long 12-inch steel pipeline over 4 longwall panels	Partial uncovering	Service has never been intrrupted	Subsidence, strain
Overland conveyor belt system	About 1,400 ft long erected between 16 and 50 ft above ground level with a 300-ton transfer tower over a longwall panel	Uncovering support bases, loosening bolts at the bases, lateral stabilization	Despite of large surface movement, it required only some minor repairs before being put into operation again	Subsidence, strain, tilting
Telecommunication transmission tower	About 200 ft high located on the top of high mountain and between two longwall panels	Compensation trench, strengthening tower base	Despite of ground cracks observed nearby, no damage observed on the structure and service not interrupted	Visual observation
Coal refuse disposal facility	Large slurry pond with an embankment nearly 200 ft high.	A 1,300x1,930 ft^2 support area under the embankment only	The integrity, stability and functionality of the facility not affected	Subsidence

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Fig. 4 This brick house was successfully protected by a compensation trench and two tension cables. The placements of the trench and cables and the required tension in the cables were determined by subsidence simulations.

lifting method has been developed. The original elevation profile of the railroad, the predicted final subsidence profile and the permissible railroad grade are considered in determining the required adjustment along the section of railroad to be affected. This method has been applied to protect a section of railroad about 11,000 ft long undermined by four longwall panels (Table 2). The maximum subsidence at the site was about 4.5 ft. Adjustment on the railroad was only recommended in some sections much shorter than the total length of the railroad affected by subsidence with the maximum adjustment being about 2.5 ft only. As a result of implementing the partial lifting method, the subsided and adjusted railroad was kept smooth for safe railroad operation while the required adjustment was kept to a minimum.

A CASE STUDY

This section shows a case of the protection of a railroad over a longwall panel. The longwall panel was 930 ft wide mining a coal seam of about 6.5 ft thick. The overburden depth at the site was about 680 ft. The layout of the railroad over the longwall panel is shown in Fig. 5. The predicted final subsidence at the site is also plotted in this figure with the maximum subsidence being about 4.2 ft which matched very well with the measurements. The elevation profile of this section of railroad before subsidence is shown in Fig. 6. Based on the predicted final subsidence, original elevation and the permissible grade of 0.7%, the final railroad profile requiring the minimum amount of vertical adjustment was determined before it was undermined. In preparation, a large proportion of the required amount of gravel to raise the railroad was shipped to the site and spread in the sections needing the most amount of adjustment. During the active subsidence period, the railroad was monitored and vertical adjustment was made accordingly. A temporary speed limit of 5 mph was also posted as a precaution. Figure 6 shows one set of recommended adjustment during the active subsidence period and the elevation profiles of the railroad before and after the implementation of the recommended adjustment. By implementing the recommended adjustment, the maximum railroad grade was reduced from about 1.0% to the permissible 0.7% (Fig. 7). The railroad service was never interrupted during the entire subsidence process. Figure 8 shows a fully loaded coal train was passing the section of subsiding and adjusted railroad.

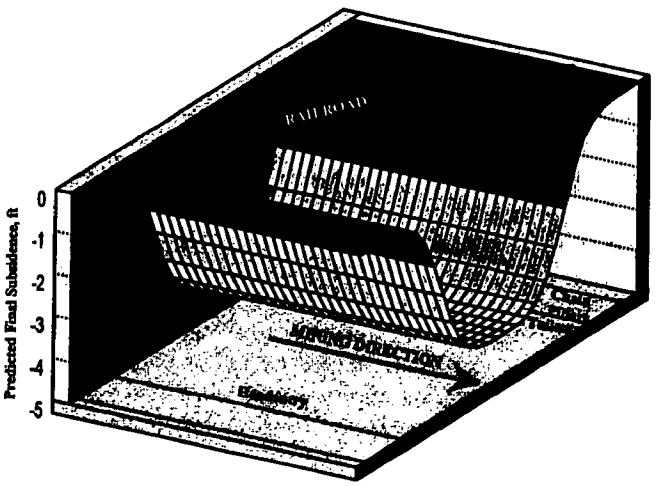

Fig. 5 Layout of the railroad over the longwall panel and predicted final surface subsidence at the site

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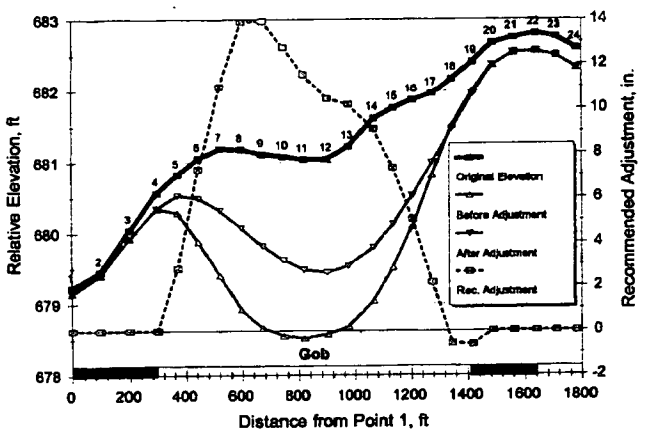

Fig. 6 Elevation profiles of the railroad and one set of recommended vertical adjustment during the active subsidence period. Using the partial lifting method, the required adjustment was kept to a minimum while the railroad was smooth.

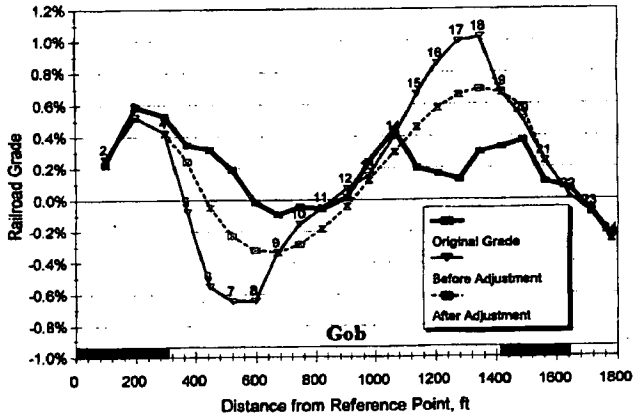

Fig. 7 Grade profiles of the subsiding railroad before and after implementing the recommended adjustement. The maximum grade of the adjusted railroad was kept within the permissible grade of 0.7%

SUMMARY

Subsidence prediction, influence assessment and damage control have come a long way. A systematic subsidence research program coupled with intensive field monitoring and extensive data collection during the past twenty years have produced vast amount of quality data and knowledge. Numerous case studies have demonstrated that using these research results, surface subsidence caused by full and high extraction mining methods and its effects can be predicted with confidence, and mitigation measures can be selected, designed and implemented successfully.

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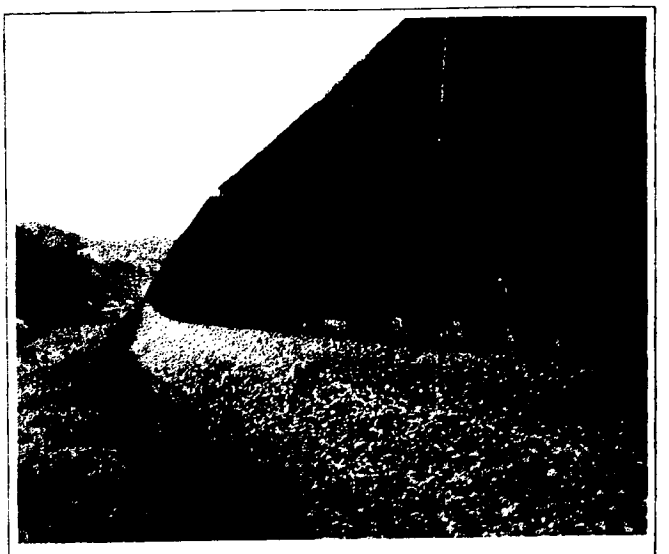

Fig. 8 This loaded coal train was passing through a section of subsiding railroad. The railroad was successfully protected using the partial lifting method.

AEC 06036

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AEC 06037

COAL MINING AND RECLAMATION PERMIT

REVISED 3-7-06 RSS

Issued To: AMERICAN ENERGY CORP
43521 Mayhugh Hill Rd.
Twp Hwy 88
Beallsville, OH 43716

Telephone: (740) 926-9152

Permit Number: D-425
Application Number: D-0425-5
Acreage: 0
Underground Acreage: 3605.5

Effective: 08/04/2005
Expires: 10/21/2009

Type of Operation: Underground (Longwall)

CONDITIONS

CONDITION TYPE	DESCRIPTION
Archeology	No planned subsidence mining may occur (except for the three northern most panels which do not contain historic structures) until the division and the Ohio Historic Preservation Office has approved the historic architectural survey report.
Subsidence	No planned subsidence operations may be conducted (except for the three northern most panels) until a subsidence control plan has been submitted and approved through an ARP.

The issuance of this permit means only that the application to conduct a coal mining operation meets the requirements of Chapter 1513 of the Revised Code, and as such DOES NOT RELIEVE the operator of any obligation to meet other federal, state or local requirements.

This permit is issued in accordance with and subject to the provisions, conditions, and limitations of Chapter 1513 of the Revised Code and Chapters 1501:13-1, 1501:13-3 through 1501:13-14 of the Administrative Code.

The water monitoring plan for this permit shall be:

Quality: See Page 26, F3 of the Permit Application
Quantity: See Page 26, F3 of the Permit Application

Note: These monitoring requirements are separate from NPDES monitoring requirements.

Signature: Michael L. Sponsler by [illegible] **Date:** 08/04/2005
Chief, Mineral Resources Management

OPERATOR

F46 Rev: 07/01/2001

COAL MINING AND RECLAMATION PERMIT

Issued To: AMERICAN ENERGY CORP
43521 Mayhugh Hill Rd.
Twp Hwy 88
Beallsville, OH , 43716

Telephone: (740) 926-9152

Permit Number: D-425
Application Number: D-0425-5
Acreage: 0
Underground Acreage: 3605.5

Effective: 06/28/2007
Expires: 10/21/2009

Type of Operation: Underground (Longwall)

CONDITIONS (Revised)

CONDITION TYPE	DESCRIPTION
Archeology	~~No planned subsidence mining may occur (except for the three northern most panels which do not contain historic structures) until the division and the Ohio Historic Preservation Office has approved the historic architectural survey report~~. Condition Removed 6-28-07
Archeology	Prior to any surface repair caused by underground mining subsidence, further coordination with the Division and Ohio Historic Preservation Office is necessary. Condition Added 6-28-07
Subsidence	~~No planned subsidence operations may be conducted (except for the three northern most panels) until a subsidence control plan has been submitted and approved through an ARP~~. Condition Removed 4-17-07

LOCATION IS NOT AVAILIABLE

The issuance of this permit means only that the application to conduct a coal mining operation meets the requirements of Chapter 1513 of the Revised Code, and as such DOES NOT RELIEVE the operator of any obligation to meet other federal, state or local requirements.

This permit is issued in accordance with and subject to the provisions, conditions, and limitations of Chapter 1513 of the Revised Code and Chapters 1501:13-1, 1501:13-3 through 1501:13-14 of the Administrative Code.

The water monitoring plan for this permit shall be:

Quality: See Page 26, F3 of the Permit Application
Quantity: See Page 26, F3 of the Permit Application

Note: These monitoring requirements are separate from NPDES monitoring requirements.

Signature: Scott Kell By Lanny Erdos NRA 3 **Date:** 06/28/2007
Chief, Mineral Resources Management

OPERATOR

F46 Rev: 07/01/2001

OHIO DEPARTMENT OF NATURAL RESOURCES

MINERAL RESOURCES MANAGEMENT

COAL MINING AND RECLAMATION PERMIT

Issued To: AMERICAN ENERGY CORP
43521 Mayhugh Hill Rd.
Beallsville, OH 43716

Telephone: (740) 926-9152

Permit Number: D-425
Application Number: D-0425-5
Acreage: 0
Underground Acreage: 3605.5

Effective: 08/04/2005
Expires: 10/21/2009

Type of Operation: Underground (Longwall)

CONDITIONS

CONDITION TYPE	DESCRIPTION
Archeology	No planned subsidence mining may occur until the division and the Ohio Historic Preservation Office has approved the historic architectural survey report.
Subsidence	This permit is conditionally issued to allow main entry development only. No planned subsidence operations may be conducted until a subsidence control plan has been submitted and approved through an ARP.

The issuance of this permit means only that the application to conduct a coal mining operation meets the requirements of Chapter 1513 of the Revised Code, and as such DOES NOT RELIEVE the operator of any obligation to meet other federal, state or local requirements.

This permit is issued in accordance with and subject to the provisions, conditions, and limitations of Chapter 1513 of the Revised Code and Chapters 1501:13-1, 1501:13-3 through 1501:13-14 of the Administrative Code.

The water monitoring plan for this permit shall be:

Quality: See Page 26, F3 of the Permit Application
Quantity: See Page 26, F3 of the Permit Application

Note: These monitoring requirements are separate from NPDES monitoring requirements.

Signature: Michael L Sponsler by [illegible] **Date:** 08/04/2005
Chief, Mineral Resources Management

OPERATOR

F46 Rev: 07/01/2001

COAL MINING AND RECLAMATION PERMIT

Issued To: AMERICAN ENERGY CORP
43521 Mayhugh Hill Rd.
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Telephone: (740) 926-9152

Permit Number: D-425
Application Number: D-0425-5
Acreage: 0
Underground Acreage: 3605.5

Effective: 08/04/2005
Expires: 10/21/2009

Type of Operation: Underground (Longwall)

CONDITIONS

CONDITION TYPE	DESCRIPTION
Archeology	No planned subsidence mining may occur until the division and the Ohio Historic Preservation Office has approved the historic architectural survey report.
Subsidence	This permit is conditionally issued to allow main entry development only. No planned subsidence operations may be conducted until a subsidence control plan has been submitted and approved through an ARP.

LOCATION IS NOT AVAILIABLE

The issuance of this permit means only that the application to conduct a coal mining operation meets the requirements of Chapter 1513 of the Revised Code, and as such DOES NOT RELIEVE the operator of any obligation to meet other federal, state or local requirements.

This permit is issued in accordance with and subject to the provisions, conditions, and limitations of Chapter 1513 of the Revised Code and Chapters 1501:13-1, 1501:13-3 through 1501:13-14 of the Administrative Code.

The water monitoring plan for this permit shall be:

Quality: See Page 26, F3 of the Permit Application
Quantity: See Page 26, F3 of the Permit Application

Note: These monitoring requirements are separate from NPDES monitoring requirements.

Signature: Michael L. Sponsler for [signature] **Date:** 08/04/2005
Chief, Mineral Resources Management

F46 Rev: 07/01/2001

file copy

_____ New Submittal
_____ Revised Submittal R- 425-17

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

APPLICATION TO REVISE A COAL MINING PERMIT

Note: Refer to the division's "General Guidelines for Processing ARPs" and "Requirements for Specific Types of Common ARPs" for guidance on submitting and processing ARPs.

1. Applicant's Name **American Energy Corporation**

   Address **43521 Mayhugh Hill road**

   City **Beallsville** State **Ohio** Zip **43716**

   Telephone Number **740.926.9152**

2. Permit Number **D-0425**

3. Section of mining and reclamation to be revised:

   Subsidence Mitigation Part 3,K(5) (6) (7)

4. Describe in detail the proposed revision and submit any necessary drawings, plans, maps, etc:

   To lift the subsidence condition of D 425-5

5. Describe in detail the reason for requesting the revision:

   To obtain permission to subside structures in the shadow area by submitting a report from Dr.Yi Luo.

6. Will this revision constitute a significant alteration from the mining and reclamation operations contemplated in the original permit? ☐ Yes, ☒ No.
   (**Note:** refer to paragraph (E)(2) of 1501:13-04-06 of the Ohio Administrative Code to determine if a revision is deemed significant.)

   If "yes," complete the following items 7 through 9.

7. In the space below, give the name and address of the newspaper in which the public notice is to be published.

   NA

8. In the space below, give the text of the public notice that is to be published. (Include the information required by paragraph (A)(1) of 1501:13-05-01 of the Ohio Administrative Code.)

   NA

Revised 03/06
DNR-744-9003

Pillar Dimensions & Analysis

ARMPS factor

$Sp = Scc * (0.64 + 0.54 * (Wp/h) - 0.18 * (Wp^2/Lp*h))$ 1.0224

$ap = (1.1 * D * Ce * Cx) / (Wp * Lp)$

$Re = 1 - (Wp * Lp / (Ce * Cx))$

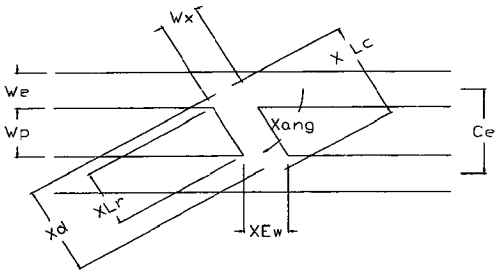
$Lp = Cx - (Wx/Sin(Xang))$

Panels Butts

Scc= 900 psi

h= 5 ft 7

D= 500 ft



Entry Centers	X Cut Centers	X Cut Angle	Entry Width	X Cut Width	Pillar Width	Pillar Length	XC Rib Length	% Extraction	Pillar Loading psi	Pillar Strength psi		XC Center Length	XC Cut Thru from Entry CL	XC Width along Entry
Ce	Cx	X ang	We	Wx	Wp	Lp	XLr	Re	ap	Sp	SF	XLc	Xd	XEw
50	250	60	17	17	33	230.4	38.1	39.2%	924.6	3630.4	3.93	57.7	52.8	19.63
50	200	60	17	17	33	180.4	38.1	40.5%	944.7	3588.0	3.80	57.7	52.8	19.63
50	150	60	17	17	33	130.4	38.1	42.6%	980.3	3513.0	3.58	57.7	52.8	19.63
45	250	60	17	17	28	230.4	32.3	42.7%	980.7	3187.3	3.25	52.0	47.1	19.63
45	200	60	17	17	28	180.4	32.3	43.9%	1002.1	3156.8	3.15	52.0	47.1	19.63
45	150	60	17	17	28	130.4	32.3	45.9%	1039.8	3102.8	2.98	52.0	47.1	19.63
40	250	60	17	17	23	230.4	26.6	47.0%	1061.3	2737.2	2.58	46.2	41.3	19.63
40	200	60	17	17	23	180.4	26.6	48.1%	1084.4	2716.6	2.51	46.2	41.3	19.63
40	150	60	17	17	23	130.4	26.6	50.0%	1125.2	2680.1	2.38	46.2	41.3	19.63
35	250	60	17	17	18	230.4	20.8	52.6%	1186.6	2280.0	1.92	40.4	35.5	19.63
35	200	60	17	17	18	180.4	20.8	53.6%	1212.4	2267.4	1.87	40.4	35.5	19.63
35	150	60	17	17	18	130.4	20.8	55.3%	1258.0	2245.1	1.78	40.4	35.5	19.63
													Butt Centers at Mains	
45	120	60	17	17	28	100.4	32.3	48.0%	1080.5	2339.2	2.16	52.0		103.9
45	115	60	17	17	28	95.4	32.3	48.4%	1089.7	2329.8	2.14	52.0		99.6
45	110	60	17	17	28	90.4	32.3	48.9%	1100.0	2319.2	2.11	52.0		95.3
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45	95	60	17	17	28	75.4	32.3	50.6%	1139.1	2279.3	2.00	52.0		82.3
45	90	60	17	17	28	70.4	32.3	51.3%	1155.8	2262.2	1.96	52.0		77.9
45	85	60	17	17	28	65.4	32.3	52.1%	1175.1	2242.4	1.91	52.0		73.6
45	80	60	17	17	28	60.4	32.3	53.0%	1197.6	2219.5	1.85	52.0		69.3
45	75	60	17	17	28	55.4	32.3	54.1%	1224.1	2192.3	1.79	52.0		65.0
45	70	60	17	17	28	50.4	32.3	55.2%	1255.9	2159.8	1.72	52.0		60.6

AEC 06043

Pillar Dimensions & Analysis

ARMPS factor

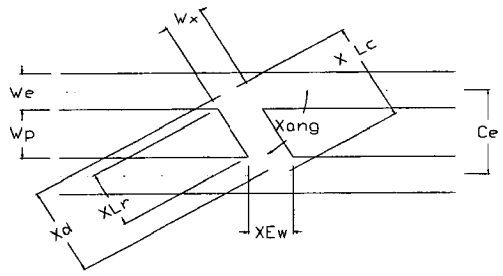
$Sp = Scc * (0.64 + 0.54 * (Wp/h) - 0.18 * (Wp^2/Lp*h))$ — 1.0224

$ap = (1.1 * D * Ce * Cx) / (Wp * Lp)$

$Re = 1 - (Wp * Lp / (Ce * Cx))$

$Lp = Cx - (Wx/Sin(Xang))$

	Panels	Butts
Scc=	900 psi	
h=	5 ft	7
D=	500 ft	



Entry Centers	X Cut Centers	X Cut Angle	Entry Width	X Cut Width	Pillar Width	Pillar Length	XC Rib Length	% Extraction	Pillar Loading psi	Pillar Strength psi		XC Center Length	XC Cut Thru from Entry CL	XC Width along Entry
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50	250	60	17	17	33	230.4	38.1	39.2%	924.6	3630.4	**3.93**	57.7	52.8	19.63
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45	250	60	17	17	28	230.4	32.3	42.7%	980.7	3187.3	**3.25**	52.0	47.1	19.63
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45	150	60	17	17	28	130.4	32.3	45.9%	1039.8	3102.8	**2.98**	52.0	47.1	19.63
40	250	60	17	17	23	230.4	26.6	47.0%	1061.3	2737.2	**2.58**	46.2	41.3	19.63
40	200	60	17	17	23	180.4	26.6	48.1%	1084.4	2716.6	**2.51**	46.2	41.3	19.63
40	150	60	17	17	23	130.4	26.6	50.0%	1125.2	2680.1	**2.38**	46.2	41.3	19.63
35	250	60	17	17	18	230.4	20.8	52.6%	1186.6	2280.0	**1.92**	40.4	35.5	19.63
35	200	60	17	17	18	180.4	20.8	53.6%	1212.4	2267.4	**1.87**	40.4	35.5	19.63
35	150	60	17	17	18	130.4	20.8	55.3%	1258.0	2245.1	**1.78**	40.4	35.5	19.63
													Butt Centers at Mains	
45	120	60	17	17	28	100.4	32.3	48.0%	1080.5	2339.2	**2.16**	52.0		103.9
45	115	60	17	17	28	95.4	32.3	48.4%	1089.7	2329.8	**2.14**	52.0		99.6
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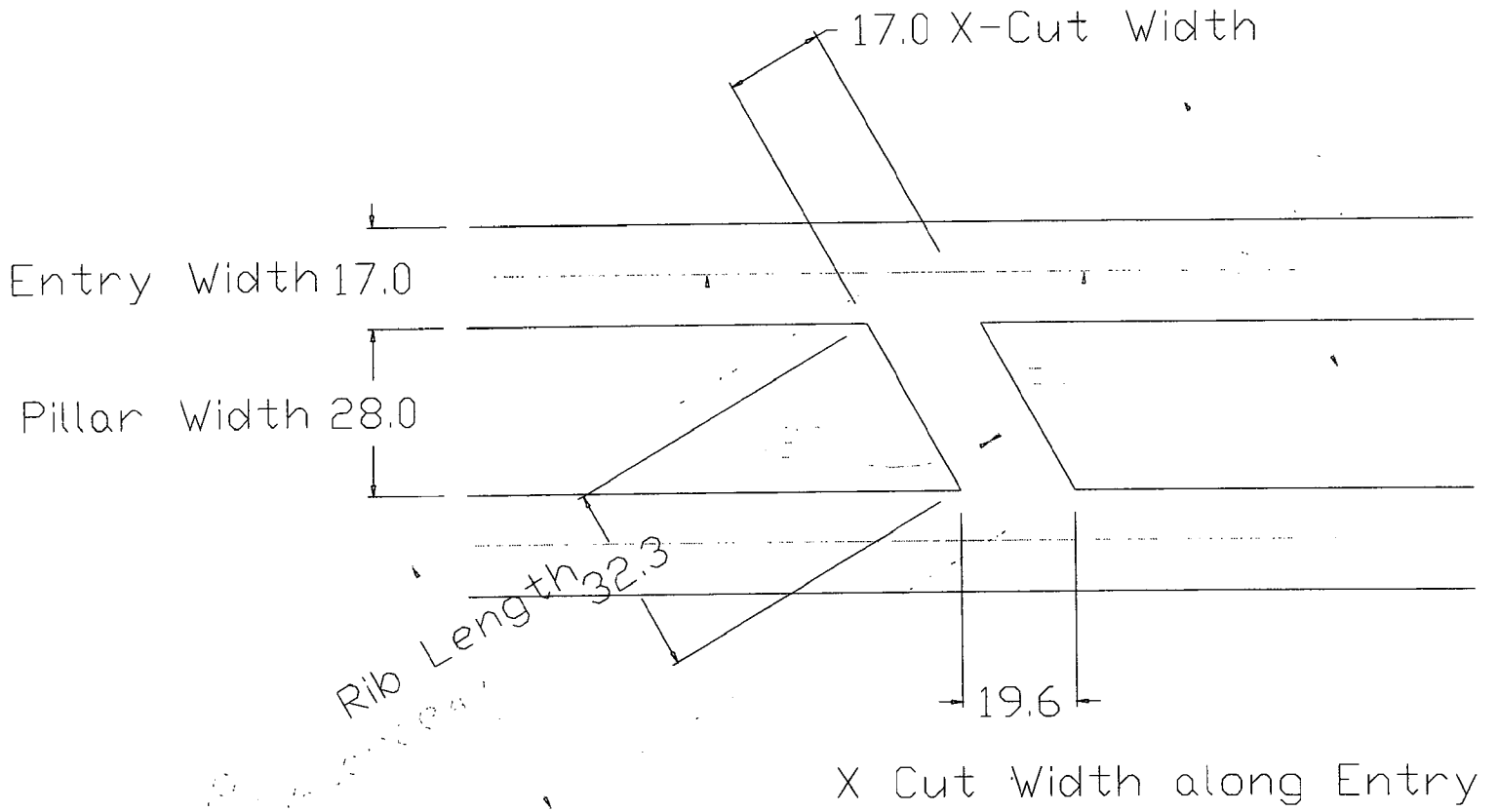
45	95	60	17	17	28	75.4	32.3	50.6%	1139.1	2279.3	**2.00**	52.0		82.3
45	90	60	17	17	28	70.4	32.3	51.3%	1155.8	2262.2	**1.96**	52.0		77.9
45	85	60	17	17	28	65.4	32.3	52.1%	1175.1	2242.4	**1.91**	52.0		73.6
45	80	60	17	17	28	60.4	32.3	53.0%	1197.6	2219.5	**1.85**	52.0		69.3
45	75	60	17	17	28	55.4	32.3	54.1%	1224.1	2192.3	**1.79**	52.0		65.0
45	70	60	17	17	28	50.4	32.3	55.2%	1255.9	2159.8	**1.72**	52.0		60.6

AEC 06044



Cross Cut Details for 45' Centers

AEC 06045

Sent to Division 1-29-07 overnight JMB.

43521 Mayhugh Hill Road
Twp.Hwy.88
Beallsville, Ohio 43716
Phone: 740-926-9152

American Energy Corporation

January 12, 2007

Treva Knasel
Division of Mineral Resources Management
2045 Morse RD. Bldg. 2
Columbus, Ohio 43229-6693

Re: Information requested by Mr. Joe Noonan

Dear Ms. Knasel:

Please find attached; a copy of the mining location map and pillar stability information requested by Mr. Joe Noonan concerning the Murray Mining Method for American Energy Corporation. Also attached is a complete copy of Dr.Luo's mitigation of subsidence influences on tower structures. Joe had asked me to send this information to you.

If you have any questions or need additional information please feel free to contact me your convenience.

Yours truly,

Fred M. Blumling

Fred M. Blumling
Environmental Engineer

I attest that the methodology and findings presented in this report are based upon the currently accepted principles of mining engineering. Specifically, the subsidence prediction and modeling methods used in the report have been developed and calibrated through years of research and applications on similar structures.

Yi Luo, Ph.D., P.E.
Associate Professor
Department of Mining Engineering
College of Engineering and Mineral Resources
West Virginia University
Morgantown, WV 26506

Under temporary authorization (based on application to register by comity in the State of Ohio, dated January 11, 2007) which will expire on March 19, 2007.

Signature: _____, January 24, 2007

YI LUO
REGISTERED
15073
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Registration No. and Seal: WV 15073

State of Ohio: Temporary Permit Granted on January 19, 2007

Assessment and Mitigation of Subsidence Influences on Tower Structures Affected by Longwall Mining Operations

By

Yi Luo, *Ph.D., P.E., Research Associate Professor*
Syd S. Peng, *Ph.D., Professor and Chairman*
Department of Mining Engineering
West Virginia University

INTRODUCTION

In the new permit area of the American Energy Corporation's Century Mine (Permit application No.: D-0425-5), the planned longwall mining operations will be conducted under a number of municipal and industrial structures. These structures include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for telecommunications. The first author visited the sites on July 19, 2005 and obtained the necessary mine maps.

This report presents the methods for assessing and mitigating the potential subsidence influences on these tower structures caused by the planned longwall operations in the permit area.

SITE AND STRUCTURES

Surface and Mine Layout

Figure 1 shows the site where the main structures are located. The water tower and a larger communication tower are located on the top part of the figure while the smaller cell tower and the power transmission line are on the lower part of the figure. At the time of the site visit, the mining company has also considered to lay out the longwall panels in a different way to place some of the main structures (i.e., water towers, and guyed telecommunication towers) over the central portions of the longwall panels so that they will not subject to permanent surface deformations caused by the mining operations.

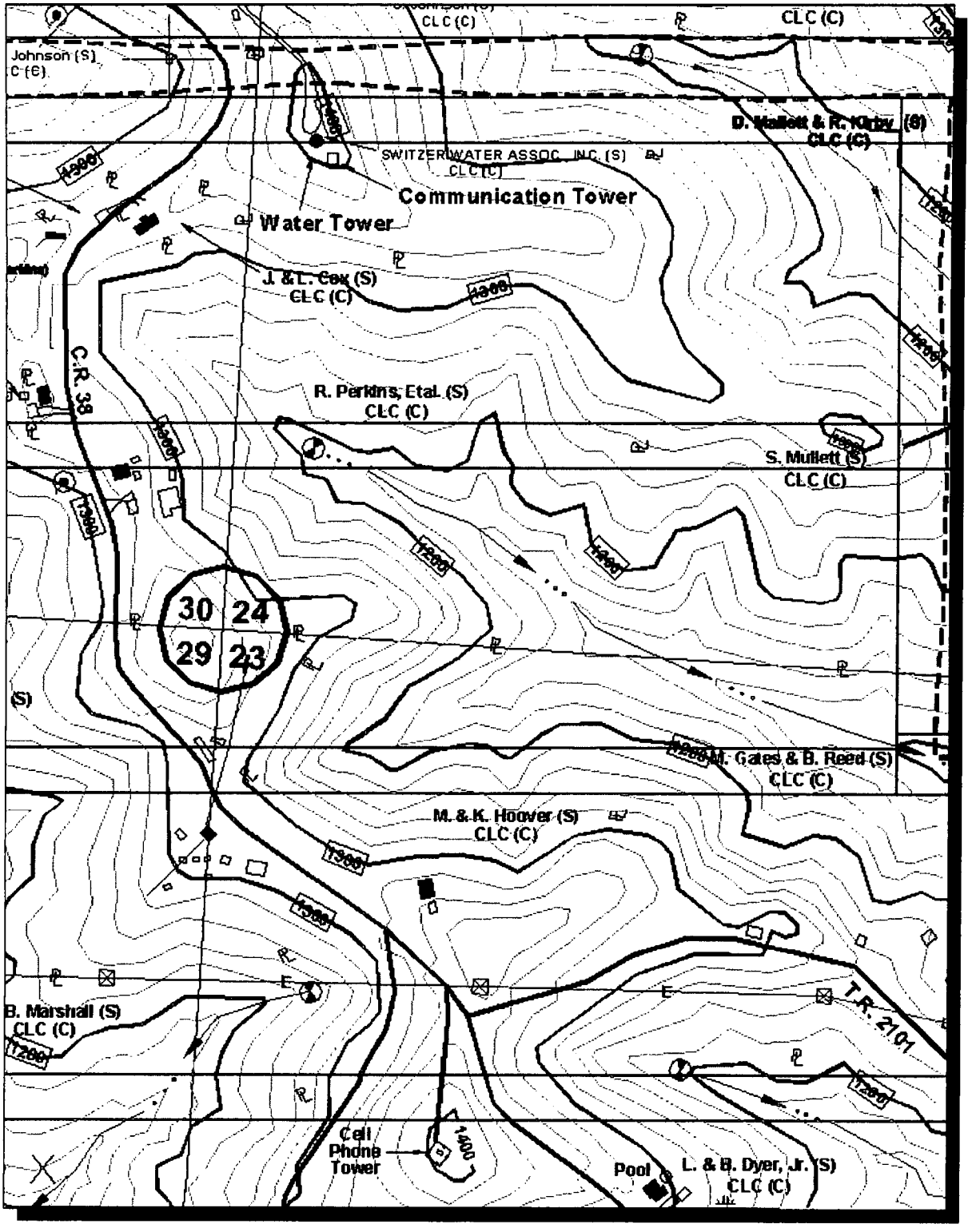


Fig. 1 Area with the Main Structures

The gentle hilly surface topography in the area is also shown in Fig. 1. The overburden depth at the locations of the tower structures ranges from 460 ft to 745 ft. The rib-to-rib width of the longwall panels is 920 and the width of the three-entry chain pillar system between adjacent longwall panels is about 140 ft.

Main Structures

The main structures in the permit area include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for wireless telecommunications.

Figure 2 shows the water tower. It is located on the top of a gentle hill. The tower is a steel cylindrical structure sitting on a concrete base. The cylindrical tank is about 50 ft tall and 14 ft in diameter and has a holding capacity of 54,000 gallons. The concrete base under the tank is about 15 ft in diameter and between 3 and 4 ft thick (Fig. 3). The outer layer of the steel sheet that was used to construct the water tank is about 3/16" thick.

Figure 4 shows the larger communication tower. It is located a short distance away from the water tower on a gentle slope. The height of the tower is about 300 ft. The tower is a guyed steel lattice tower with the guy wires tied at five different levels on the tower. Three guy wires are used at each tie level. Therefore, guy wires permit the main tower structure to rotate in the horizontal plane to certain degree. The base on the tower (Fig. 5) is bolted to the concrete foundation with one bolt to allow horizontal rotation. The guy wires are tied to the ground at three anchor locations (Fig. 6) that are spaced 120° apart from the base. Pole type antennae are mounted on the top of the tower.

Figure 7 shows the small cell phone tower located on the top of another gentle hill. It is also a guyed steel tower and is about 150 ft high. The guy wires are tied to the main tower structures at three different levels. At the lower two levels, three guy wires are used at each tie level. On the top level, six guy wires, two on each direction, are used to restrict the horizontal rotation of the tower structure (Fig. 8). The base of the tower is the same of the larger tower. On the ground, three anchors are buried about 120° apart from the tower base. Four dish type antennae are mounted on the top of the tower and another dish antenna at middle level.

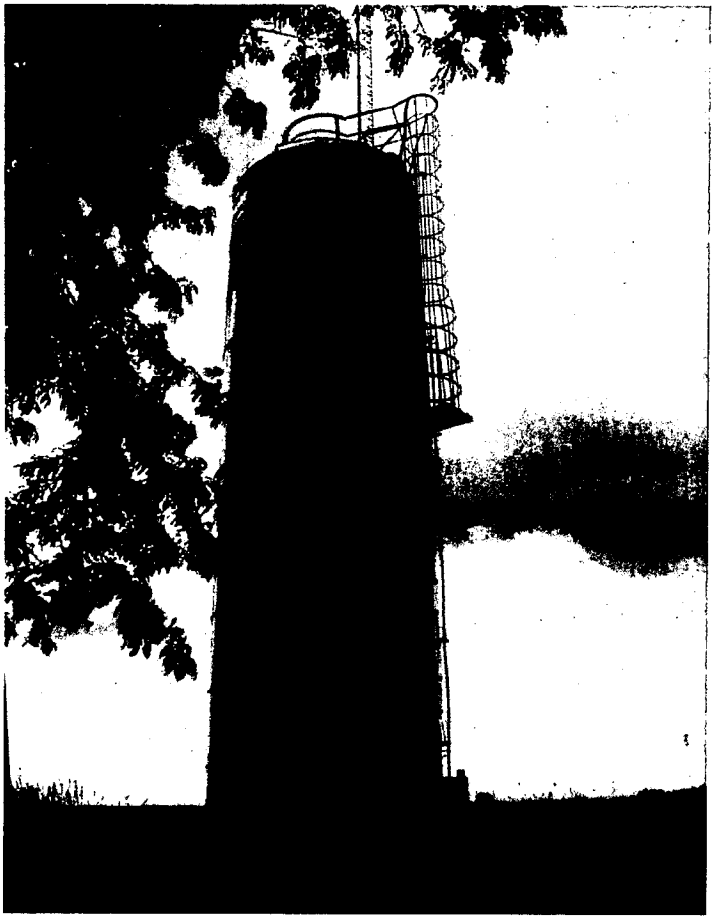


Fig. 2 Municipal Water Tower

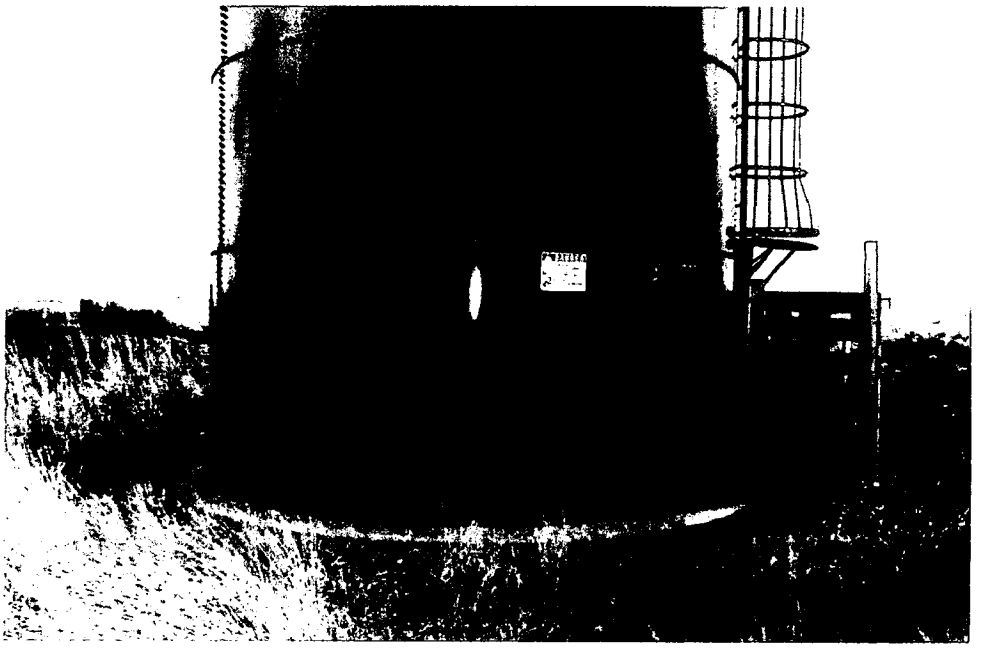


Fig. 3 Base of the Water Tower

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Fig. 3 Larger Communication Tower

Fig. 5 Base of the Large Communication Tower

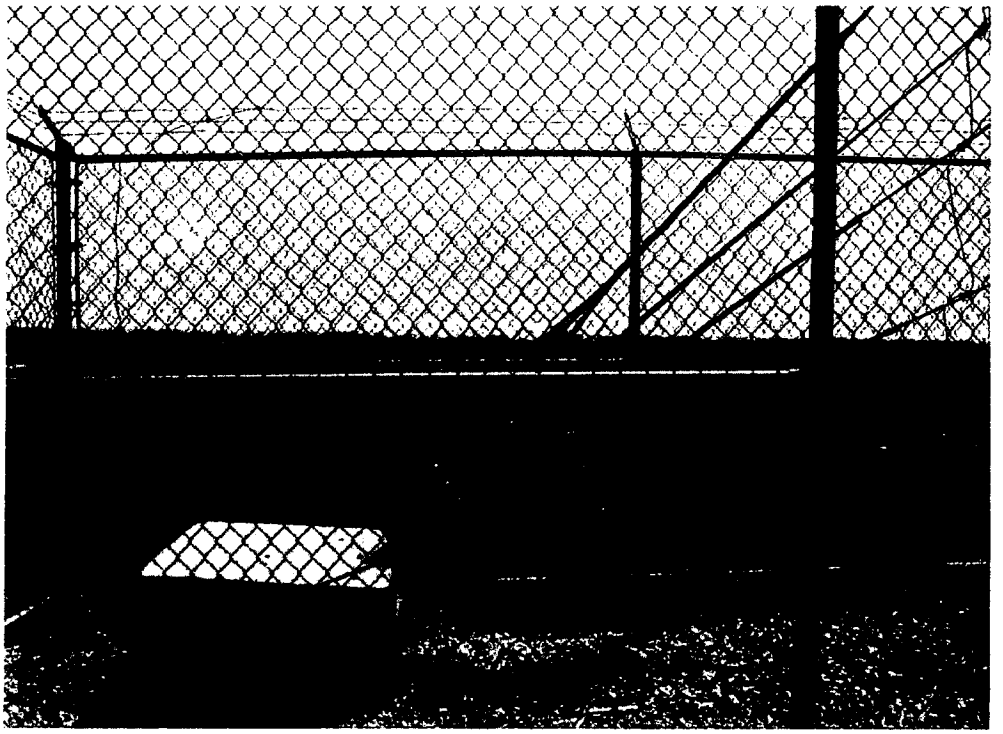

Fig. 6 One of the Three Anchors for the Large Communication Tower

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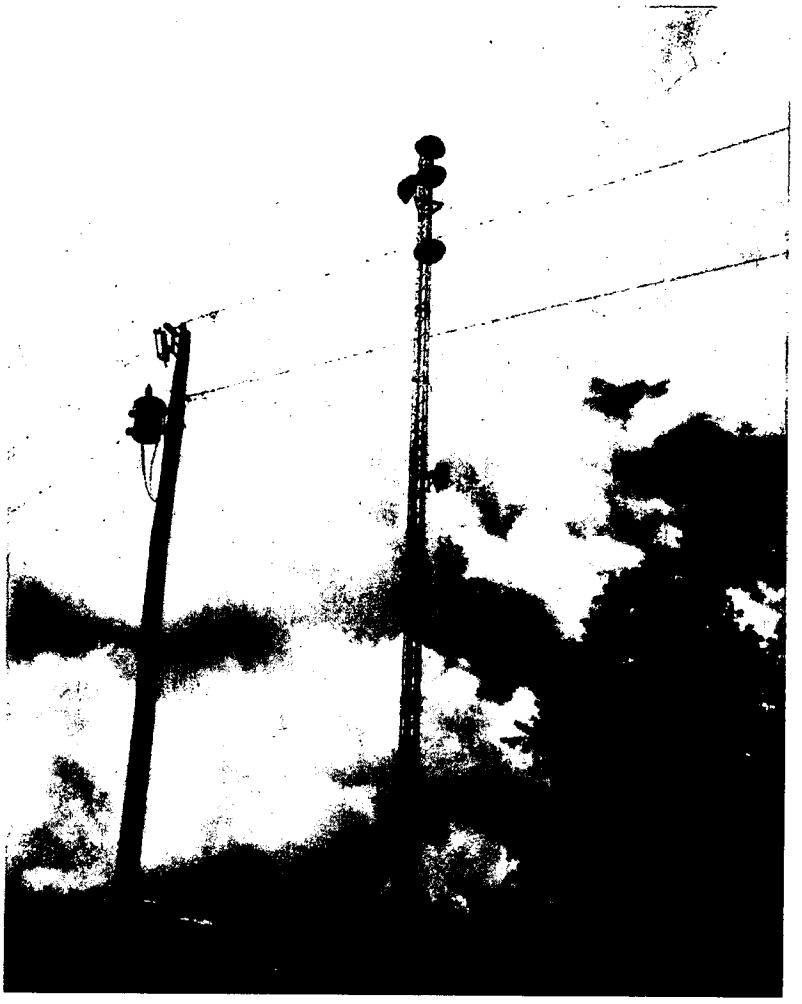

Fig. 7 Small Cell Phone Tower

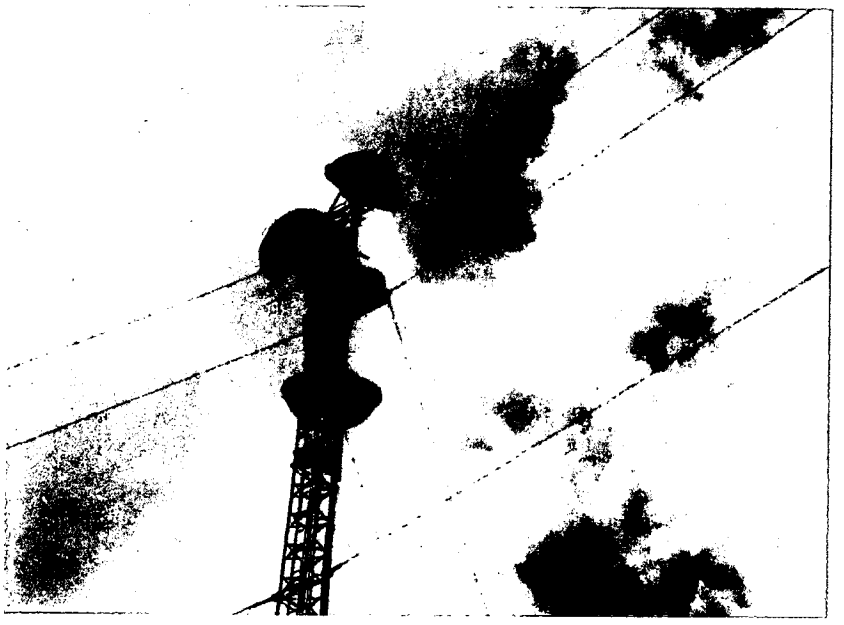

Fig. 8 Directional Control Guy Wires Tied at the Top Level

One of the power transmission towers is shown in Fig. 9. All 14 power tower share the same structural design. The steel lattice tower has four legs bolted to their concrete bases. The side distance is about 28.5 ft. The tower is about 75 ft tall and the transmission lines are hung at two levels. The main load-bearing members of the tower are made of 5-inch angle steels while smaller bars or angle steels are used for the other members. The lowest restrictive horizontal bars are located about 20 ft above the ground surface.

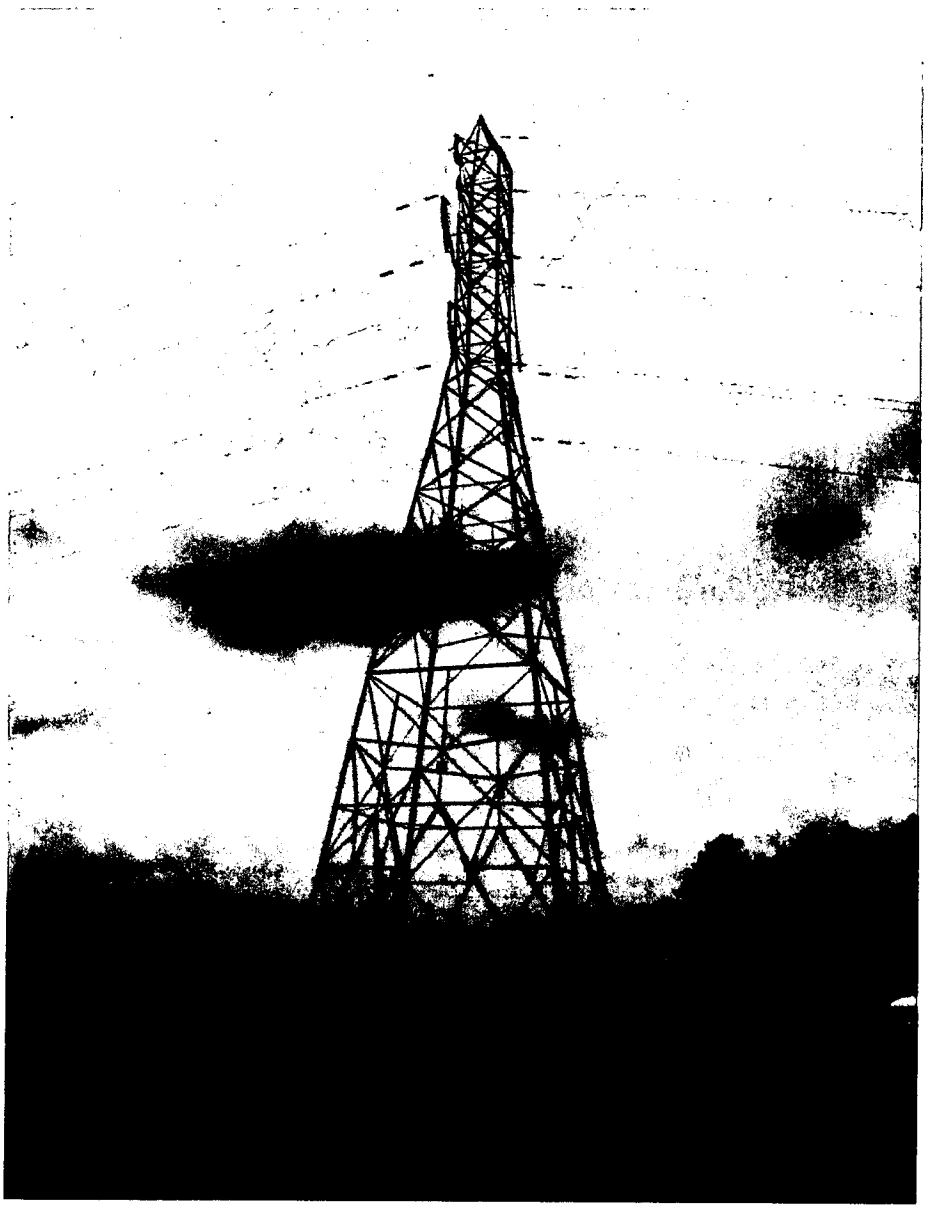

Fig. 9 Power Transmission Tower

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ASSESSMENT AND MITIGATION OF THE SUBSIDENCE INFLUENCES

In this section, the potential subsidence influences on the water tower has been assessed and the mitigation measure for it has been recommended. In assessing the potential subsidence influences, the structural integrity, stability and functionality of the structures should be assessed. For the two communication towers, the methods for assessing and mitigating the influences are mentioned. Surveys to locate the anchors should be performed before the detailed analysis can be performed. Among the 14 transmission towers, eight of them could experience subsidence influences. The subsidence influences could be dependent on many factors and should be assessed one by one.

Influences on and Mitigation Measures for Water Tower

In order to assess the potential subsidence influences to the water tower, the final and dynamic surface movements at the location of the tower have been predicted. The subsidence prediction program CISPM version 2.01 is used. The development of the prediction package is based on the influence function method that is widely adopted in the major mining countries including US coal mining industry and a large amount of collected subsidence data. Most of subsidence cases are collected over longwall panels mining in the Pittsburgh coal seam. This subsidence prediction program package has been successfully applied in various subsidence projects and proven accurate.

The overburden depth at the location is about 745 ft and the center of the tower is located 325 ft inside the panel edge according to the new panel layout. A mining height of 6.0 ft is used in the prediction. The predicted final subsidence profile across a longwall panel with the minimum (460 ft) and maximum (745 ft) overburden depths are plotted in Fig. 10. The location of the water tower, as well as the two guyed telecommunication towers, is also shown in the figure. It shows that the tower is located near the flat bottom portion of the final subsidence basin to be formed over the longwall panel and the predicted final subsidence at the center of the tower is about 3.43 ft. Since the water tower is located on the top of a high hill with its elevation much higher than its customers in the adjacent area. The reduction on water head due to mining subsidence (only about 7% of the tower height) will be too insignificant to reduce its ability for serving the cus-

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tomers. The predicted final surface slope, strain and curvature are 0.31%, -5.2×10^{-3} ft/ft (compression) and -6.4×10^{-5} 1/ft (concave). Due to its small foot size, the water tower is very unlikely to be affected by these final deformations.

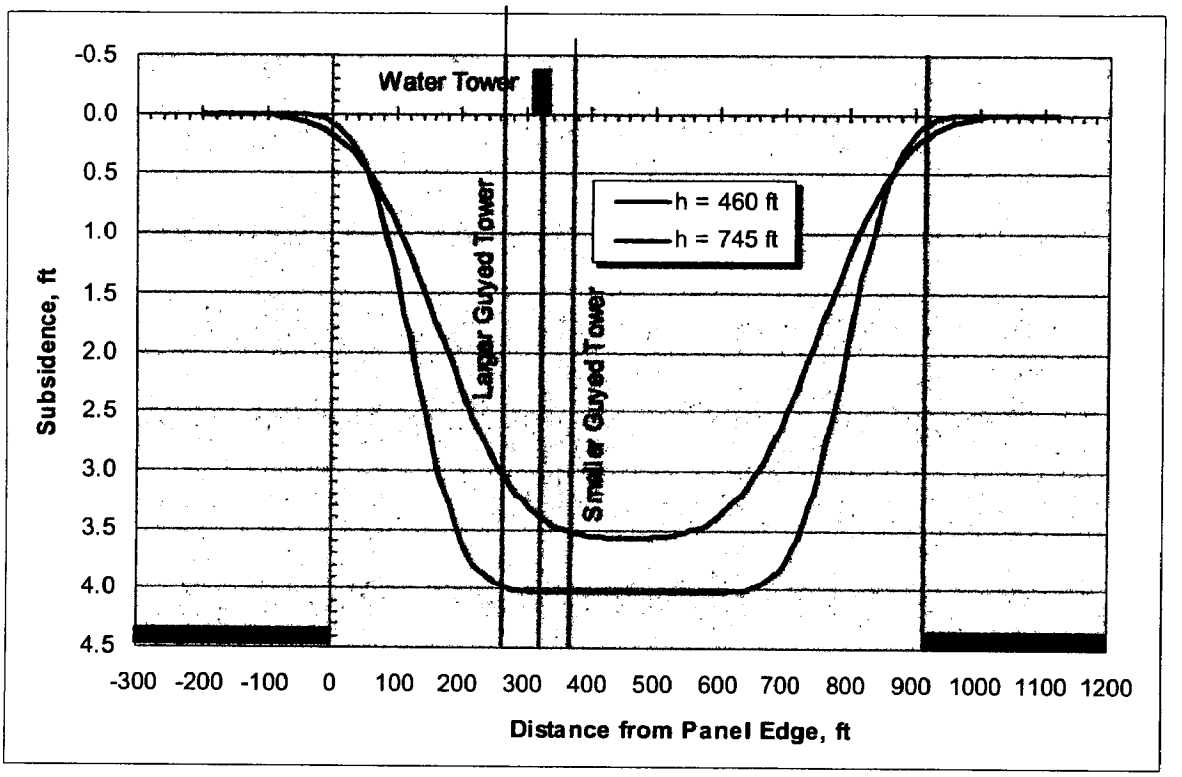

Fig. 10 Predicted Final Subsidence Along a Transverse Cross-section

Before the water tower finally settles down, it will experience a dynamic subsidence process. Figure 11 shows the predicted dynamic subsidence development curves at the location of the tower. Face advance rates in a large range of 20, 40, 60 and 80 ft/day have been used in the dynamic subsidence predictions. It shows the faster the face advances, the longer and gentler is the subsidence development curve. The tower is to experience the dynamic subsidence when the longwall face is about 50 ft inby and 700 ft outby the tower with the most active subsidence precess occurring when the longwall face is between 270 and 330 ft past the tower. Due to its small base and large height, the structural stability under the influence of dynamic subsidence process might be a concern. To assess the stability, the predicted dynamic slope development curves are shown in Fig. 12. The maximum dynamic slopes are 1.0%, 0.89%, 0.79% and 0.72% for the four ad-

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vance rates used. Such small dynamic slopes are even barely noticeable without pri. These maximum slopes would occur when the longwall face has passed the center of the tower a distance between 250 and 290 ft. Even when the water tank is operated at full level as the worst case, the center of the gravity of the water tower is located about 25 ft above the ground surface. Using the predicted maximum dynamic slope of 1.0%, the center of gravity of the tilted tower will only move a horizontal distance of 0.25 ft (3 inches) away from its original base center. Compared to the 7-ft radius of the tower base, the relocation of the center of gravity of the tower is very insignificant (3.6%). Therefore, the stability of the water tower will not be affected by the dynamic subsidence process at all.

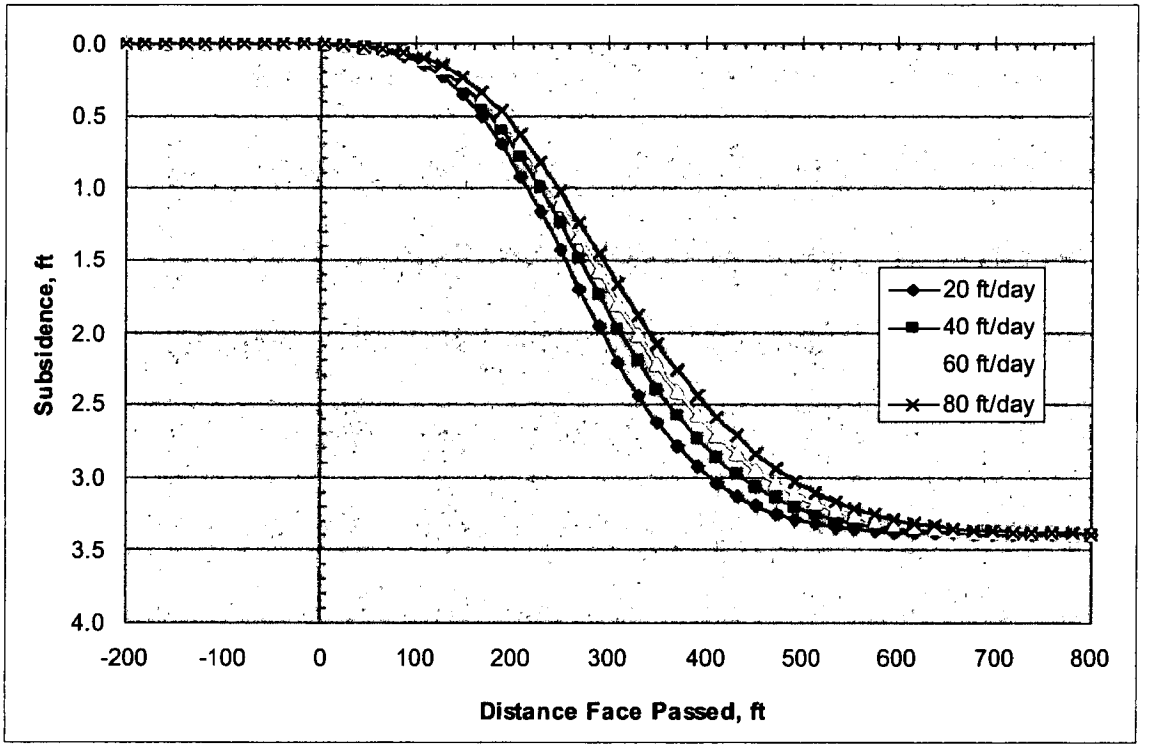

Fig. 11 Predicted Dynamic Subsidence Development Curves at the Water Tower with Various Face Advance Rates

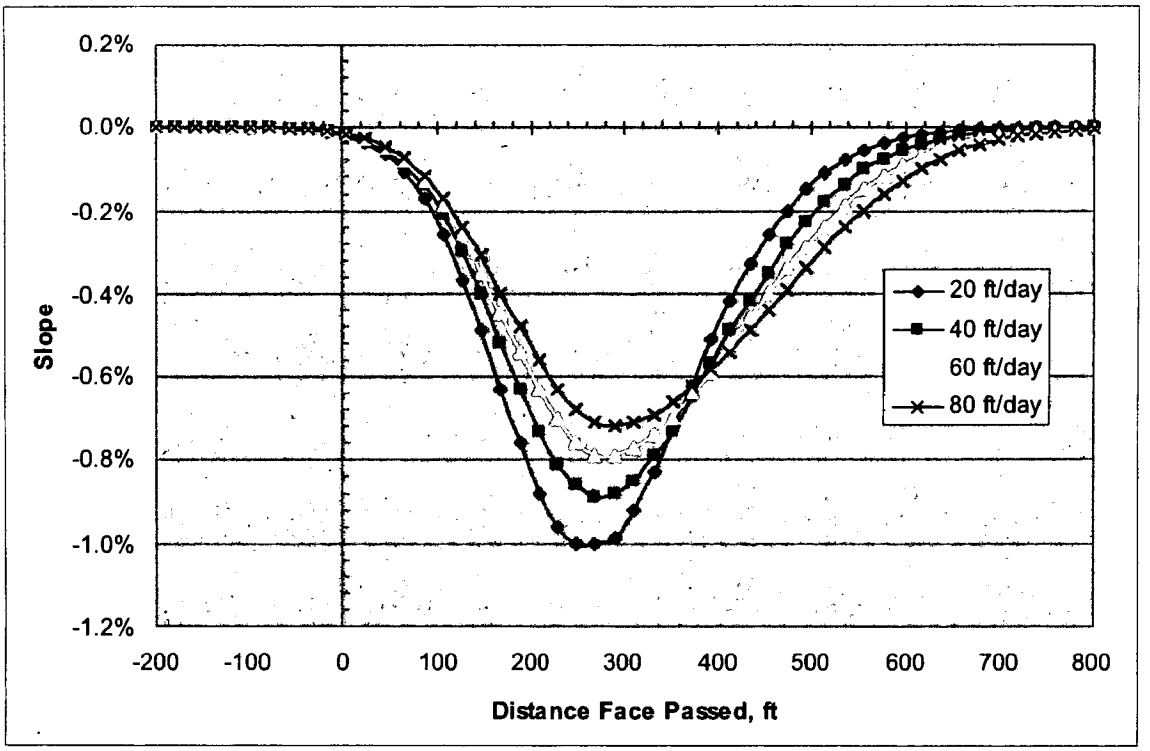

Fig. 12 Predicted Dynamic Slope Development Curves at the Water Tower

The predicted maximum dynamic tensile strains (not shown) for the ranges of face advance rates range from 3.46×10^{-3} to 5.51×10^{-3} ft/ft occurring at 165 ft behind the longwall face. The maximum dynamic tensile strain might be able to create some hair-line cracks on the concrete base of the water tower. The maximum dynamic convex curvatures will be in the range from 4.19×10^{-5} to 6.67×10^{-5} 1/ft, too small to cause any problems to the water tower structures.

In order to prevent the concrete base of the water tower from being cracked by the dynamic tensile strain, it is recommended to wrap the concrete base with two steel tension cables. New 3/4 –inch steel wire cables should be used. The cables should be placed about 4-inches below the top surface of the concrete base and each cable should be tensioned to 4-tons (8,000 lbs). The cables should be installed when the longwall face is still 200 ft to the tower and can be released after the face has passed the tower a distance of 1,000 ft.

Influences on and Mitigation Measures for the Telecommunication Towers

The locations of the two telecommunication towers with respect to the edges of the longwall panel are also plotted along with the predicted final subsidence profiles in Fig. 10. The smaller tower is located in the central and flat bottom portion of the subsidence basin with the final subsidence at its base being about 3.6 ft. The larger tower is located in the concave portion of the final subsidence basin and the final subsidence at its base is about 3.0 ft.

The assessment of subsidence influences on the guyed towers is much more complicated than that for the water tower. The authors have developed the assessment techniques and successfully applied them to one guyed tower that was similar to the two towers in this study and used for signal relay of cellular phone services. Based on the assessment, simple and inexpensive mitigation measures were recommended and mitigated. That tower was successfully protected and its services was never been affected despite of severe winter weather while mining was conducted under the tower. The publication (Luo et al, 2003) detailing the assessment techniques and mitigation measures is attached as an appendix. In assessing the influences, the following design and operating parameters of the towers are required:

- Coordinates and elevations of the tower base and ground anchors
- Elevations of the guy wire ties on the towers
- Sizes of guy wires
- Ranges of the tensions in the guy wires

We request these necessary design and operating parameters be provided before the detailed analyses on the potential subsidence influences on the guyed towers are performed. The predicted final and dynamic movements at the base and the anchors will be used in addition to other input information in assessing the subsidence influences on the guyed towers.

However, it is anticipated based on our past experience that the tensions in the guy wires could increase in the first half of the dynamic subsidence process and decrease in the second half of the process. If the guy wire tensions increase too much, they place a significant additional load on the lower members of the tower structure and potentially

leads to problems to the tower base, the guy wires and the anchors. If the guy wire tension decreases too much, it could cause slacking condition to the guy wires which reduces lateral restraints to the main tower structure. The significant differential ground movements in both vertical and horizontal directions at the tower base and ground anchors will also cause vertical and horizontal rotations that could lead functionality problems to the towers.

However, as mentioned previously, we have developed and successfully applied some mitigation measures for such guyed towers. The mitigation measures could include: (1) periodical monitoring the tensions in the guy wires (i.e., 2 to 3 times a day during the active dynamic subsidence period) and adjusting the tensions in the guy wires if needed, and (2) monitoring the plumb of the main tower structures from two orthogonal directions (i.e., parallel and perpendicular to the mining direction) and adjust the guy wires as needed. These mitigation measures are relatively simple and inexpensive to implement.

Influences on and Mitigation Measures for the Power Transmission Towers

The 14 power transmission towers are located over two longwall panels according to the latest mine layout. Among them, three are located beyond the panel setup entries or recovery lines expecting no or very minor subsidence influences. Eight towers are located over or near the chain pillar system between two adjacent longwall panels. These towers are to experience a small amount of final subsidence but some of them may be subject to high final tensile strains. The remaining three power towers are located in the "central" portion of one longwall panel and expecting to experience strong dynamic subsidence process. Therefore, the power transmission towers located over the chain pillars system and within the panel edges may be affected by the proposal longwall mining operations. The severity of the potential subsidence influences to each of the tower could be different depends on their relative locations to the longwall panels, surface topography, the design and construction of the towers, etc. At the time of this writing, the design information of the power towers have not been provided for us to performed detailed analyses.

However, it should be noted that the authors have previously performed assessments on the subsidence effects and monitored the stress on a number of power transmis-

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sion towers similar to the ones in this permit area. That study found that the longwall subsidence process would have very little effects on the stability even when the lateral load by the strongest wind was applied on the subsided tower. That study also considered the additional tension or sagging conditions when two adjacent towers are subject to differential lateral movements and slopes during and after the subsidence process. It was found that such additional tension was insignificant to affect the power transmission lines. However, the differential movements, especially differential horizontal displacements, among the legs of each tower could cause bending and twisting to the steel members at the lower level.

In another study, the authors studied a very important and large 4-leg telecommunication tower located on the top of a very steep mountain peak (Luo and Peng, 1997). The tower was responsible for sending and receiving signals to telecommunication satellite for a national telephone company. It experienced two subsidence processes when two adjacent longwall panels were mined. The analyses on the stability, functionality and structural integrity were performed. It was found that the differential movements at the legs could cause problems to the lower parts of the tower. In order to reduce the severity of the anticipated subsidence influences, mitigation measures, including a compensation trench and bracing methods, were recommended and implemented for this tower. The mitigation was very successful. No damages were found on the tower structure despite that ground cracks were observed nearby. The services were never been interrupted. Based on the experiences with 4-leg towers, we believe that the same or similar mitigation measures can be applied in protecting these power transmission towers. In order to perform detailed analyses of the structures, design information from the power company is needed.

CONCLUSIONS

A preliminary study has been performed for three types of tower structures located in an area where the mining permit is in application process. It is concluded that among the three types of the structures:

1. The stability and functionality of the water tower would not be affected by the dynamic subsidence process according to the new mine layout. The dynamic strain could cause some minor cracks on the concrete base of the tower but the anticipated problem can be controlled using tension cable method.
2. The potential subsidence influences on the two guyed telecommunication towers can be assessed using the techniques developed by the authors. Based on our previous experience, relatively simple and inexpensive mitigation measures can be applied to protect these two structures.
3. The subsidence influences on 4-leg steel towers for electrical power transmission can be assessed and mitigated using proven techniques.

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Luo, Y. and S.S. Peng, 1997, "Subsidence Prediction, Influence Assessment and Damage Control," *Proc. 16th Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, West Virginia University, WV, pp. 50-57.

Luo, Y., S.S. Peng and B. Miller, 2003, "Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study," *Proc. 22nd Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, C. Mark and A.W. Khair, pp. 360-366.

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APPENDICES

Two publications by the authors
on assessing and mitigating subsidence influences
on tower structures.

AEC 06064

Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study

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ABSTRACT

The potential influences of mining subsidence on structural stability, integrity and functionality of guyed tower structures have not been systematically studied before. This paper presents a case study where a guyed steel tower of a telecommunication company was mined under by a longwall operation. Prior to mining, every aspect of the subsidence influences to this structure was studied. The pre-mining assessment indicated that the structure could experience vibration problem in the second half of the dynamic subsidence process. Based on the study, a simple mitigation measure was recommended and implemented and the structure was successfully protected.

INTRODUCTION

Guyed tower structures have been frequently employed to elevate objects (e.g., radio or TV transmitters, wind turbines, etc.) high above ground surface because of their low construction cost and great stability. A guyed steel tower is consisted of a tall and slim steel lattice structure restrained laterally by a number of steel guy wires from different directions.

Mining in a longwall panel with a fairly large overburden was conducted under a guyed steel tower used for wireless phone service. Assessment of the influences of the subsidence process on this structure has been performed using the methods developed in this study prior to the longwall mining operation. The assessment concluded that the stability, integrity and functionality of this tower structure would not be affected by the subsidence process. However, the lateral restraint to the steel tower by the guy wires would be reduced, possibly causing vibration of the structure under gusty wind conditions, in the second half of the dynamic subsidence process. The only mitigation measure for this tower was to monitor and to maintain proper tensions on the guy wires. The structure was successfully protected and its services had never been affected.

This paper presents the methods for assessing the subsidence influences on the guyed tower at various stages of the subsidence process.

LONGWALL PANEL AND TOWER STRUCTURE

The portion of the longwall panel over which the transmission tower is located is shown in Fig. 1. The longwall panel was 874 ft wide (rib-to-rib) and the mining height in the Pittsburgh coal seam is between 6.5 and 7.0 ft. The base of the tower is located near the central portion of the longwall panel. The tower sits in a flat area on the top of a steep hill. The overburden depth at the tower base is about 1,017 ft.

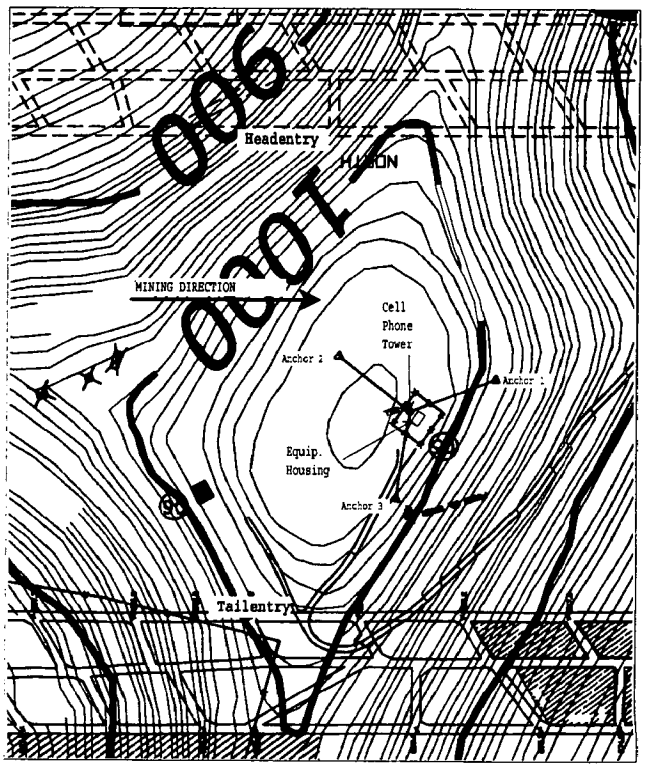

Fig. 1 Overview of the Site

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The tower (Fig. 2), belonging to one of largest wireless phone companies in the nation, serves as a relay station to transmit cellular phone signals between two similar towers located more than 20 miles away in the tri-city area in the northern West Virginia and southwestern Pennsylvania. The steel lattice tower is about 180 ft tall and laterally restrained by 12 steel guy wires. These guy wires are installed in three vertical planes that are separated from each other by about a 120° horizontal angle. Along each plane, the lower ends of the four wires are tied to a concrete anchor block (Fig. 3) and the upper ends are tied to the tower at three different levels. The turnbuckle on each guy wire makes it possible to make necessary adjustment for regular maintenance. The anchors were located about 160 ft away from the tower base. The concrete anchor blocks, 2' (H) x 3' (W) x 7'-6" (L), were buried about 6 ft below the ground surface.

Fig. 2 Transmission Tower

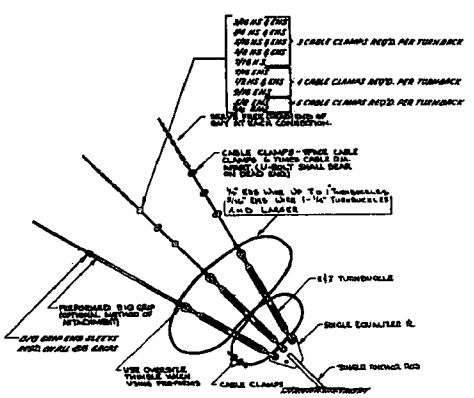

Fig. 3 Method to Tie the Guy Wires to the Anchor Block

Table 1 shows the pre-mining coordinates and elevations of the points of interest on the tower structure (i.e., base, anchors and ties). A local coordinate system is used for the structure. The datum of the elevation of the local coordinate system is set at the base of the tower ($z = 0$ ft at the base). It should be noted that the anchors are not on the same elevation as the tower base. The x-direction of the coordinate system follows the mining direction with $x = 0$ at the tower base. The y-axis points from the panel tailentry to the headentry with $y = 0$ at the panel tailentry.

Table 1 Local Coordinates of the Tower Base and Anchors

Point of Interest	x	y	z*
Base (0)	0	369	0
Anchor 1	149	427	-12
Anchor 2	-123	469	-6
Anchor 3	-23	215	-1
Tie 1	0	369	60
Tie 2	0	369	123
Tie 3	0	369	173

* elevations are expressed in relation to tower base

The tower super-structure is tied to its foundation with one steel bolt (ϕ =15/16"). The reinforced concrete foundation is constructed in two sections. The lower section is a square one with side length being 4'-6" and the thickness being 1'-6". The upper section is cylindrical with its diameter and height being 2 and 4 ft, respectively. The foundation is buried with only the top 6 inches being exposed above the ground surface.

In each of the three guy wire planes, one guy wire (ϕ = 3/8") is used at the lower level located about 60 ft above the tower base (referred as Tie 1). Two guy wires (ϕ = 7/16") are tied to the tower at the middle level (123 ft above the tower base) to resist the possible rotation of the tower structure (Tie 2). The top of the tower is tied with one guy wire (ϕ = 7/16") at the elevation of 173 ft above the tower base (Tie 3). At lower and top tie levels, breast type of ties are used to provide lateral restrain to the tower only while the middle tie is a torque type to provide both lateral and rotational restrains to the tower as shown in Fig. 4. The guy wires have been pre-tensioned with the tensions ranging from 1,250 lbs at the lower level to 1,975 lbs at the top level.

SUBSIDENCE PREDICTION

In order to assess the potential subsidence influence on the tower structures, dynamic subsidence prediction is performed at four surface points of interest, the tower base and the three anchors, using the subsidence prediction program CISPM version 2.01 (Peng and Luo, 1992). Mining height of 7.0 ft and an advance rate of 80 ft/day were used in the predictions.

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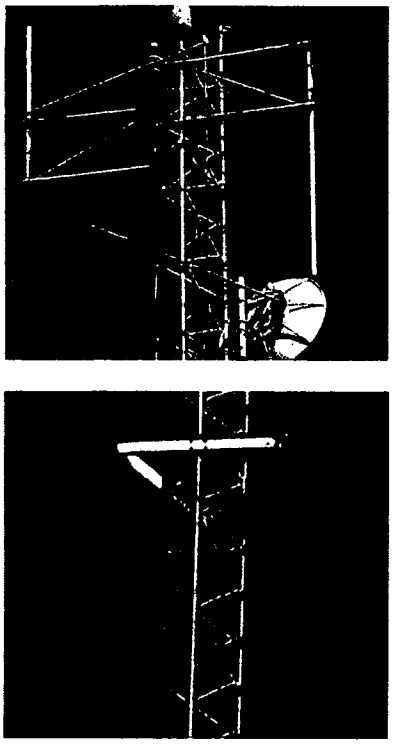

Fig. 4 Breast Type (Top) and Torque Type (Bottom) Ties

The predictions was performed at different time stages ranging from when the longwall face was from 300 ft inby to 1,700 ft outby the tower base. These time stages are chosen to cover the entire active dynamic subsidence process. The prediction for the last time stage (i.e., the face has passed the tower base for a distance of 1,700 ft) should be considered as the final subsidence. The predicted surface subsidence (S) and the two components of horizontal displacement (U_x and U_y along the x and y directions, respectively) at these specified time stages are plotted in Figs. 5, 6 and 7, respectively.

Figure 5 shows the predicted subsidence development curves at the tower base and anchors. Insignificant amount of subsidence would be experienced by the tower structures when the longwall face was directly under the tower base. The subsidence process would be most active when the face was between 300 and 400 ft passed the tower base. The ground begin to regain stability after the face has passed the tower base a distance of 1,000 ft. The final prediction shows that anchor 1 will subside the most (3.06 ft) while anchor 3 the least (1.62 ft). There is no significant differential subsidence among the base, anchors 1 and 2 after the subsidence process is over.

The predicted development curves of horizontal displacements along the mining direction are plotted in Fig. 6. The negative values shown in the figure indicate that the movements were against the mining direction. The maximum movements along the mining direction ranged from 0.43 to 0.54 ft when the longwall face was between 300 and 700 ft passed the tower base.

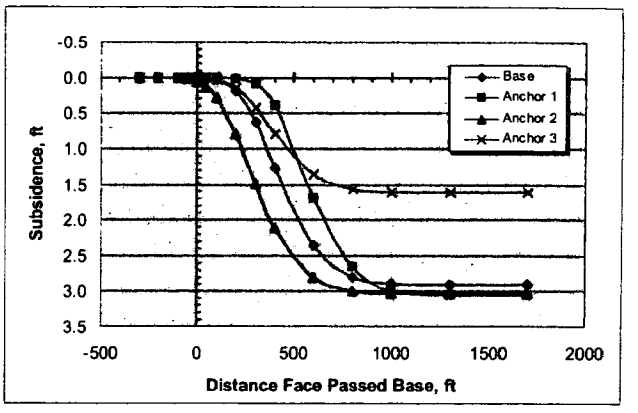

Fig. 5 Predicted Dynamic Subsidence

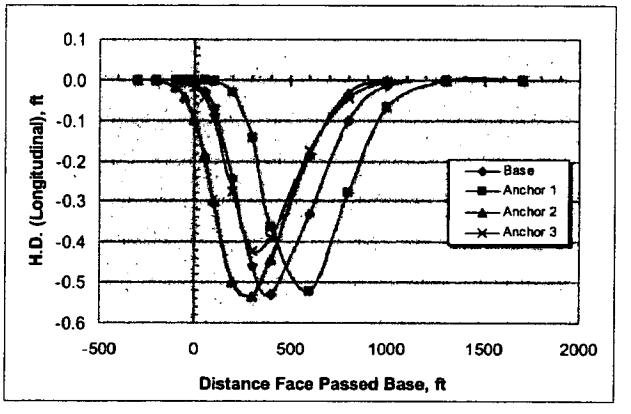

Fig. 6 Predicted Dynamic Horizontal Displacement Along Mining Direction

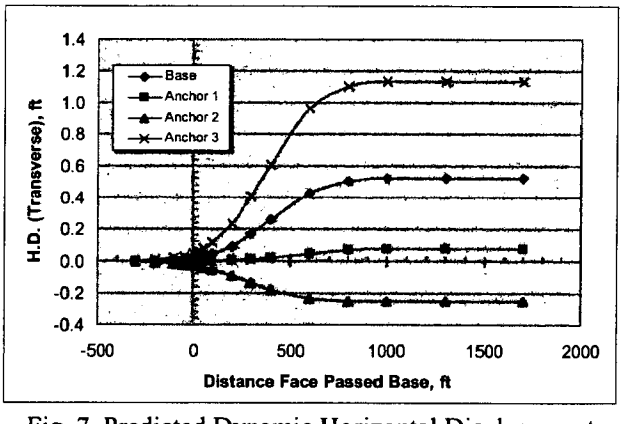

Fig. 7 Predicted Dynamic Horizontal Displacement Along Panel Transverse Direction

The predicted development curves of horizontal displacements along the panel transverse direction are plotted in Fig. 7. A positive value indicates movement from the panel tailentry to headentry. It shows that the base and anchors 1 and 3 would move toward the panel headentry side while anchor 2 would move toward the panel tailentry side. Among these four points, anchor 3 will have the largest movement (1.15 ft) while anchor 1 will have the least movement (0.07 ft) when the subsidence process is over.

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ASSESSMENT OF SUBSIDENCE INFLUENCES

Based on the predicted dynamic surface movements at the tower base and three anchors as well as the structural characteristics of the tower, the movements and deformations of the tower structure can be determined. Subsequently, the following three aspects of potential influences that the ground subsidence process could cause to the tower structures can be assessed.

- *Structural stability*: Since the tower structure is tall and sits on the hill top, its stability during and after the subsidence process was a concern.
- *Structural integrity*: The subsidence process could induce some additional forces on various parts of the tower structures. If strong enough, these forces could cause structural damages to some of the structural parts.
- *Functionality*: If the tilting and rotation of the transmission tower induced by the subsidence process exceed certain critical values, they could cause blockage and alignment problems to the paths of the signal transmission resulting in disruption or degradation of the cellular phone services.

Assessment of Structural Stability

Stability analysis is normally required for tall structure with small bases such as transmission tower to assess the potential for the structure to be toppled by external lateral forces. Because of their designs, the guyed towers are a type of very stable tower structures that can sustain high winds, earthquakes and extreme weather. The stability of the guyed tower could only be jeopardized when some of the guy wires, especially those tied to the upper levels of the towers, break under some extreme forces. The determination of the subsidence-induced forces in the guy wires to be induced for this case is presented in the next section. That analysis indicated that the subsidence-induced tensions in the guy wires were insignificant compared to pretensions in these wires and to their ultimate breaking loads of the steel cables. Therefore, the ground subsidence process associated with the longwall mining operation will not affect the stability of this particular transmission tower.

Assessment of Structural Integrity

As the ground subsides, the relative spatial locations of the tower base and the anchors, the ground-contacting points of the guyed tower structure, will change. Such changes in elevations and coordinates of these ground-contacting points could induce additional tensions or slacking condition in the guy wires and additional loads in the tower structure.

Determination of Tower Equilibrium State

In determining the subsidence-induced tensions and loads, the predicted dynamic surface movements at the tower base and the anchors at a time stage are imposed on their respective original coordinates and elevations listed in Table 1. The most important task is to determine the coordinates of the ties on the tower when a new equilibrium is developed in the tower structure for that time stage. Since the guy wires tied to each of the three ties on the tower are of the same size (3/8" for wires connected to tie 1, and 7/16" to ties 2 and 3), the following conditions should be satisfied when a new equilibrium at each tie position is reached.

$$\begin{cases} \sum_{i=1}^{3} \varepsilon_i \cos\beta_i \cos\alpha_i = 0 \\ \sum_{i=1}^{3} \varepsilon_i \sin\beta_i \cos\alpha_i = 0 \end{cases} \quad (1)$$

In Equation 1, ε_i is the subsidence-induced strain developed in the guy wire connected between anchor i and the tie of interest. The horizontal angle between this guy wire and the mining direction is β_i while the slope angle is expressed as α_i. The subsidence-induced strain in this guy wire is determined as:

$$\varepsilon_i = \frac{\sqrt{(x_i - x_o)^2 + (y_i - y_o)^2 + (z_i - z_o)^2} - L_o}{L_o} \quad (2)$$

In equation 2, x_i, y_i, and z_i are the coordinates and elevation of ground anchor i at a given time stage. The coordinates and elevation at a given tie on the tower are x_o, y_o, and z_o. The original length of the guy wire is L_o. In setting up equations 1 and 2, the following two reasonable assumptions are made:

- The vertical deformation of the tower structure is insignificant. Therefore, the new elevation at a tie position z_o is equal to the elevation of the subsiding tower base plus the original height of this tie.
- The ability for the tower structure itself at the tie levels to resist lateral displacement is insignificant.

By solving the two simultaneous nonlinear equations (Eq. 1), the coordinates, x_o and y_o, of each of the three ties can be determined when the new equilibrium of the tower structures is reached at a given time stage. A computer program was developed for solving the simultaneous nonlinear equations involved in this task. Using the program repeatedly, the coordinates for the three ties and the horizontal displacements (x-component, y-component and principal, Δx, Δy and ΔU) of these three ties relative to the tower base were determined and the results are shown in Figs. 6, 7 and 8, respectively. It is apparent that the upper part of the tower would displace with respect to its base more than the lower part.

Changes in Guy Wire Tensions

Using these determined coordinates of the ties and the anchors, the subsidence-induced strains in the guy wires on the tower base can be determined. In converting the subsidence-induced strain (Eq. 2) to the subsidence-induced tension, the stiffness (S) of each of the two types of the steel wire ropes should be determined based on the average value of 6-strand and 8-strand steel wire ropes as:

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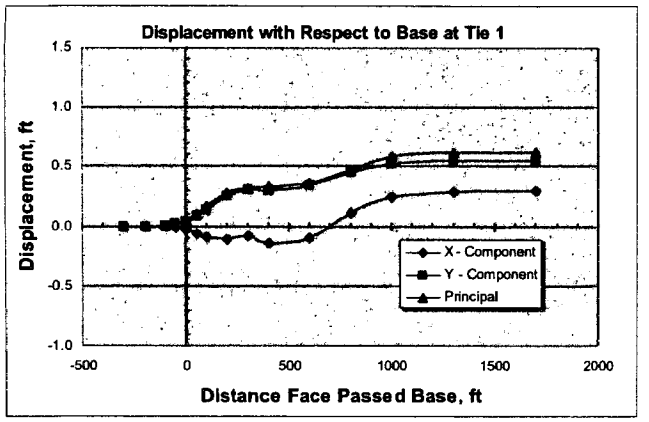

Fig. 6 Horizontal Displacements of Tie 1

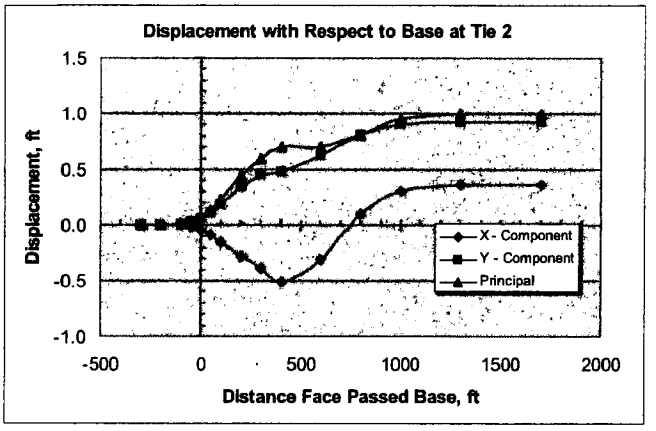

Fig. 7 Horizontal Displacements of Tie 2

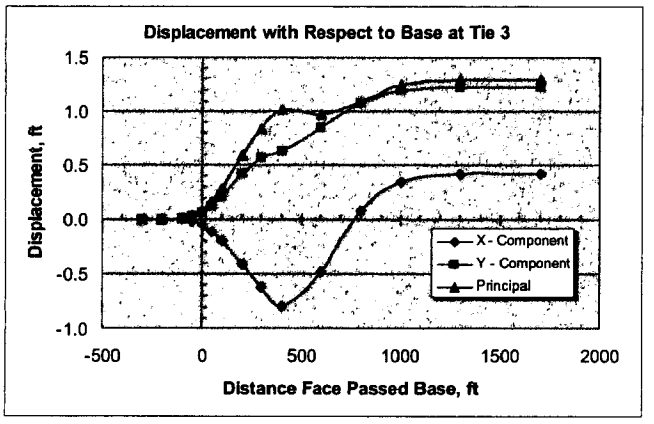

Fig. 8 Horizontal Displacements of Tie 3

$$S = 10x10^6 A \qquad \text{lbs} \qquad (3)$$

In Eq. 3, A is the cross-sectional area of the wire rope. The stiffness values used in the conversion are 1,104,466 and 1,503,301 lbs ft/ft for the 3/8" and 7/16" guy wires, respectively. The average tensions in the guy wires induced by the ground subsidence process associated with the longwall operation are plotted in Fig. 9. A positive value indicates that an additional tension has been induced in the guy wire by the subsidence process while a negative value shows that the existing tension in the guy wire observed before mining will be reduced. A negative force is only meaningful when its magnitude is smaller than the pre-mining tension in the guy wire. Figure 9 shows that tensions would develop in the guy wires when the longwall face is between 50 ft inby and 300 ft outby the tower base. The maximum subsidence-induced tension was about 780 lbs for guy wires tied to the level 3 of the tower when the longwall face is about 200 ft passed the tower base. Such additional tensions are smaller than the pre-mining tensions ranging from 1,250 to 1,975 lbs and are insignificant compared to the ultimate breaking strengths of the guy wires (10,600 lbs for 3/8" wire rope and 14,400 lbs for 7/16" wire rope). Therefore, the subsidence-induced tensions were incapable of causing breakage of the guy wires.

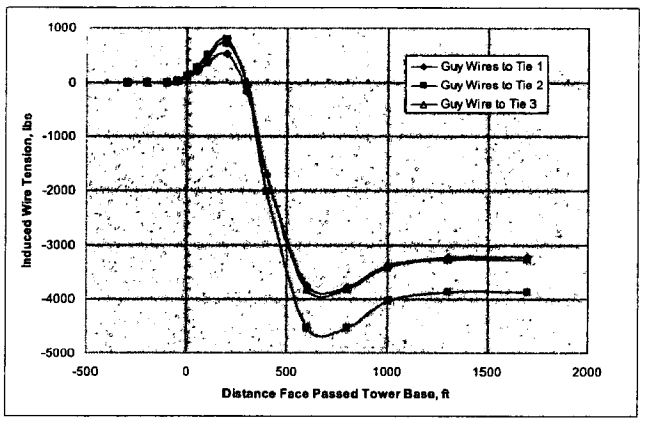

Fig. 9 Subsidence-Induced Tensions in the Guy Wires

However, after the longwall face has passed the tower base a distance 350 ft, the tensions in the guy wires become nonexistent (The magnitudes of the negative values are larger than the pre-mining wire tensions). Under such condition, the guy wires would slack and the tower would be no longer effectively restrained laterally by the guy wires within certain small range. The lack of effective lateral restraint makes it possible for the tower, especially its upper sections, to vibrate under strong gushing winds.

Additional Load to the Tower

The subsidence-induced tensions in the guy wires also induce additional loads to the tower structure, especially in the section near the tower base. The additional load in the lower section at a given time stage is the summation of the vertical components of the tensions in all of the guy wires. The calculations show that additional loads can be induced in the first half of the dynamic subsidence process until the longwall face has passed the tower base a distance of 350 ft. The maximum subsidence-induced load on the tower base would be 4,947 lbs when the face was 200 ft past the base. Such additional load was also insignificant compared to the weight of the steel tower structure and the load from the pre-mining wire tensions (about 12,000 lbs). Therefore, the subsidence-induced load to the tower base would not cause any structural integrity problems to the tower.

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Bending Curvature on the Tower

The differential lateral displacements between the base and the three ties would create a bending condition in the tow lattice structure. The calculation shows that the lower part of the tower was bent laterally more severely than the upper part. However, the maximum bending curvature, 5.5×10^{-5} 1/ft in the lower part when the longwall face was about 300 ft passed the tower base, was still insignificant for the tower steel lattice structure. Therefore, the bending developed on the tower structure would have no effect on its structural integrity.

Assessment of Structural Functionality

The assessment of subsidence influences on the functionality of the transmission tower is to assess whether the ground subsidence process is to disrupt or degrade the ability of the transmitters on the tower to relay phone signals to and from the transmission towers in the other two cities. Such ability could be potentially affected by: the blockage of the signal path, and (2) the incorrect alignment of the signal path. This section assesses the possibilities for such two potential problems to occur during and after the ground subsidence process.

Possibility of Signal Path Blockage

The cellular phone company was concerned with the vertical subsidence at the location of the tower base that would place the tower a few feet (2.9 ft as predicted and shown in Fig. 5) lower than its original elevation. It was thought that such lowering of tower elevation could make high obstacles (such as large trees) to intrude into the signal path between the transmission towers causing signal blockage.

However, it should be noted that the transmission tower was located on the top of one of the highest hills, if not the only highest hill, in a large area around and the transmitters were also located high above the ground on the tower. The ground subsidence process would not only lower the tower but also the surrounding surface area to certain extent. Therefore, the signal paths are impossible to be blocked by any local obstacles around this transmission tower.

Another fact was that the other two transmission towers were located about 23.5 miles (air distance) away from this transmission tower. The predicted 2.9 ft elevation lowering at this transmission tower would only change the signal path by a minor angle of 4.84 seconds. Such insignificant change in signal path would make it impossible for any obstacles located close to the other towers to intrude into the signal paths, either. Therefore, the possibility for the subsidence process to cause blockage of the signal paths was none.

Possibility of Misalignment of Signal Paths

During and after the subsidence process, some minor inclination and rotation will develop on the tower structure. Such inclination and rotation, if large enough, could affect the alignment of the signal paths between the transmitters. According to the cellular phone company, any inclination away from the vertical direction or rotation in the horizontal plane of the tower larger than one degree could affect the alignment of the signal paths.

Based on the determined coordinates and elevations of the tower base and the ties, the inclinations of the tower structures away from the vertical direction at each time stage were determined for each section and the entire height of the tower. The results include inclinations along x and y directions as well as the principal one. The principal inclination of the tower would increase as the dynamic subsidence process with the maximum being reached when the ground regains its stability. The maximum inclinations would be 0.59°, 0.36° and 0.35° for the lower, middle and top sections, respectively. The maximum inclination for the entire tower is about 0.43°.

The rotation of the tower structure is determined using the coordinates of the anchors and tie 2 because torque type tie at this level were designed to provide rotational restraint to the tower lattice structure. The maximum tower rotation, 0.56°, would occur when the dynamic subsidence process was over.

The analysis indicated that both the maximum inclination and the maximum rotation of the tower are smaller than their critical values. Therefore, the alignments of the signal paths would not be affected by the ground subsidence process associated with the longwall mining operation, either.

MITIGATION MEASURE AND RESULTS

Based on the analyses performed, it was concluded that the only possible problem is the vibration of the tower under strong gushing winds due to the lack of effective lateral restraint by the guy wires. Such condition would occur in the second half of the dynamic subsidence process starting at the time when the longwall face is 300 ft outby the tower base.

In order to prevent the condition for potential vibration from occurring, it was recommended that the tensions in the guy wires were to be monitored daily when the longwall face is between 0 and 1,000 ft past the tower base. Necessary adjustments should be made by loosening or tightening the turnbuckles (Fig. 3) on the guy wires near the anchor blocks to maintain the needed tension levels. During the time period when the face is between 300 and 750 ft passt the tower base, multiple adjustments should be made daily to compensate the anticipated large reduction of tensions in the guy wires. When making these adjustments, the plumbing of the lattice structure should be also checked to avoid over-adjustments.

Mining under the tower started in the early January, 2003. The recommended mitigation measure was implemented. The dynamic subsidence process in the area of the transmission tower was over by the end of that month. Despite severe winter weathers in the first two to three months of this year, the tower was successfully protected and no complaints about the phone services were made.

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CONCLUSIONS

This paper presents a case study where a telecommunication transmission tower was subsided by a longwall operation. The potential subsidence influences on the structure were carefully assessed based on the predicted surface movements in the dynamic subsidence process and the structural information of the tower using a systematic approach.

The assessment indicated that structural stability, integrity and functionality of this tower would not be significantly affected by the subsidence event. However, a vibration condition could develop in the second half of the dynamic subsidence process because of the slack of the guy wires.

Based on the assessment, a simple mitigation measure, monitoring and tension adjustment was recommended and implemented. The project was successful as evidenced by the continued quality service carried by this transmission tower.

REFERENCE

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Subsidence Prediction Influence Assessment and Damage Control

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ABSTRACT

An extensive subsidence research program conducted by the authors has greatly improved the accuracy and the capabilities of subsidence prediction under complicated mining and surface conditions. The techniques developed for assessing and mitigating subsidence influences on various surface structures have been applied in numerous cases with a very good record of success.

INTRODUCTION

Total extraction of a coal seam using longwall mining or room-and-pillar mining with pillar extraction tends to disturb the overburden strata and causes immediate surface subsidence. Depending on various factors, such subsidence events may or may not have the potential to cause problems to surface structures. Surface subsidence research conducted by the authors has demonstrated that in order to effectively and efficiently minimize the subsidence influences on surface structures, the following techniques should be applied systematically:

- *Methods for accurately predicting surface subsidence under varying mining and surface conditions.* Success in dealing with the issues of subsidence depends primarily on the accurate prediction of the magnitude, distribution and timing of surface subsidence. By studying the subsidence basins produced by different mining plans, the possible subsidence effects on surface structures can be greatly reduced.
- *Techniques for assessing the subsidence influences on surface structures.* The probability and severity of subsidence influences on a structure of interest need to be assessed before it is undermined. Due to the large differences in types, design, material and construction of the structures as well as variations of movements and deformations to be experienced by the structures, the different assessment techniques are required.
- *Techniques for mitigating subsidence influences.* If the assessment indicates that the subsidence influences on a structure exceed the structure's tolerable level in terms of its integrity, stability and functionality, proper mitigation techniques should be designed and implemented to reduce the subsidence influences on the structure.

This paper describe the efforts and results of a subsidence research program conducted by the authors.

SUBSIDENCE PREDICTION

Accurate prediction of surface subsidence caused by underground mining is required for assessment of the subsidence influences and is the basis for the design of effective and efficient mitigation measures. In the past a great majority of subsidence research have been concentrated on the prediction of final subsidence over a single longwall panel with a relatively flat surface. The prediction models produced by those researches have limited value for practical applications because of varying and complicated mining, geological and topographical conditions. In order to improve the prediction accuracy, the authors have collected more than 200 longwall subsidence cases all over the US coal fields through an intensive subsidence monitoring program and from various other sources. These data were used to continuously refine and improve a PC-based program package, CISPM (Comprehensive and Integrated Subsidence Prediction Model) developed previously by the authors (Peng and Luo, 1992). This program package has a unique and rich set of capabilities for meeting nearly all of the subsidence prediction requirements in underground coal mining employing high or total extraction methods in the US. It is very user-friendly requiring neither particular skills in computer operations nor in-depth knowledge of subsidence theory. It has been proven fairly accurate according to the feedback from its domestic and international users and according to our own

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subsidence monitoring data. The following important findings from our subsidence research program have been incorporated into the current version of CISPM program package:

- *Dynamic subsidence process associated with longwall mining operations.* As underground mining progresses, a surface point will experience a fairly complicated dynamic subsidence process before it becomes stable again. During the dynamic subsidence process, the magnitudes, natures and directions of the subsidence movements and deformations at the surface point change with time and their influences to structures are also time dependent. Very often the dynamic subsidence process plays a more important role in assessing and mitigating subsidence influences than final subsidence. Mathematical models have been developed to predict the entire dynamic subsidence process associated with longwall mining operations (Luo and Peng, 1992).
- *Final subsidence basin over a single and multiple longwall panels.* Most of the subsidence prediction methods have been developed for mining of a single panel only. They are unsuitable for the prediction of subsidence over multiple panels such as the longwall panels separated by chain pillar systems as normally practiced in the US. A mathematical model has been developed to predict the final subsidence basin over multiple longwall panels (Luo and Peng, 1990, 1991). This model is based on the finding that the convergence of the chain pillar systems between the longwall panels could contribute a very significant amount of subsidence in the area over and near the chain pillars.
- *Final subsidence caused by high extraction room-and-pillar mining method.* If the recovery ratio in a room-and-pillar panel is 70% or higher by partially or fully extracting the pillars in a room-and-pillar panel, immediate surface subsidence (versus the unpredictable subsidence events over low extraction room-and-pillar mines often seen as the abandoned mine subsidence) will be induced. The existing methods which have been derived from subsidence data collected over longwall panels are not suitable for subsidence prediction over high extraction room-and-pillar mines. Based on the available subsidence data collected over room-and-pillar panels, a method has been developed for the prediction of the final subsidence basin over high extraction room-and-pillar panels (Luo and Peng, 1993).
- *Studies of subsidence parameters.* The two basic components of a subsidence prediction method are the chosen mathematical models and the parameters involved in the mathematical model. The subsidence parameters often play a very important role in the prediction accuracy. However, the reported subsidence parameters often vary in very large ranges which are of little values in practical applications. Such large variations are often resulted from the use of inconsistent definitions of the subsidence parameters and inadequate determination methods. A great effort has been made in collecting subsidence data in the US coal fields, standardizing the definitions of and determining the subsidence parameters (Peng et al., 1995). Based on this study, the ranges of a number of commonly used final subsidence parameters have been greatly narrowed.

In additional to prediction of surface subsidence, tools are provided and self improvement mechanism is built in CISPM. They include data processing for subsidence survey, determination of subsidence parameters based on mining and geological information and deduction of parameters from collected subsidence data

Numerous field observations have demonstrated that complicated surface topography and steep surface slope in hilly regions have a profound impact on the ground subsidence process, often resulting in very different characteristics of subsidence basin from that on a relatively flat surface. Effort has been made to study the surface topography effects on ground subsidence process. A method has been developed for the prediction of final subsidence basin in hilly regions (Luo and Peng, 1990). Figure 1 shows a comparison of the calculated final horizontal displacement profiles with and without considerations of the surface topography. The surface elevation is also plotted at the top for reference. A much better agreement with the measured horizontal displacement in the steepest portion of the subsidence monument line has achieved when surface natural slope was considered. It should be noted that horizontal displacement often plays a much more important role in causing damages to surface structures than subsidence (i.e., vertical settlement).

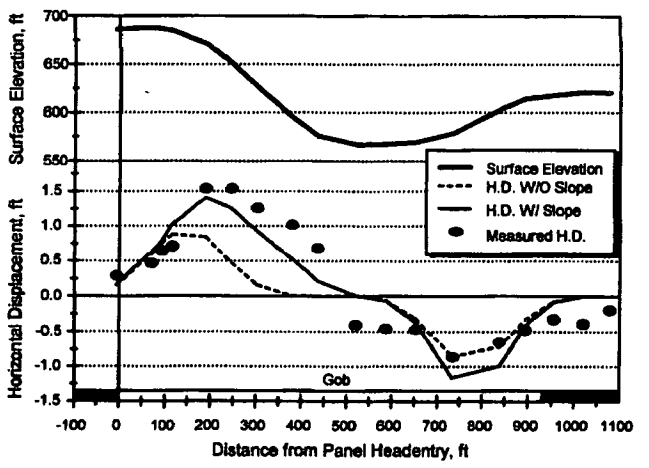

Fig. 1 Measured vs. calculated final horizontal displacement (H.D.) profiles along a cross-section over a longwall panel with relatively steep surface slope

TECHNIQUES FOR ASSESSMENT OF SUBSIDENCE INFLUENCES

Research emphasis has also been placed on monitoring the interaction between the subsiding surface and various surface structures. Based on the collected data, critical deformation values for various relatively simple structures have been

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established, techniques for assessing subsidence influences on those structures of large dimension and/or complexity have been developed.

A number of critical deformation values for typical residential structures (wood frame or brick super-structure on stone or concrete-block basement or foundation) in the northern Appalachian coal fields have been established. High surface tension and compression are generally responsible for cracks and buckling on the lower portion of the residential structures, respectively. High surface bending could causes problems to the super-structures such as sticky doors and windows, fissures on dry walls, peeling of old wall papers and paint. It is also found that a large tilting on floor could cause some inconveniences to the residents.

Ground cracks and bumps are caused by high surface tension and compression, respectively. Ground cracks as wide as 4 ft, though very rare, have been observed in certain locations over a few longwall panels. Generally ground cracks cause more problems (e.g., dewatering of surface streams or ponds) than the bumps. Criteria for initiating ground cracks on various ground surface have also been established.

For those structures of large dimensions and/or complicated design and construction, a more comprehensive and detailed assessment should be performed. However, due to the large variation of type, material, construction, dimension and functions of the structures, the techniques for assessing the subsidence influences on these types of structures vary considerably. Basic analysis should be performed to determine the nature and severity of the following three types of potential problems:

- *Structural integrity*: This is an indicator of mechanical failure of a structure of interest under the influence of subsidence. Ideally, the stress or strain field on the structures should be evaluated. The peak stress or strain are then compared to the permissible values of the structural material to determine the possibility of structural failure. For instance, a method has been proposed and successfully applied to assess the stress distribution on buried pipeline affected by subsidence (Peng and Luo, 1988). In cases where stress/strain fields are difficult or impossible to determine, the weakest components of the structure should be identified and empirical values are used to determine their integrity under the influence of surface subsidence.
- *Structural stability*: For those tall structures with small bases, the subsidence-induced slope could make them potentially unstable during or after subsidence process. Both the short and long term stability of the structure should be assessed. If the subsidence-induced slope could move the center of gravity of a structure out of its base, the structure is said to have lost its short-term stability. A structure loses its long-term stability if the strongest wind blowing in the direction of maximum slope caused by subsidence will be able to topple the structure.
- *Structural functionality*: The ability and level for the structures to perform their intended functions during and after subsidence may be affected by ground subsidence process. For example, subsidence could change the grade of a railroad well above its permissible grade. A conveyor belt could be rendered inoperable due to vertical and lateral alignment problems caused by the subsidence process.

The authors have applied the established criteria and the developed assessment techniques in various projects in assessing subsidence influences on various surface structures. Some examples of applying these assessment techniques are shown in Table 1.

TECHNIQUES FOR SUBSIDENCE MITIGATION

If the assessment indicates that a structure will be adversely affected, effective and efficient mitigation measures should be designed and implemented. The following three approaches can be used to design the mitigation measures: (1) reducing surface movements and deformations in the area of concern to an acceptable level by modifying the mining plan (e.g., leaving a support area under the structure), (2) reducing transmission of movements and deformations from ground to the structure of interest (e.g., trenching and plan-fitting), and (3) reinforcing the structure so that it can tolerate higher

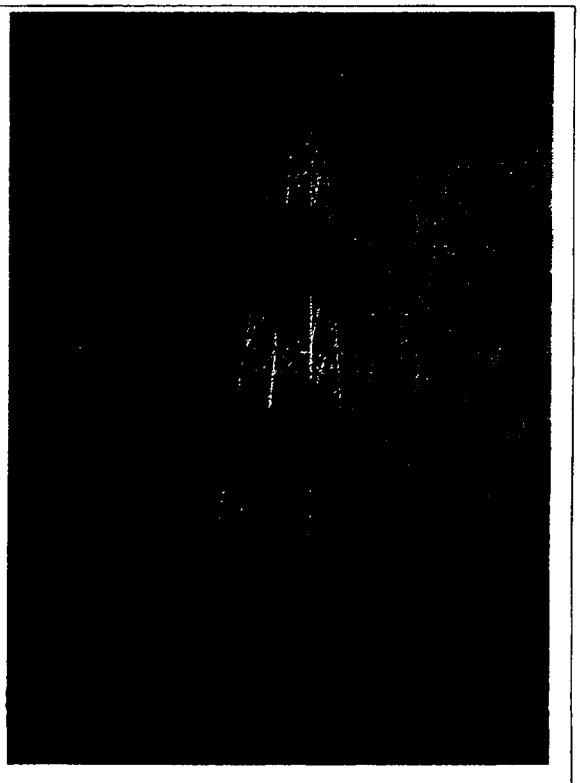

Fig. 2 This telecommunication transmission tower, about 200 ft tall, was located on a steep slope of a mountain peak. It was undermined by a longwall panel. In order to protect this tower, trench was dug around one of its legs and reinforcement beams were installed at the base. Despite of ground cracks observed nearby, there was no damage on thestructure and its service was kept open all time.

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Table 1 Some Examples of Subsidence Influence Assessments and Results

Structure or Feature	Descriptions	Major Concerns	Conculsions and Recommendations	Results
Residential Structures	More than 50 houses over or near longwall panels	Structural integrity and functionality	Verying damage potentials and mitigation measures recommended for about 30 structures	Accurate assessments and successful protection
Oil pipeline	Buried oil pipeline over 7 longwall panels	Structural integrity	Damage potential high. Mitigation measures recommended.	Feedback not available
Concrete water pipeline	Main transmission pipeline over 3 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures and alternatives recommended	Alternative plan adopted
Cast iron water pipeline	Two pipelines over 2 longwall panels	Structural integrity and functionality	Damage potential moderate. Mitigations recommended.	Not yet undermined
Steel water pipeline	Main water supply line over 4 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures recommended.	Protection successful
Plastic and steel gas pipeline	Low pressure distribution line over 3 longwall panels	Structural integrity and functionality	Damage potential for the steel pipe portions. Mitigation recomeended.	Mining in progress
Lake	A large lake over 11 planned longwall panels	Land area to be submerged by water after subsidence	About 400 acres of land will be submerged or ponded	Successfully undermined
Water ponds	2 water ponds over 2 longwall panels	Stream dewatering, potential underground mine workings flooding	Possibility of dewatering is low	Accurate assessment
Streams	3 streams over 7 longwall panels	Stream dewatering, potential underground mine workings flooding	Varying potential of stream dewatering	Accurate assessment
Mine refuse facility	Over 3 longwall panels with high embankment	Feasibility of longwall mining under	Support area recommended under the embankment, feasible to mine under pond	Successfully undermined
Mine refuse facility	Over 3 longwall panels previously mined	Feasibility of building the facility over the mined panels, long-term subsidence	Effects of long-term subsidence is very minor. Construction is feasible.	Feedback not available
Mine refuse facility	Over 3 planned longwall panels with very shallow overburden	Feasibility of longwall mining under	Safety questionable. Alternative mining plans suggested.	Not yet undermined
Railroad and bridge	A railroad over 4 longwall panels	Subsidence influences and operation safety	Influences could be strong. Monitoring and Mitigations recommended	Successfully protected
Power transmission system	3 towers (80 to 120 ft tall) and one substation over two longwall panels	Integrity, stability, functionality and operation safety	Anticipated structural problem on one tower and stability problem on another	Accurate assessment
Telecommunication transmission tower	200-ft tall tower located over a longwall panels (Fig. 2)	Integrity, stability, functionality	Strong influences. Mitigation measures recommeneded and implemented	Accurate assessment and successful protection
Highway and bridge	Highway across the end areas of 3 longwall panels	Subsidence influences	Very minor influence on highway. Questionable on bridge	Accurate assessment
Primary and secondary roads	Four roads over 8 lonwall panels	Subsidence influences	Varying degrees of influences. mitigations recommended for 2 roads	Accurate assessment

movements and deformations without being damaged (e.g., tension cable method). Mitigation measures for various structures affected by subsidence have been developed and tested in field conditions. Table 2 shows some of the structures that have been successfully protected with direct involvement of the authors.

Design of Support Area

By leaving an adequate area of coal unmined or partially mined under the structure to be protected, the surface movements and deformations in the area of the structure can be kept below the permissible level of the structure. The Pennsylvania method for designing support area is one example of applying this concept. However, the PA method over-designs the support area when mining depth is more than 350 ft. Based on a large number of collected longwall subsidence cases, a new method for designing support area has been proposed as shown in Fig. 3 (Peng and Luo, 1993) and successfully applied for two large structures (Table 2).

Mitigation Techniques for Residential Structures

A number of simple but effective mitigation measures have been frequently applied by the authors in protection of nearly 30 residential structures (Table 2). Among them, *com-*

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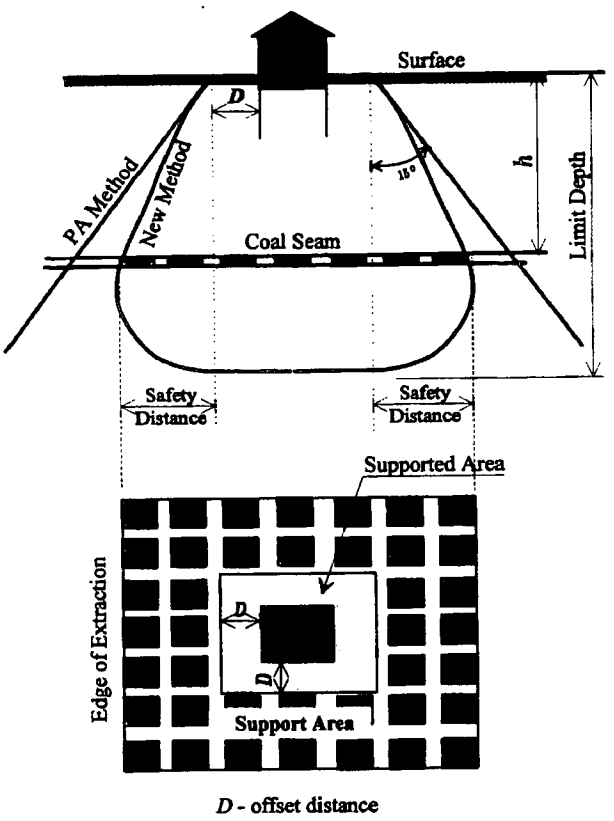

Fig. 3 A method to design support area for surface structure has been developed based on the analysis of a large number of longwall subsidence cases. The support area designed using this method is usually smaller than that using PA method

pensation trench method is used to absorb surface tension or compression that could be transmitted to the structure from its surrounding ground. This method has been proven effective to reduce problems on the structural parts that have direct contact with the subsiding ground, such as basement and foundations. *Plane-fitting method* is to protect the super-structure of a house from being damaged by the bending and twisting actions associated with subsidence process. During the implementation of this method, the house super-structure is placed on a time-dependent inclined plane so that the super-structure is free of stress while the required amount of adjustments are kept minimized. *Tension cable method* is used to strengthen the structures so that they can tolerate higher surface tension and bending. Figure 4 shows a brick house that were successfully protected using a compensation trench and two tension cables.

Mitigation Measures for Buried Pipelines

Ground subsidence process often has the potential to cause damages to buried pipelines. Assessments of subsidence influences on various buried pipelines have indicated that the strain transmitted from the surrounding soil to the pipeline is always the No. 1 source of stress on the pipeline (Luo et al., 1997). Therefore, reduction of the strain transmission is the most effective method in the protection of buried pipelines. Uncovering pipeline only in the sections where the estimated stress is higher than the permissible stress of the pipeline material can greatly reduce the pipeline stress contributed by the ground strain. Such partial uncovering method has been successfully applied in the protection of a 7,800-ft section of water supply pipeline undermined by four longwall panels (Table 2).

Mitigation Measures for Railroad

Ground subsidence is capable of causing serious problems to railroads if proper cautions are not taken. A partial

Table 2 Some Examples of Successfully Protected Structures

Structures Protected	Descriptions	Mitigation Measures Employed	Results	Monitoring Performed
Residential Structures	25 houses, 2 garages and 1 swimming pool over 19 longwall panels	plane-fitting, compensation trench, tension cable, external bracing	Very good rate of success. Figure 4 is one of the examples	Subsidence
Railroad	About 11,000 ft long over 4 longwall panels	Partial lifting	It was kept operating during subsidence. Great saving in material and labor costs	Subsidence
Railroad bridge	130 ft, three sections	A 440x510 ft² support area under the bridge	Bridge not affected at all	Subsidence
Water pipeline	About 7,800 ft long 12-inch steel pipeline over 4 longwall panels	Partial uncovering	Service has never been intrrupted	Subsidence, strain
Overland conveyor belt system	About 1,400 ft long erected between 16 and 50 ft above ground level with a 300-ton transfer tower over a longwall panel	Uncovering support bases, loosening bolts at the bases, lateral stabilization	Despite of large surface movement, it required only some minor repairs before being put into operation again	Subsidence, strain, tilting
Telecommunication transmission tower	About 200 ft high located on the top of high mountain and between two longwall panels	Compensation trench, strengthening tower base	Despite of ground cracks observed nearby, no damage observed on the structure and service not interrupted	Visual observation
Coal refuse disposal facility	Large slurry pond with an embankment nearly 200 ft high.	A 1,300x1,930 ft² support area under the embankment only	The integrity, stability and functionality of the facility not affected	Subsidence

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Fig. 4 This brick house was successfully protected by a compensation trench and two tension cables. The placements of the trench and cables and the required tension in the cables were determined by subsidence simulations.

lifting method has been developed. The original elevation profile of the railroad, the predicted final subsidence profile and the permissible railroad grade are considered in determining the required adjustment along the section of railroad to be affected. This method has been applied to protect a section of railroad about 11,000 ft long undermined by four longwall panels (Table 2). The maximum subsidence at the site was about 4.5 ft. Adjustment on the railroad was only recommended in some sections much shorter than the total length of the railroad affected by subsidence with the maximum adjustment being about 2.5 ft only. As a result of implementing the partial lifting method, the subsided and adjusted railroad was kept smooth for safe railroad operation while the required adjustment was kept to a minimum.

A CASE STUDY

This section shows a case of the protection of a railroad over a longwall panel. The longwall panel was 930 ft wide mining a coal seam of about 6.5 ft thick. The overburden depth at the site was about 680 ft. The layout of the railroad over the longwall panel is shown in Fig. 5. The predicted final subsidence at the site is also plotted in this figure with the maximum subsidence being about 4.2 ft which matched very well with the measurements. The elevation profile of this section of railroad before subsidence is shown in Fig. 6. Based on the predicted final subsidence, original elevation and the permissible grade of 0.7%, the final railroad profile requiring the minimum amount of vertical adjustment was determined before it was undermined. In preparation, a large proportion of the required amount of gravel to raise the railroad was shipped to the site and spread in the sections needing the most amount of adjustment. During the active subsidence period, the railroad was monitored and vertical adjustment was made accordingly. A temporary speed limit of 5 mph was also posted as a precaution. Figure 6 shows one set of recommended adjustment during the active subsidence period and the elevation profiles of the railroad before and after the implementation of the recommended adjustment. By implementing the recommended adjustment, the maximum railroad grade was reduced from about 1.0% to the permissible 0.7% (Fig. 7). The railroad service was never interrupted during the entire subsidence process. Figure 8 shows a fully loaded coal train was passing the section of subsiding and adjusted railroad.

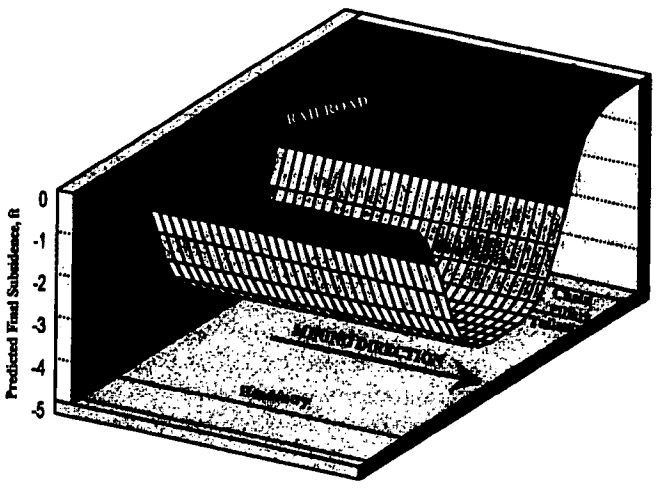

Fig. 5 Layout of the railroad over the longwall panel and predicted final surface subsidence at the site

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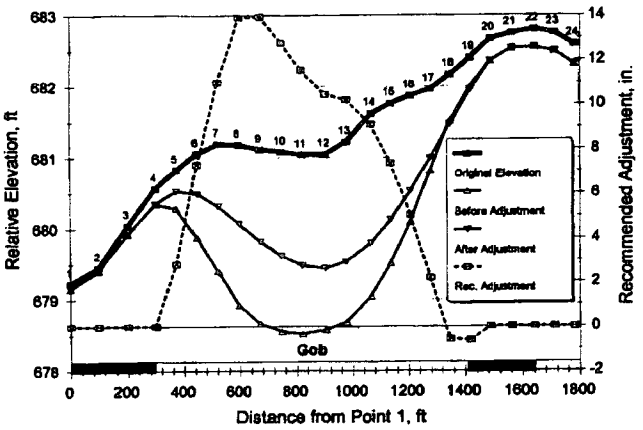

Fig. 6 Elevation profiles of the railroad and one set of recommended vertical adjustment during the active subsidence period. Using the partial lifting method, the required adjustment was kept to a minimum while the railroad was smooth.

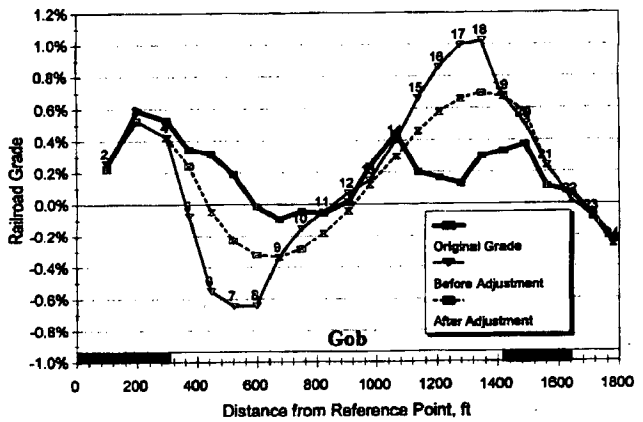

Fig. 7 Grade profiles of the subsiding railroad before and after implementing the recommended adjustement. The maximum grade of the adjusted railroad was kept within the permissible grade of 0.7%

SUMMARY

Subsidence prediction, influence assessment and damage control have come a long way. A systematic subsidence research program coupled with intensive field monitoring and extensive data collection during the past twenty years have produced vast amount of quality data and knowledge. Numerous case studies have demonstrated that using these research results, surface subsidence caused by full and high extraction mining methods and its effects can be predicted with confidence, and mitigation measures can be selected, designed and implemented successfully.

REFERENCES

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Fig. 8 This loaded coal train was passing through a section of subsiding railroad. The railroad was successfully protected using the partial lifting method.

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WILLIAM J. SIPLIVY, P.E., INC.

Geotechnical Engineer

17 August 2006

Melanie H. Murray, Civil and Environmental Engineer
American Energy Corporation
43521 Mayhugh Hill Road
Beallsville, OH 43716

Re: Report – Assessment and Mitigation of Subsidence Influences on Tower Structures Affected by Longwall Mining Operations, 12 September 2005, by Yi Luo, Ph.D, P.E., and Syd S. Peng, Ph.D.

Dear Melanie:

At your request, a review was made of referenced report. This report was submitted to the Ohio Department of Natural Resources, Division of Mines and Reclamation by American Energy Corporation in support of ARP: R-425-17.

In my opinion the report has been expertly prepared and is based upon currently accepted engineering principles regarding mine subsidence prediction and modeling analyses.

Please feel to call if there are any questions.

Sincerely,

William J. Siplivy, P.E., Inc.

William J. Siplivy, M.S., P.E., C.P.G.
President

STATE OF OHIO
WILLIAM
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AMERICAN ENERGY CORPORATION

43521 Mayhugh Hill Road • Twp. Hwy. 88 • Beallsville, OH 43716

PHONE: (740) 926-9152
FAX: (740) 926-9138

May 9, 2006

Treva Knasel
Division of Mines & Reclamation
1855 Fountain Square Court
Building H-3
Columbus, Ohio 43224-1383

Dear Treva:
Enclosed is the response to the ARP revision letter dated January 10, 2006 for #R-425-17.

1. In order to prevent subsidence damage to the water tank, AEC will place two steel tension cables on the concrete base. New ¾-inch cables will be used. The cables will be placed approximately 4 inches below the top surface of the concrete base and each cable will be tensioned to approximately four tons. The cables will be installed prior to the longwall being 200 feet from the tower, and released after the longwall is further than 1000 feet from the tower.
   AEC believes that AEC's rights supersede the rights of the telecommunication and power transmission companies. AEC will notify the telecommunication and power transmission companies prior to mining under the towers. AEC expects the communication and power transmission companies to mitigate for and monitor their structures.
2. The panel layout has been revised and submitted through a separate ARP.
3. As noted earlier, AEC believes that AEC's rights supersede the rights of the power transmission company, and that it is the responsibility of the power transmission company to mitigate and monitor their structures.
4. See the enclosed document. This seal page is to be attached to the report written by Dr. Yi Luo.

Sincerely,

Melanie Murray

Melanie Murray
Civil and Environmental Engineer

I attest that the methodology and findings presented in this report are based upon the currently accepted principles of mining engineering. Specifically, the subsidence prediction and modeling methods used in the report have been developed and calibrated through years of research and applications on similar structures.

Yi Luo, Ph.D., P.E.
Research Associate Professor
Department of Mining Engineering
College of Engineering and Mineral Resources
West Virginia University
Morgantown, WV 26506

Signature: _____ Date: *January 20, 2006*

__X__ New Submittal
_____ Revised Submittal R-

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND RECLAMATION

APPLICATION TO REVISE A COAL MINING PERMIT

Note: Refer to the Division's "General Guideline for Processing ARPs" and "Requirements for Specific Types of Common ARPs" for guidance on submitting and processing ARPs.

1. Applicant's Name American Energy Corporation

   Address 43521 Mayhugh Hill Road

   City Beallsville State OH Zip 43933

   Telephone Number 740 - 926 - 9152

2. Permit Number D-0425 .

3. Section of mining and reclamation plan to be revised:
   Part 3, Page 30, K (5) and (7)

4. Describe in detail the proposed revision and submit any necessary drawings, plans, maps, etc.:

   Submit a subsidence plan for the D-0425-5 permit

5. Describe in detail the reason for requesting the revision:

   To obtain permission to subside structures in the shadow area by submitting a report from Dr. Yi Luo.

6. Will this revision constitute a significant alteration from the mining and reclamation operations contemplated in the original permit? _____ Yes, __X__ No.
   (**Note:** refer to paragraph (E) (2) of 1501:13-04-06 of the Ohio Administrative Code to determine if a revision is deemed significant.)

   If "yes", complete the following items 7 through 9.

7. In the space below give the name and address of the newspaper in which the public notice is to be published.

8. In the space below give the text of the public notice that is to be published. (Include the information required by paragraph (A)(1) of 1501:13-05-01 of the Ohio Administrative Code.)

9. In the space below give the name and address of the public office where this application is to be filed for public viewing.

I, the undersigned, a responsible official of the applicant, do hereby verify the information contained in this revision request is true and correct to the best of my information and belief.

JAMES R TURNER, JR — 10-24-05

Print Name — Date

Signature — Title: TREASURER

Sworn before me and subscribed in my presence this 24th day of October, 2005

NOTARIAL SEAL STATE OF OHIO
BARBARA L. RUSH
NOTARY PUBLIC, STATE OF OHIO
MY COMMISSION EXPIRES 9-09-09

Barbara L. Rush
Notary Public

FOR DIVISION USE ONLY

This request is hereby _____.

Chief, Division of Mines and Reclamation — Date

Assessment and Mitigation of Subsidence Influences on Tower Structures Affected by Longwall Mining Operations

By

Yi Luo, *Ph.D., P.E., Research Associate Professor*
Syd S. Peng, *Ph.D., Professor and Chairman*
Department of Mining Engineering
West Virginia University

INTRODUCTION

In the new permit area of the American Energy Corporation's Century Mine (Permit application No.: D-0425-5), the planned longwall mining operations will be conducted under a number of municipal and industrial structures. These structures include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for telecommunications. The first author visited the sites on July 19, 2005 and obtained the necessary mine maps.

This report presents the methods for assessing and mitigating the potential subsidence influences on these tower structures caused by the planned longwall operations in the permit area.

SITE AND STRUCTURES

Surface and Mine Layout

Figure 1 shows the site where the main structures are located. The water tower and a larger communication tower are located on the top part of the figure while the smaller cell tower and the power transmission line are on the lower part of the figure. At the time of the site visit, the mining company has also considered to lay out the longwall panels in a different way to place some of the main structures (i.e., water towers, and guyed telecommunication towers) over the central portions of the longwall panels so that they will not subject to permanent surface deformations caused by the mining operations.

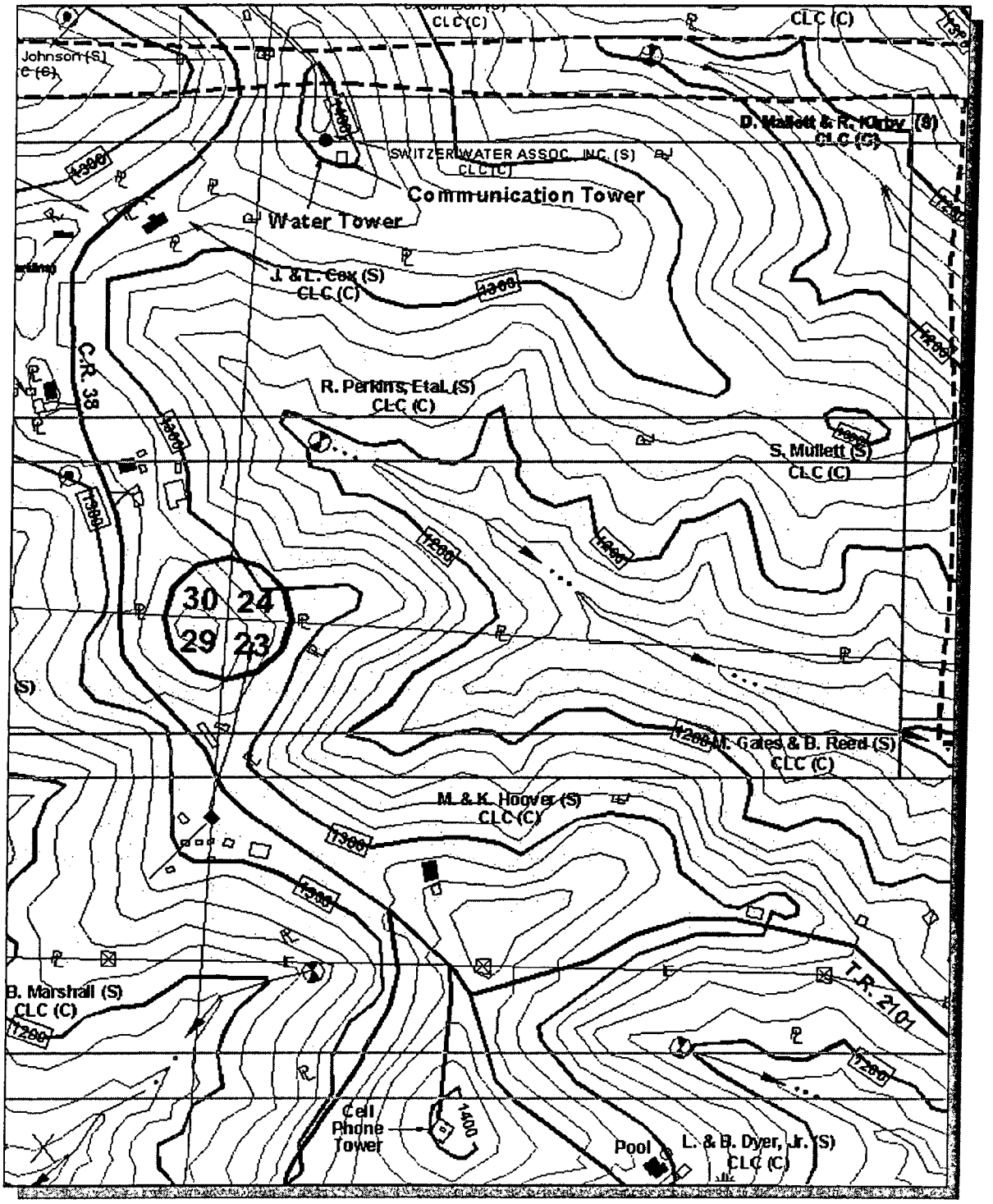

Fig. 1 Area with the Main Structures

The gentle hilly surface topography in the area is also shown in Fig. 1. The overburden depth at the locations of the tower structures ranges from 460 ft to 745 ft. The rib-to-rib width of the longwall panels is 920 and the width of the three-entry chain pillar system between adjacent longwall panels is about 140 ft.

Main Structures

The main structures in the permit area include: (1) one steel water tower, (2) 14 4-leg steel lattice towers for an electrical power transmission line, (3) two guyed steel towers for wireless telecommunications.

Figure 2 shows the water tower. It is located on the top of a gentle hill. The tower is a steel cylindrical structure sitting on a concrete base. The cylindrical tank is about 50 ft tall and 14 ft in diameter and has a holding capacity of 54,000 gallons. The concrete base under the tank is about 15 ft in diameter and between 3 and 4 ft thick (Fig. 3). The outer layer of the steel sheet that was used to construct the water tank is about 3/16" thick.

Figure 4 shows the larger communication tower. It is located a short distance away from the water tower on a gentle slope. The height of the tower is about 300 ft. The tower is a guyed steel lattice tower with the guy wires tied at five different levels on the tower. Three guy wires are used at each tie level. Therefore, guy wires permit the main tower structure to rotate in the horizontal plane to certain degree. The base on the tower (Fig. 5) is bolted to the concrete foundation with one bolt to allow horizontal rotation. The guy wires are tied to the ground at three anchor locations (Fig. 6) that are spaced 120° apart from the base. Pole type antennae are mounted on the top of the tower.

Figure 7 shows the small cell phone tower located on the top of another gentle hill. It is also a guyed steel tower and is about 150 ft high. The guy wires are tied to the main tower structures at three different levels. At the lower two levels, three guy wires are used at each tie level. On the top level, six guy wires, two on each direction, are used to restrict the horizontal rotation of the tower structure (Fig. 8). The base of the tower is the same of the larger tower. On the ground, three anchors are buried about 120° apart from the tower base. Four dish type antennae are mounted on the top of the tower and another dish antenna at middle level.

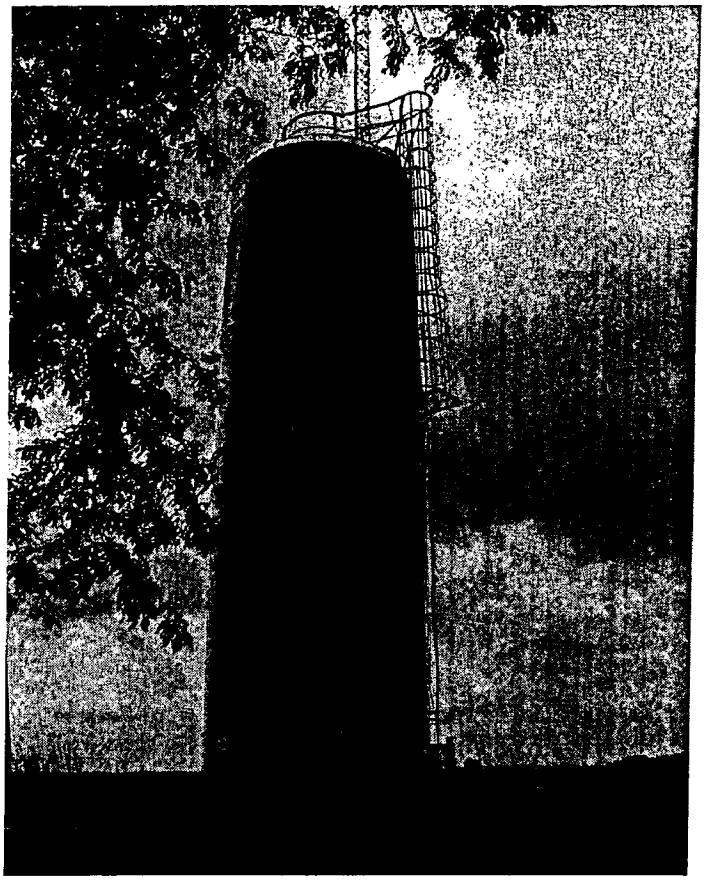

Fig. 2 Municipal Water Tower

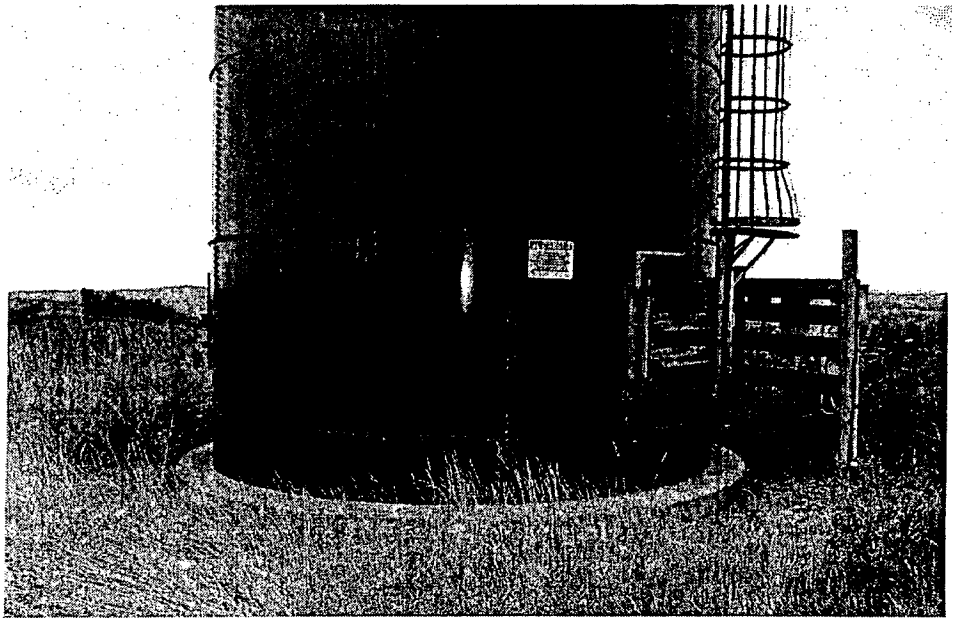

Fig. 3 Base of the Water Tower

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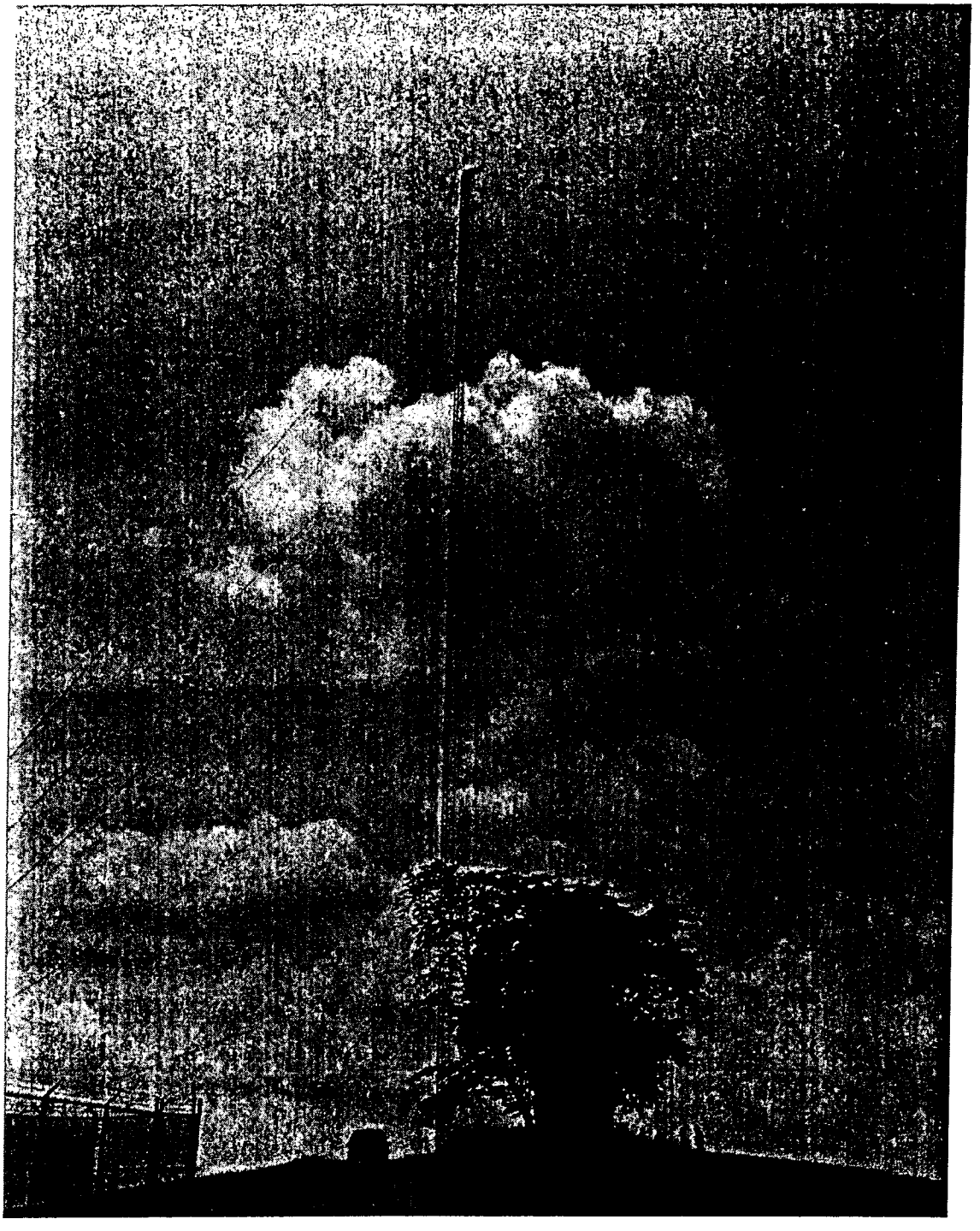

Fig. 3 Larger Communication Tower

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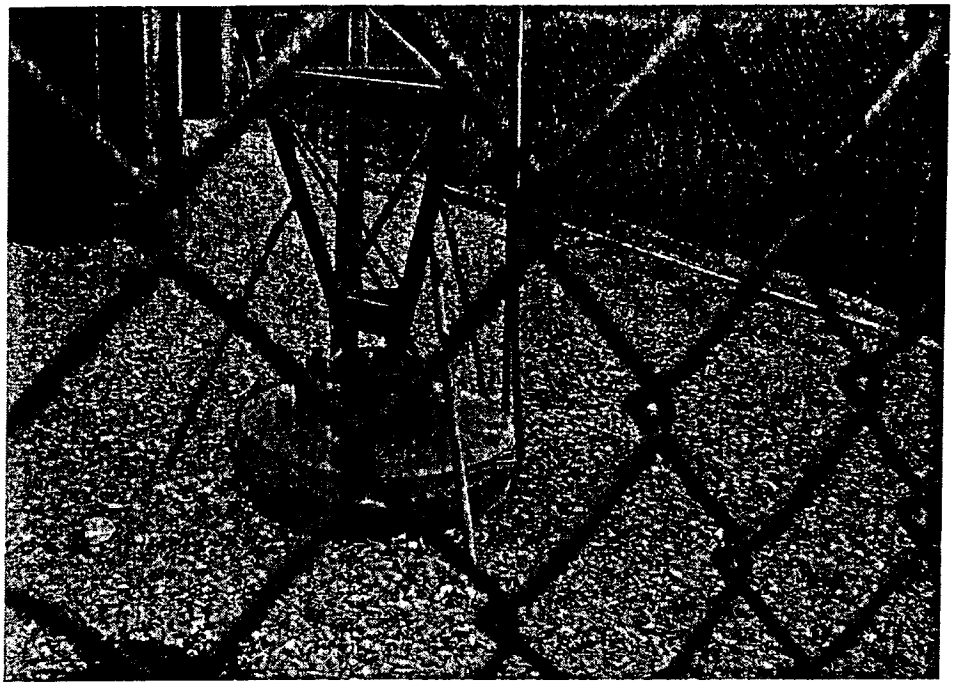

Fig. 5 Base of the Large Communication Tower

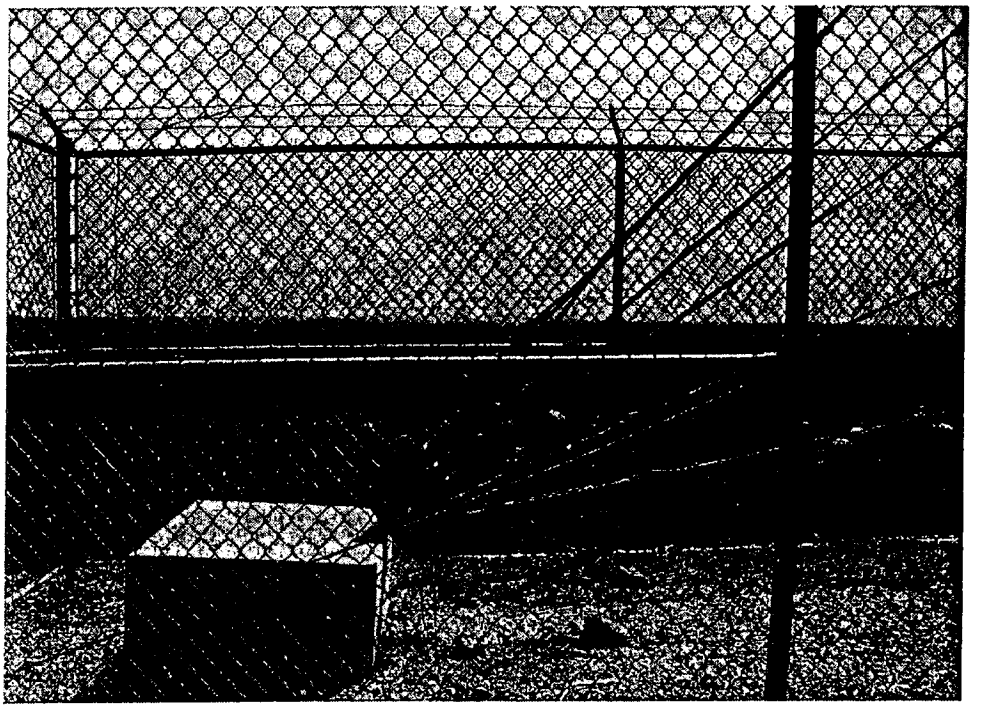

Fig. 6 One of the Three Anchors for the Large Communication Tower

Fig. 7 Small Cell Phone Tower

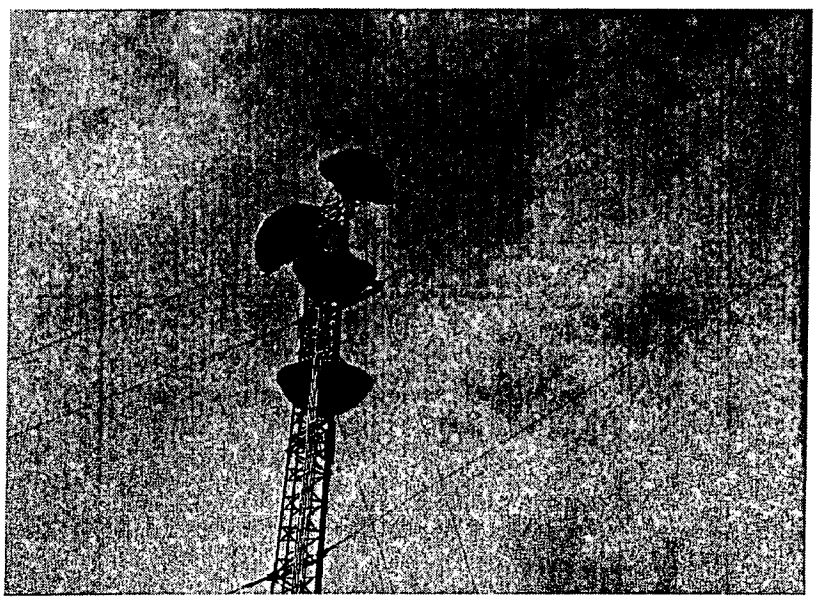

Fig. 8 Directional Control Guy Wires Tied at the Top Level

One of the power transmission towers is shown in Fig. 9. All 14 power tower share the same structural design. The steel lattice tower has four legs bolted to their concrete bases. The side distance is about 28.5 ft. The tower is about 75 ft tall and the transmission lines are hung at two levels. The main load-bearing members of the tower are made of 5-inch angle steels while smaller bars or angle steels are used for the other members. The lowest restrictive horizontal bars are located about 20 ft above the ground surface.

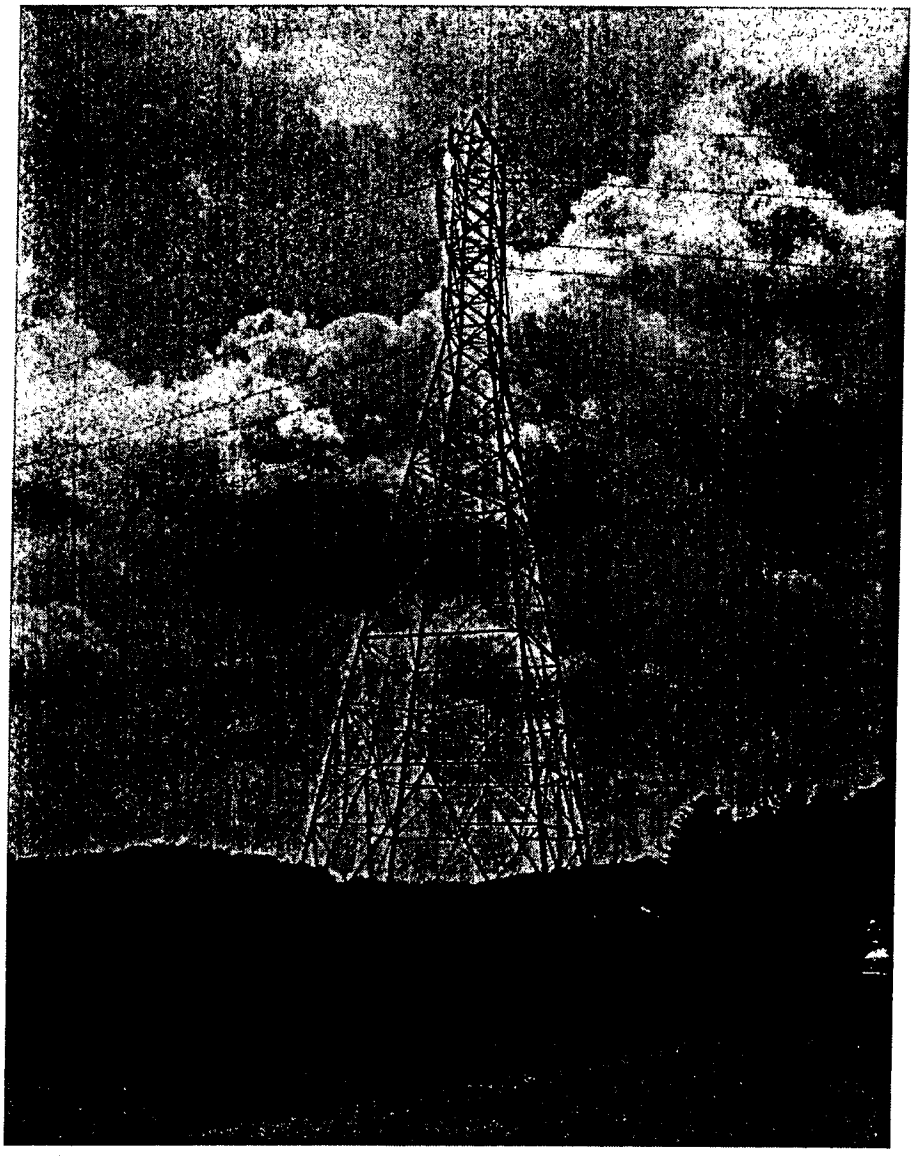

Fig. 9 Power Transmission Tower

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ASSESSMENT AND MITIGATION OF THE SUBSIDENCE INFLUENCES

In this section, the potential subsidence influences on the water tower has been assessed and the mitigation measure for it has been recommended. In assessing the potential subsidence influences, the structural integrity, stability and functionality of the structures should be assessed. For the two communication towers, the methods for assessing and mitigating the influences are mentioned. Surveys to locate the anchors should be performed before the detailed analysis can be performed. Among the 14 transmission towers, eight of them could experience subsidence influences. The subsidence influences could be dependent on many factors and should be assessed one by one.

Influences on and Mitigation Measures for Water Tower

In order to assess the potential subsidence influences to the water tower, the final and dynamic surface movements at the location of the tower have been predicted. The subsidence prediction program CISPM version 2.01 is used. The development of the prediction package is based on the influence function method that is widely adopted in the major mining countries including US coal mining industry and a large amount of collected subsidence data. Most of subsidence cases are collected over longwall panels mining in the Pittsburgh coal seam. This subsidence prediction program package has been successfully applied in various subsidence projects and proven accurate.

The overburden depth at the location is about 745 ft and the center of the tower is located 325 ft inside the panel edge according to the new panel layout. A mining height of 6.0 ft is used in the prediction. The predicted final subsidence profile across a longwall panel with the minimum (460 ft) and maximum (745 ft) overburden depths are plotted in Fig. 10. The location of the water tower, as well as the two guyed telecommunication towers, is also shown in the figure. It shows that the tower is located near the flat bottom portion of the final subsidence basin to be formed over the longwall panel and the predicted final subsidence at the center of the tower is about 3.43 ft. Since the water tower is located on the top of a high hill with its elevation much higher than its customers in the adjacent area. The reduction on water head due to mining subsidence (only about 7% of the tower height) will be too insignificant to reduce its ability for serving the cus-

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tomers. The predicted final surface slope, strain and curvature are 0.31%, -5.2×10^{-3} ft/ft (compression) and -6.4×10^{-5} 1/ft (concave). Due to its small foot size, the water tower is very unlikely to be affected by these final deformations.

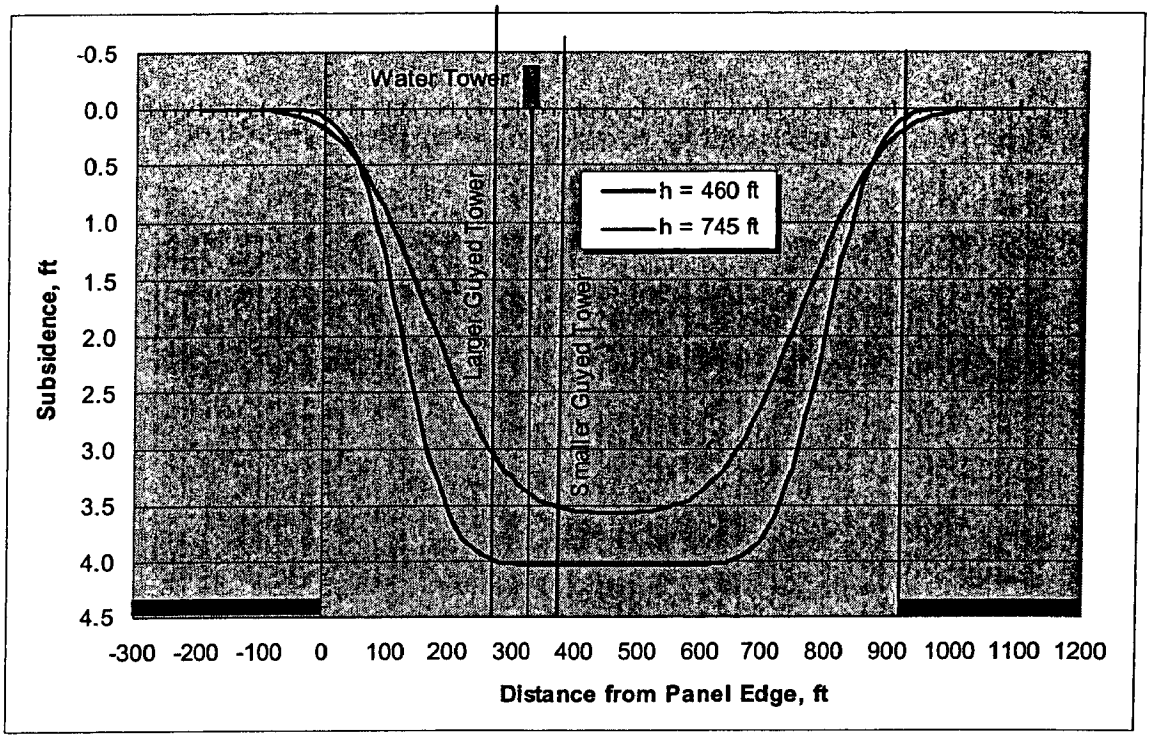

Fig. 10 Predicted Final Subsidence Along a Transverse Cross-section

Before the water tower finally settles down, it will experience a dynamic subsidence process. Figure 11 shows the predicted dynamic subsidence development curves at the location of the tower. Face advance rates in a large range of 20, 40, 60 and 80 ft/day have been used in the dynamic subsidence predictions. It shows the faster the face advances, the longer and gentler is the subsidence development curve. The tower is to experience the dynamic subsidence when the longwall face is about 50 ft inby and 700 ft outby the tower with the most active subsidence precess occurring when the longwall face is between 270 and 330 ft past the tower. Due to its small base and large height, the structural stability under the influence of dynamic subsidence process might be a concern. To assess the stability, the predicted dynamic slope development curves are shown in Fig. 12. The maximum dynamic slopes are 1.0%, 0.89%, 0.79% and 0.72% for the four ad-

vance rates used. Such small dynamic slopes are even barely noticeable without pri. These maximum slopes would occur when the longwall face has passed the center of the tower a distance between 250 and 290 ft. Even when the water tank is operated at full level as the worst case, the center of the gravity of the water tower is located about 25 ft above the ground surface. Using the predicted maximum dynamic slope of 1.0%, the center of gravity of the tilted tower will only move a horizontal distance of 0.25 ft (3 inches) away from its original base center. Compared to the 7-ft radius of the tower base, the relocation of the center of gravity of the tower is very insignificant (3.6%). Therefore, the stability of the water tower will not be affected by the dynamic subsidence process at all.

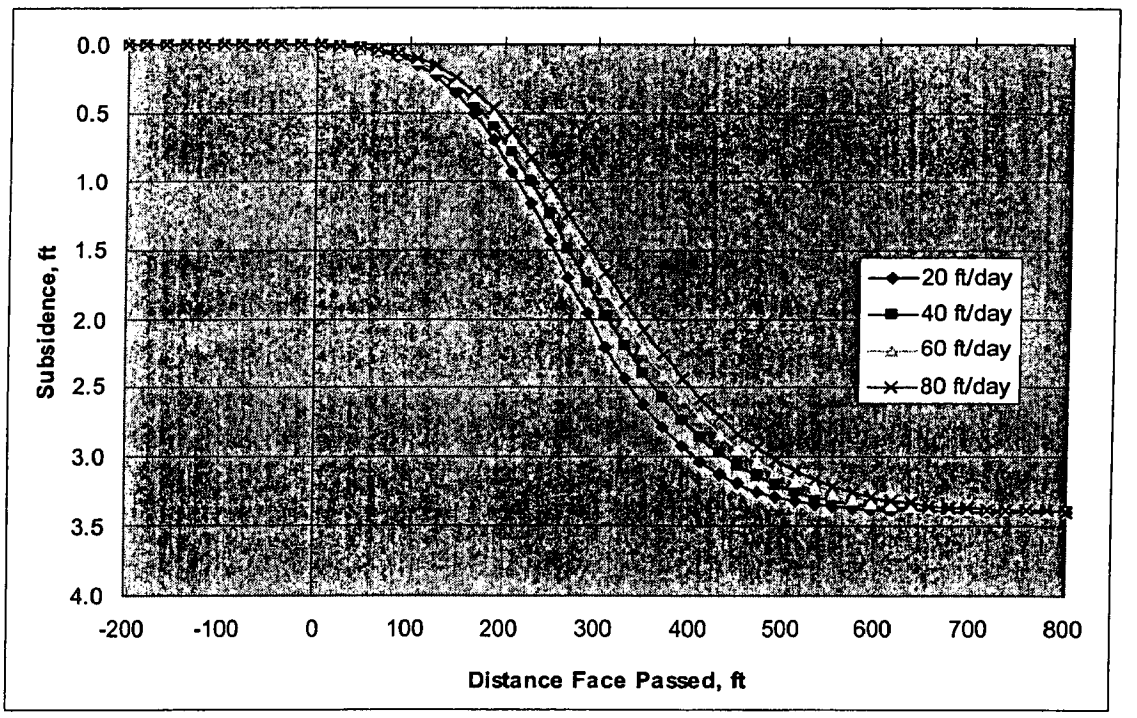

Fig. 11 Predicted Dynamic Subsidence Development Curves at the Water Tower with Various Face Advance Rates

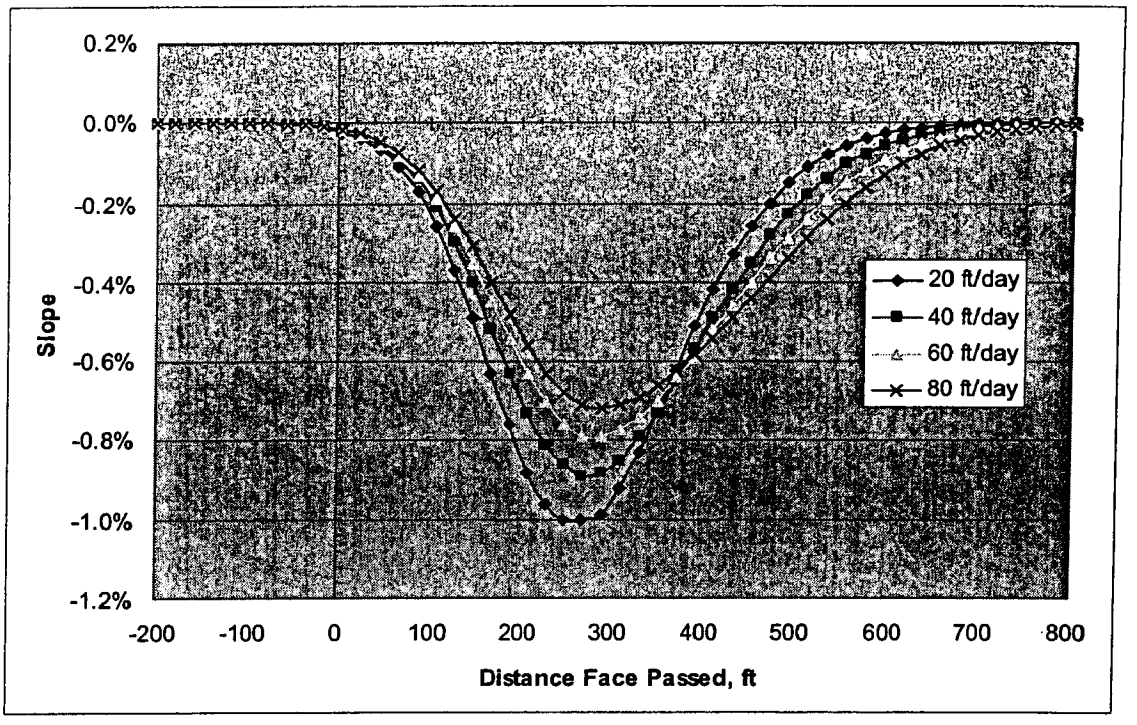

Fig. 12 Predicted Dynamic Slope Development Curves at the Water Tower

The predicted maximum dynamic tensile strains (not shown) for the ranges of face advance rates range from 3.46×10^{-3} to 5.51×10^{-3} ft/ft occurring at 165 ft behind the longwall face. The maximum dynamic tensile strain might be able to create some hair-line cracks on the concrete base of the water tower. The maximum dynamic convex curvatures will be in the range from 4.19×10^{-5} to 6.67×10^{-5} 1/ft, too small to cause any problems to the water tower structures.

In order to prevent the concrete base of the water tower from being cracked by the dynamic tensile strain, it is recommended to wrap the concrete base with two steel tension cables. New 3/4 –inch steel wire cables should be used. The cables should be placed about 4-inches below the top surface of the concrete base and each cable should be tensioned to 4-tons (8,000 lbs). The cables should be installed when the longwall face is still 200 ft to the tower and can be released after the face has passed the tower a distance of 1,000 ft.

Influences on and Mitigation Measures for the Telecommunication Towers

The locations of the two telecommunication towers with respect to the edges of the longwall panel are also plotted along with the predicted final subsidence profiles in Fig. 10. The smaller tower is located in the central and flat bottom portion of the subsidence basin with the final subsidence at its base being about 3.6 ft. The larger tower is located in the concave portion of the final subsidence basin and the final subsidence at its base is about 3.0 ft.

The assessment of subsidence influences on the guyed towers is much more complicated than that for the water tower. The authors have developed the assessment techniques and successfully applied them to one guyed tower that was similar to the two towers in this study and used for signal relay of cellular phone services. Based on the assessment, simple and inexpensive mitigation measures were recommended and mitigated. That tower was successfully protected and its services was never been affected despite of severe winter weather while mining was conducted under the tower. The publication (Luo et al, 2003) detailing the assessment techniques and mitigation measures is attached as an appendix. In assessing the influences, the following design and operating parameters of the towers are required:

- Coordinates and elevations of the tower base and ground anchors
- Elevations of the guy wire ties on the towers
- Sizes of guy wires
- Ranges of the tensions in the guy wires

We request these necessary design and operating parameters be provided before the detailed analyses on the potential subsidence influences on the guyed towers are performed. The predicted final and dynamic movements at the base and the anchors will be used in addition to other input information in assessing the subsidence influences on the guyed towers.

However, it is anticipated based on our past experience that the tensions in the guy wires could increase in the first half of the dynamic subsidence process and decrease in the second half of the process. If the guy wire tensions increase too much, they place a significant additional load on the lower members of the tower structure and potentially

leads to problems to the tower base, the guy wires and the anchors. If the guy wire tension decreases too much, it could cause slacking condition to the guy wires which reduces lateral restraints to the main tower structure. The significant differential ground movements in both vertical and horizontal directions at the tower base and ground anchors will also cause vertical and horizontal rotations that could lead functionality problems to the towers.

However, as mentioned previously, we have developed and successfully applied some mitigation measures for such guyed towers. The mitigation measures could include: (1) periodical monitoring the tensions in the guy wires (i.e., 2 to 3 times a day during the active dynamic subsidence period) and adjusting the tensions in the guy wires if needed, and (2) monitoring the plumb of the main tower structures from two orthogonal directions (i.e., parallel and perpendicular to the mining direction) and adjust the guy wires as needed. These mitigation measures are relatively simple and inexpensive to implement.

Influences on and Mitigation Measures for the Power Transmission Towers

The 14 power transmission towers are located over two longwall panels according to the latest mine layout. Among them, three are located beyond the panel setup entries or recovery lines expecting no or very minor subsidence influences. Eight towers are located over or near the chain pillar system between two adjacent longwall panels. These towers are to experience a small amount of final subsidence but some of them may be subject to high final tensile strains. The remaining three power towers are located in the "central" portion of one longwall panel and expecting to experience strong dynamic subsidence process. Therefore, the power transmission towers located over the chain pillars system and within the panel edges may be affected by the proposal longwall mining operations. The severity of the potential subsidence influences to each of the tower could be different depends on their relative locations to the longwall panels, surface topography, the design and construction of the towers, etc. At the time of this writing, the design information of the power towers have not been provided for us to performed detailed analyses.

However, it should be noted that the authors have previously performed assessments on the subsidence effects and monitored the stress on a number of power transmis-

sion towers similar to the ones in this permit area. That study found that the longwall subsidence process would have very little effects on the stability even when the lateral load by the strongest wind was applied on the subsided tower. That study also considered the additional tension or sagging conditions when two adjacent towers are subject to differential lateral movements and slopes during and after the subsidence process. It was found that such additional tension was insignificant to affect the power transmission lines. However, the differential movements, especially differential horizontal displacements, among the legs of each tower could cause bending and twisting to the steel members at the lower level.

In another study, the authors studied a very important and large 4-leg telecommunication tower located on the top of a very steep mountain peak (Luo and Peng, 1997). The tower was responsible for sending and receiving signals to telecommunication satellite for a national telephone company. It experienced two subsidence processes when two adjacent longwall panels were mined. The analyses on the stability, functionality and structural integrity were performed. It was found that the differential movements at the legs could cause problems to the lower parts of the tower. In order to reduce the severity of the anticipated subsidence influences, mitigation measures, including a compensation trench and bracing methods, were recommended and implemented for this tower. The mitigation was very successful. No damages were found on the tower structure despite that ground cracks were observed nearby. The services were never been interrupted. Based on the experiences with 4-leg towers, we believe that the same or similar mitigation measures can be applied in protecting these power transmission towers. In order to perform detailed analyses of the structures, design information from the power company is needed.

CONCLUSIONS

A preliminary study has been performed for three types of tower structures located in an area where the mining permit is in application process. It is concluded that among the three types of the structures:

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1. The stability and functionality of the water tower would not be affected by the dynamic subsidence process according to the new mine layout. The dynamic strain could cause some minor cracks on the concrete base of the tower but the anticipated problem can be controlled using tension cable method.
2. The potential subsidence influences on the two guyed telecommunication towers can be assessed using the techniques developed by the authors. Based on our previous experience, relatively simple and inexpensive mitigation measures can be applied to protect these two structures.
3. The subsidence influences on 4-leg steel towers for electrical power transmission can be assessed and mitigated using proven techniques.

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Luo, Y., S.S. Peng and B. Miller, 2003, "Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study," *Proc. 22nd Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, C. Mark and A.W. Khair, pp. 360-366.

AEC 06100

APPENDICES

Two publications by the authors
on assessing and mitigating subsidence influences
on tower structures.

AEC 06101

22nd International Conference on Ground Control in Mining

Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study

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ABSTRACT

The potential influences of mining subsidence on structural stability, integrity and functionality of guyed tower structures have not been systematically studied before. This paper presents a case study where a guyed steel tower of a telecommunication company was mined under by a longwall operation. Prior to mining, every aspect of the subsidence influences to this structure was studied. The pre-mining assessment indicated that the structure could experience vibration problem in the second half of the dynamic subsidence process. Based on the study, a simple mitigation measure was recommended and implemented and the structure was successfully protected.

INTRODUCTION

Guyed tower structures have been frequently employed to elevate objects (e.g., radio or TV transmitters, wind turbines, etc.) high above ground surface because of their low construction cost and great stability. A guyed steel tower is consisted of a tall and slim steel lattice structure restrained laterally by a number of steel guy wires from different directions.

Mining in a longwall panel with a fairly large overburden was conducted under a guyed steel tower used for wireless phone service. Assessment of the influences of the subsidence process on this structure has been performed using the methods developed in this study prior to the longwall mining operation. The assessment concluded that the stability, integrity and functionality of this tower structure would not be affected by the subsidence process. However, the lateral restraint to the steel tower by the guy wires would be reduced, possibly causing vibration of the structure under gusty wind conditions, in the second half of the dynamic subsidence process. The only mitigation measure for this tower was to monitor and to maintain proper tensions on the guy wires. The structure was successfully protected and its services had never been affected.

This paper presents the methods for assessing the subsidence influences on the guyed tower at various stages of the subsidence process.

LONGWALL PANEL AND TOWER STRUCTURE

The portion of the longwall panel over which the transmission tower is located is shown in Fig. 1. The longwall panel was 874 ft wide (rib-to-rib) and the mining height in the Pittsburgh coal seam is between 6.5 and 7.0 ft. The base of the tower is located near the central portion of the longwall panel. The tower sits in a flat area on the top of a steep hill. The overburden depth at the tower base is about 1,017 ft.

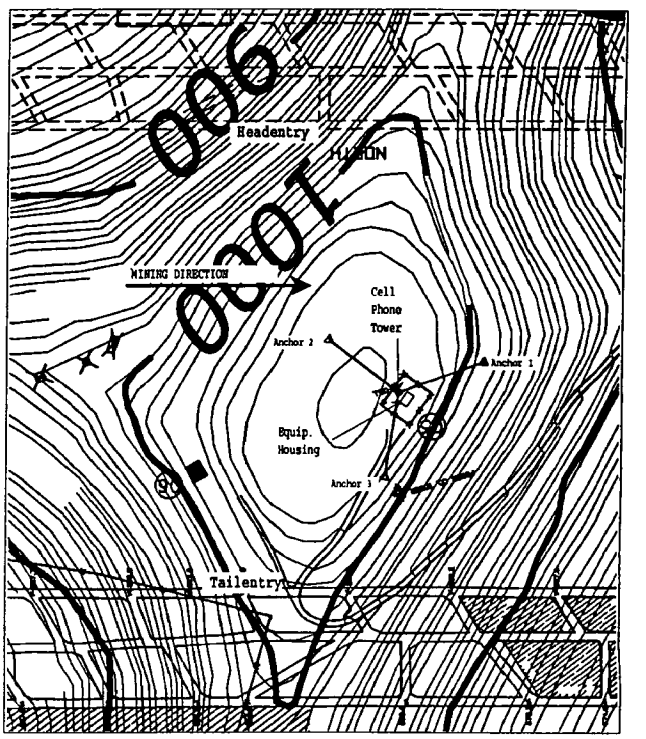

Fig. 1 Overview of the Site

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The tower (Fig. 2), belonging to one of largest wireless phone companies in the nation, serves as a relay station to transmit cellular phone signals between two similar towers located more than 20 miles away in the tri-city area in the northern West Virginia and southwestern Pennsylvania. The steel lattice tower is about 180 ft tall and laterally restrained by 12 steel guy wires. These guy wires are installed in three vertical planes that are separated from each other by about a 120° horizontal angle. Along each plane, the lower ends of the four wires are tied to a concrete anchor block (Fig. 3) and the upper ends are tied to the tower at three different levels. The turnbuckle on each guy wire makes it possible to make necessary adjustment for regular maintenance. The anchors were located about 160 ft away from the tower base. The concrete anchor blocks, 2' (H) x 3' (W) x 7'-6" (L), were buried about 6 ft below the ground surface.

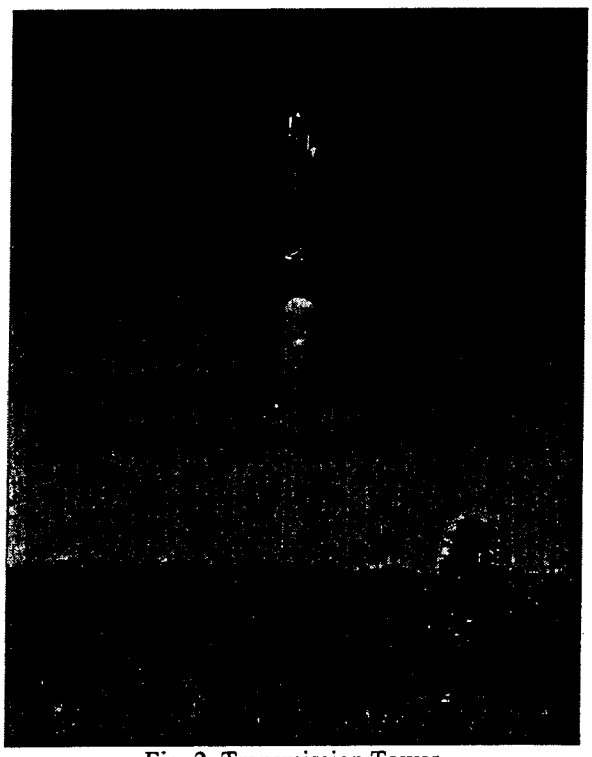

Fig. 2 Transmission Tower

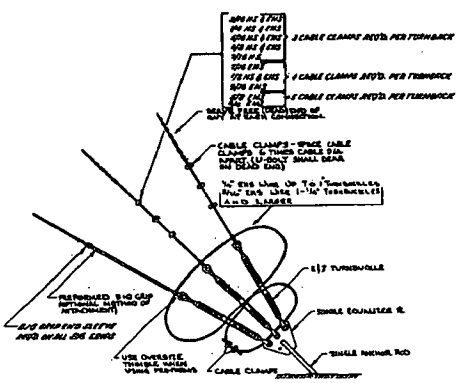

Fig. 3 Method to Tie the Guy Wires to the Anchor Block

Table 1 shows the pre-mining coordinates and elevations of the points of interest on the tower structure (i.e., base, anchors and ties). A local coordinate system is used for the structure. The datum of the elevation of the local coordinate system is set at the base of the tower ($z = 0$ ft at the base). It should be noted that the anchors are not on the same elevation as the tower base. The x-direction of the coordinate system follows the mining direction with $x = 0$ at the tower base. The y-axis points from the panel tailentry to the headentry with $y = 0$ at the panel tailentry.

Table 1 Local Coordinates of the Tower Base and Anchors

Point of Interest	x	y	z*
Base (0)	0	369	0
Anchor 1	149	427	-12
Anchor 2	-123	469	-6
Anchor 3	-23	215	-1
Tie 1	0	369	60
Tie 2	0	369	123
Tie 3	0	369	173

* elevations are expressed in relation to tower base

The tower super-structure is tied to its foundation with one steel bolt (ϕ =15/16"). The reinforced concrete foundation is constructed in two sections. The lower section is a square one with side length being 4'-6" and the thickness being 1'-6". The upper section is cylindrical with its diameter and height being 2 and 4 ft, respectively. The foundation is buried with only the top 6 inches being exposed above the ground surface.

In each of the three guy wire planes, one guy wire (ϕ = 3/8") is used at the lower level located about 60 ft above the tower base (referred as Tie 1). Two guy wires (ϕ = 7/16") are tied to the tower at the middle level (123 ft above the tower base) to resist the possible rotation of the tower structure (Tie 2). The top of the tower is tied with one guy wire (ϕ = 7/16") at the elevation of 173 ft above the tower base (Tie 3). At lower and top tie levels, breast type of ties are used to provide lateral restrain to the tower only while the middle tie is a torque type to provide both lateral and rotational restrains to the tower as shown in Fig. 4. The guy wires have been pre-tensioned with the tensions ranging from 1,250 lbs at the lower level to 1,975 lbs at the top level.

SUBSIDENCE PREDICTION

In order to assess the potential subsidence influence on the tower structures, dynamic subsidence prediction is performed at four surface points of interest, the tower base and the three anchors, using the subsidence prediction program CISPM version 2.01 (Peng and Luo, 1992). Mining height of 7.0 ft and an advance rate of 80 ft/day were used in the predictions.

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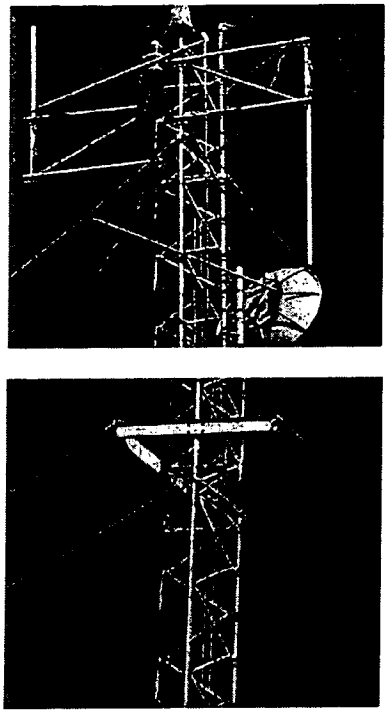

Fig. 4 Breast Type (Top) and Torque Type (Bottom) Ties

The predictions was performed at different time stages ranging from when the longwall face was from 300 ft inby to 1,700 ft outby the tower base. These time stages are chosen to cover the entire active dynamic subsidence process. The prediction for the last time stage (i.e., the face has passed the tower base for a distance of 1,700 ft) should be considered as the final subsidence. The predicted surface subsidence (S) and the two components of horizontal displacement (U_x and U_y along the x and y directions, respectively) at these specified time stages are plotted in Figs. 5, 6 and 7, respectively.

Figure 5 shows the predicted subsidence development curves at the tower base and anchors. Insignificant amount of subsidence would be experienced by the tower structures when the longwall face was directly under the tower base. The subsidence process would be most active when the face was between 300 and 400 ft passed the tower base. The ground begin to regain stability after the face has passed the tower base a distance of 1,000 ft. The final prediction shows that anchor 1 will subside the most (3.06 ft) while anchor 3 the least (1.62 ft). There is no significant differential subsidence among the base, anchors 1 and 2 after the subsidence process is over.

The predicted development curves of horizontal displacements along the mining direction are plotted in Fig. 6. The negative values shown in the figure indicate that the movements were against the mining direction. The maximum movements along the mining direction ranged from 0.43 to 0.54 ft when the longwall face was between 300 and 700 ft passed the tower base.

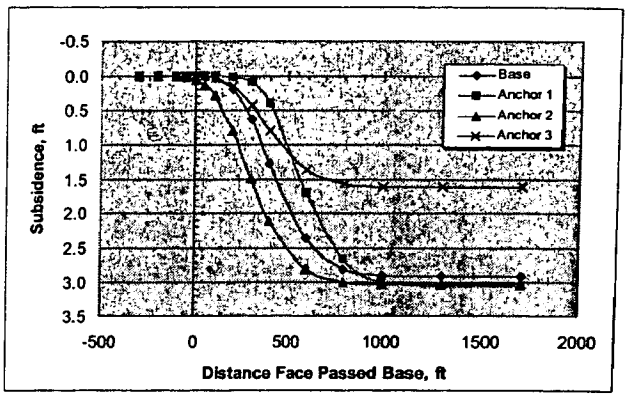

Fig. 5 Predicted Dynamic Subsidence

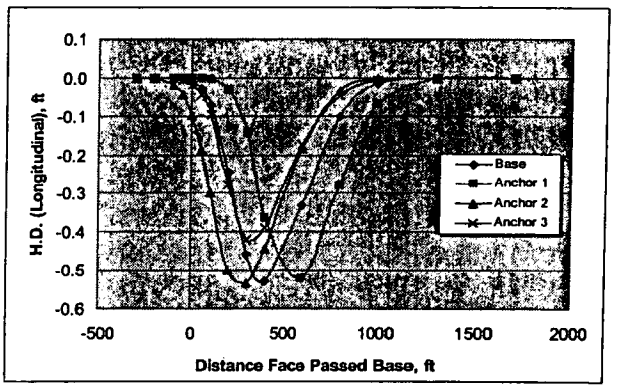

Fig. 6 Predicted Dynamic Horizontal Displacement Along Mining Direction

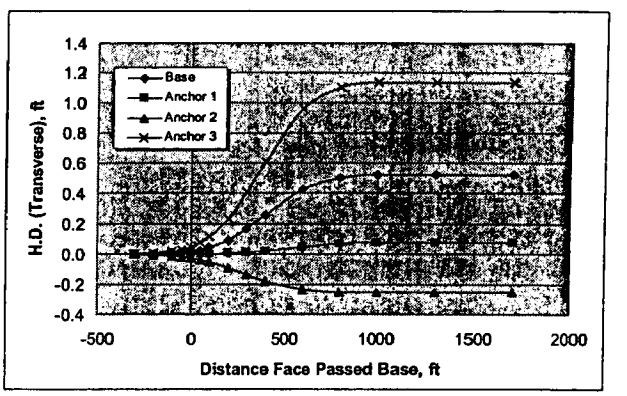

Fig. 7 Predicted Dynamic Horizontal Displacement Along Panel Transverse Direction

The predicted development curves of horizontal displacements along the panel transverse direction are plotted in Fig. 7. A positive value indicates movement from the panel tailentry to headentry. It shows that the base and anchors 1 and 3 would move toward the panel headentry side while anchor 2 would move toward the panel tailentry side. Among these four points, anchor 3 will have the largest movement (1.15 ft) while anchor 1 will have the least movement (0.07 ft) when the subsidence process is over.

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ASSESSMENT OF SUBSIDENCE INFLUENCES

Based on the predicted dynamic surface movements at the tower base and three anchors as well as the structural characteristics of the tower, the movements and deformations of the tower structure can be determined. Subsequently, the following three aspects of potential influences that the ground subsidence process could cause to the tower structures can be assessed.

- *Structural stability*: Since the tower structure is tall and sits on the hill top, its stability during and after the subsidence process was a concern.
- *Structural integrity*: The subsidence process could induce some additional forces on various parts of the tower structures. If strong enough, these forces could cause structural damages to some of the structural parts.
- *Functionality*: If the tilting and rotation of the transmission tower induced by the subsidence process exceed certain critical values, they could cause blockage and alignment problems to the paths of the signal transmission resulting in disruption or degradation of the cellular phone services.

Assessment of Structural Stability

Stability analysis is normally required for tall structure with small bases such as transmission tower to assess the potential for the structure to be toppled by external lateral forces. Because of their designs, the guyed towers are a type of very stable tower structures that can sustain high winds, earthquakes and extreme weather. The stability of the guyed tower could only be jeopardized when some of the guy wires, especially those tied to the upper levels of the towers, break under some extreme forces. The determination of the subsidence-induced forces in the guy wires to be induced for this case is presented in the next section. That analysis indicated that the subsidence-induced tensions in the guy wires were insignificant compared to pretensions in these wires and to their ultimate breaking loads of the steel cables. Therefore, the ground subsidence process associated with the longwall mining operation will not affect the stability of this particular transmission tower.

Assessment of Structural Integrity

As the ground subsides, the relative spatial locations of the tower base and the anchors, the ground-contacting points of the guyed tower structure, will change. Such changes in elevations and coordinates of these ground-contacting points could induce additional tensions or slacking condition in the guy wires and additional loads in the tower structure.

Determination of Tower Equilibrium State

In determining the subsidence-induced tensions and loads, the predicted dynamic surface movements at the tower base and the anchors at a time stage are imposed on their respective original coordinates and elevations listed in Table 1. The most important task is to determine the coordinates of the ties on the tower when a new equilibrium is developed in the tower structure for that time stage. Since the guy wires tied to each of the three ties on the tower are of the same size (3/8" for wires connected to tie 1, and 7/16" to ties 2 and 3), the following conditions should be satisfied when a new equilibrium at each tie position is reached.

$$\begin{cases} \sum_{i=1}^{3} \varepsilon_i \cos\beta_i \cos\alpha_i = 0 \\ \sum_{i=1}^{3} \varepsilon_i \sin\beta_i \cos\alpha_i = 0 \end{cases} \quad (1)$$

In Equation 1, ε_i is the subsidence-induced strain developed in the guy wire connected between anchor i and the tie of interest. The horizontal angle between this guy wire and the mining direction is β_i while the slope angle is expressed as α_i. The subsidence-induced strain in this guy wire is determined as:

$$\varepsilon_i = \frac{\sqrt{(x_i - x_o)^2 + (y_i - y_o)^2 + (z_i - z_o)^2} - L_o}{L_o} \quad (2)$$

In equation 2, x_i, y_i, and z_i are the coordinates and elevation of ground anchor i at a given time stage. The coordinates and elevation at a given tie on the tower are x_o, y_o, and z_o. The original length of the guy wire is L_o. In setting up equations 1 and 2, the following two reasonable assumptions are made:

- The vertical deformation of the tower structure is insignificant. Therefore, the new elevation at a tie position z_o is equal to the elevation of the subsiding tower base plus the original height of this tie.
- The ability for the tower structure itself at the tie levels to resist lateral displacement is insignificant.

By solving the two simultaneous nonlinear equations (Eq. 1), the coordinates, x_o and y_o, of each of the three ties can be determined when the new equilibrium of the tower structures is reached at a given time stage. A computer program was developed for solving the simultaneous nonlinear equations involved in this task. Using the program repeatedly, the coordinates for the three ties and the horizontal displacements (x-component, y-component and principal, Δx, Δy and ΔU) of these three ties relative to the tower base were determined and the results are shown in Figs. 6, 7 and 8, respectively. It is apparent that the upper part of the tower would displace with respect to its base more than the lower part.

Changes in Guy Wire Tensions

Using these determined coordinates of the ties and the anchors, the subsidence-induced strains in the guy wires on the tower base can be determined. In converting the subsidence-induced strain (Eq. 2) to the subsidence-induced tension, the stiffness (S) of each of the two types of the steel wire ropes should be determined based on the average value of 6-strand and 8-strand steel wire ropes as:

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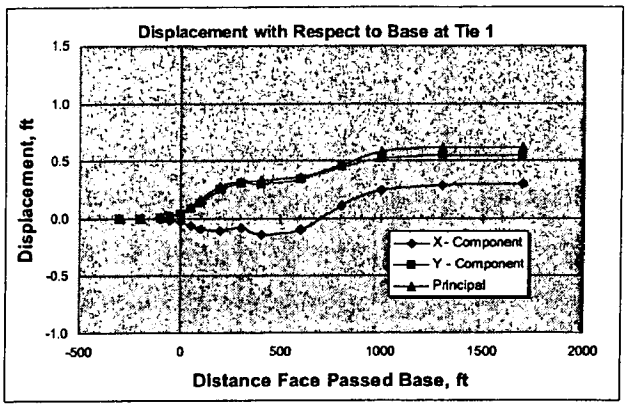

Fig. 6 Horizontal Displacements of Tie 1

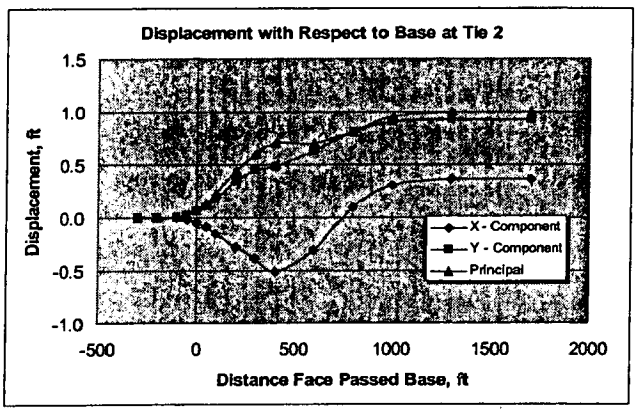

Fig. 7 Horizontal Displacements of Tie 2

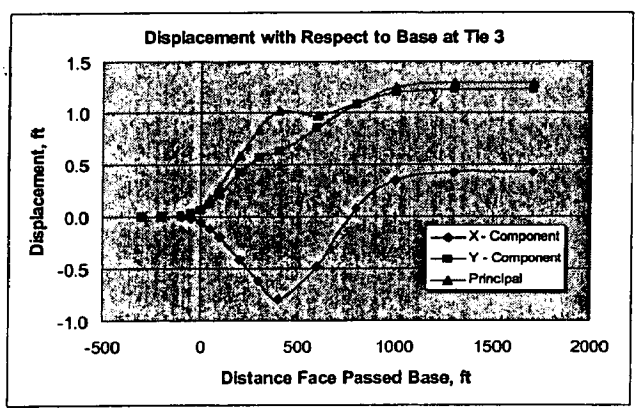

Fig. 8 Horizontal Displacements of Tie 3

$$S = 10x10^6 A \qquad \text{lbs} \qquad (3)$$

In Eq. 3, A is the cross-sectional area of the wire rope. The stiffness values used in the conversion are 1,104,466 and 1,503,301 lbs ft/ft for the 3/8" and 7/16" guy wires, respectively. The average tensions in the guy wires induced by the ground subsidence process associated with the longwall operation are plotted in Fig. 9. A positive value indicates that an additional tension has been induced in the guy wire by the subsidence process while a negative value shows that the existing tension in the guy wire observed before mining will be reduced. A negative force is only meaningful when its magnitude is smaller than the pre-mining tension in the guy wire. Figure 9 shows that tensions would develop in the guy wires when the longwall face is between 50 ft inby and 300 ft outby the tower base. The maximum subsidence-induced tension was about 780 lbs for guy wires tied to the level 3 of the tower when the longwall face is about 200 ft passed the tower base. Such additional tensions are smaller than the pre-mining tensions ranging from 1,250 to 1,975 lbs and are insignificant compared to the ultimate breaking strengths of the guy wires (10,600 lbs for 3/8" wire rope and 14,400 lbs for 7/16" wire rope). Therefore, the subsidence-induced tensions were incapable of causing breakage of the guy wires.

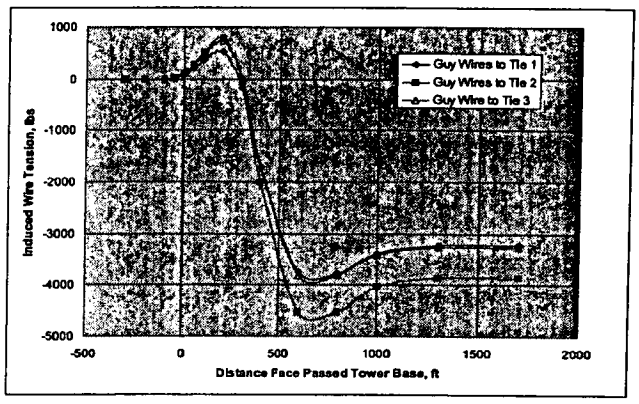

Fig. 9 Subsidence-Induced Tensions in the Guy Wires

However, after the longwall face has passed the tower base a distance 350 ft, the tensions in the guy wires become nonexistent (The magnitudes of the negative values are larger than the pre-mining wire tensions). Under such condition, the guy wires would slack and the tower would be no longer effectively restrained laterally by the guy wires within certain small range. The lack of effective lateral restraint makes it possible for the tower, especially its upper sections, to vibrate under strong gushing winds.

Additional Load to the Tower

The subsidence-induced tensions in the guy wires also induce additional loads to the tower structure, especially in the section near the tower base. The additional load in the lower section at a given time stage is the summation of the vertical components of the tensions in all of the guy wires. The calculations show that additional loads can be induced in the first half of the dynamic subsidence process until the longwall face has passed the tower base a distance of 350 ft. The maximum subsidence-induced load on the tower base would be 4,947 lbs when the face was 200 ft past the base. Such additional load was also insignificant compared to the weight of the steel tower structure and the load from the pre-mining wire tensions (about 12,000 lbs). Therefore, the subsidence-induced load to the tower base would not cause any structural integrity problems to the tower.

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Bending Curvature on the Tower

The differential lateral displacements between the base and the three ties would create a bending condition in the tow lattice structure. The calculation shows that the lower part of the tower was bent laterally more severely than the upper part. However, the maximum bending curvature, 5.5×10^{-5} 1/ft in the lower part when the longwall face was about 300 ft passed the tower base, was still insignificant for the tower steel lattice structure. Therefore, the bending developed on the tower structure would have no effect on its structural integrity.

Assessment of Structural Functionality

The assessment of subsidence influences on the functionality of the transmission tower is to assess whether the ground subsidence process is to disrupt or degrade the ability of the transmitters on the tower to relay phone signals to and from the transmission towers in the other two cities. Such ability could be potentially affected by: the blockage of the signal path, and (2) the incorrect alignment of the signal path. This section assesses the possibilities for such two potential problems to occur during and after the ground subsidence process.

Possibility of Signal Path Blockage

The cellular phone company was concerned with the vertical subsidence at the location of the tower base that would place the tower a few feet (2.9 ft as predicted and shown in Fig. 5) lower than its original elevation. It was thought that such lowering of tower elevation could make high obstacles (such as large trees) to intrude into the signal path between the transmission towers causing signal blockage.

However, it should be noted that the transmission tower was located on the top of one of the highest hills, if not the only highest hill, in a large area around and the transmitters were also located high above the ground on the tower. The ground subsidence process would not only lower the tower but also the surrounding surface area to certain extent. Therefore, the signal paths are impossible to be blocked by any local obstacles around this transmission tower.

Another fact was that the other two transmission towers were located about 23.5 miles (air distance) away from this transmission tower. The predicted 2.9 ft elevation lowering at this transmission tower would only change the signal path by a minor angle of 4.84 seconds. Such insignificant change in signal path would make it impossible for any obstacles located close to the other towers to intrude into the signal paths, either. Therefore, the possibility for the subsidence process to cause blockage of the signal paths was none.

Possibility of Misalignment of Signal Paths

During and after the subsidence process, some minor inclination and rotation will develop on the tower structure. Such inclination and rotation, if large enough, could affect the alignment of the signal paths between the transmitters. According to the cellular phone company, any inclination away from the vertical direction or rotation in the horizontal plane of the tower larger than one degree could affect the alignment of the signal paths.

Based on the determined coordinates and elevations of the tower base and the ties, the inclinations of the tower structures away from the vertical direction at each time stage were determined for each section and the entire height of the tower. The results include inclinations along x and y directions as well as the principal one. The principal inclination of the tower would increase as the dynamic subsidence process with the maximum being reached when the ground regains its stability. The maximum inclinations would be 0.59°, 0.36° and 0.35° for the lower, middle and top sections, respectively. The maximum inclination for the entire tower is about 0.43°.

The rotation of the tower structure is determined using the coordinates of the anchors and tie 2 because torque type tie at this level were designed to provide rotational restraint to the tower lattice structure. The maximum tower rotation, 0.56°, would occur when the dynamic subsidence process was over.

The analysis indicated that both the maximum inclination and the maximum rotation of the tower are smaller than their critical values. Therefore, the alignments of the signal paths would not be affected by the ground subsidence process associated with the longwall mining operation, either.

MITIGATION MEASURE AND RESULTS

Based on the analyses performed, it was concluded that the only possible problem is the vibration of the tower under strong gushing winds due to the lack of effective lateral restraint by the guy wires. Such condition would occur in the second half of the dynamic subsidence process starting at the time when the longwall face is 300 ft outby the tower base.

In order to prevent the condition for potential vibration from occurring, it was recommended that the tensions in the guy wires were to be monitored daily when the longwall face is between 0 and 1,000 ft past the tower base. Necessary adjustments should be made by loosening or tightening the turnbuckles (Fig. 3) on the guy wires near the anchor blocks to maintain the needed tension levels. During the time period when the face is between 300 and 750 ft passt the tower base, multiple adjustments should be made daily to compensate the anticipated large reduction of tensions in the guy wires. When making these adjustments, the plumbing of the lattice structure should be also checked to avoid over-adjustments.

Mining under the tower started in the early January, 2003. The recommended mitigation measure was implemented. The dynamic subsidence process in the area of the transmission tower was over by the end of that month. Despite severe winter weathers in the first two to three months of this year, the tower was successfully protected and no complaints about the phone services were made.

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CONCLUSIONS

This paper presents a case study where a telecommunication transmission tower was subsided by a longwall operation. The potential subsidence influences on the structure were carefully assessed based on the predicted surface movements in the dynamic subsidence process and the structural information of the tower using a systematic approach.

The assessment indicated that structural stability, integrity and functionality of this tower would not be significantly affected by the subsidence event. However, a vibration condition could develop in the second half of the dynamic subsidence process because of the slack of the guy wires.

Based on the assessment, a simple mitigation measure, monitoring and tension adjustment was recommended and implemented. The project was successful as evidenced by the continued quality service carried by this transmission tower.

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AEC 06108

Subsidence Prediction Influence Assessment and Damage Control

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ABSTRACT

An extensive subsidence research program conducted by the authors has greatly improved the accuracy and the capabilities of subsidence prediction under complicated mining and surface conditions. The techniques developed for assessing and mitigating subsidence influences on various surface structures have been applied in numerous cases with a very good record of success.

INTRODUCTION

Total extraction of a coal seam using longwall mining or room-and-pillar mining with pillar extraction tends to disturb the overburden strata and causes immediate surface subsidence. Depending on various factors, such subsidence events may or may not have the potential to cause problems to surface structures. Surface subsidence research conducted by the authors has demonstrated that in order to effectively and efficiently minimize the subsidence influences on surface structures, the following techniques should be applied systematically:

- *Methods for accurately predicting surface subsidence under varying mining and surface conditions.* Success in dealing with the issues of subsidence depends primarily on the accurate prediction of the magnitude, distribution and timing of surface subsidence. By studying the subsidence basins produced by different mining plans, the possible subsidence effects on surface structures can be greatly reduced.
- *Techniques for assessing the subsidence influences on surface structures.* The probability and severity of subsidence influences on a structure of interest need to be assessed before it is undermined. Due to the large differences in types, design, material and construction of the structures as well as variations of movements and deformations to be experienced by the structures, the different assessment techniques are required.
- *Techniques for mitigating subsidence influences.* If the assessment indicates that the subsidence influences on a structure exceed the structure's tolerable level in terms of its integrity, stability and functionality, proper mitigation techniques should be designed and implemented to reduce the subsidence influences on the structure.

This paper describe the efforts and results of a subsidence research program conducted by the authors.

SUBSIDENCE PREDICTION

Accurate prediction of surface subsidence caused by underground mining is required for assessment of the subsidence influences and is the basis for the design of effective and efficient mitigation measures. In the past a great majority of subsidence research have been concentrated on the prediction of final subsidence over a single longwall panel with a relatively flat surface. The prediction models produced by those researches have limited value for practical applications because of varying and complicated mining, geological and topographical conditions. In order to improve the prediction accuracy, the authors have collected more than 200 longwall subsidence cases all over the US coal fields through an intensive subsidence monitoring program and from various other sources. These data were used to continuously refine and improve a PC-based program package, CISPM (Comprehensive and Integrated Subsidence Prediction Model) developed previously by the authors (Peng and Luo, 1992). This program package has a unique and rich set of capabilities for meeting nearly all of the subsidence prediction requirements in underground coal mining employing high or total extraction methods in the US. It is very user-friendly requiring neither particular skills in computer operations nor in-depth knowledge of subsidence theory. It has been proven fairly accurate according to the feedback from its domestic and international users and according to our own

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subsidence monitoring data. The following important findings from our subsidence research program have been incorporated into the current version of CISPM program package:

- *Dynamic subsidence process associated with longwall mining operations.* As underground mining progresses, a surface point will experience a fairly complicated dynamic subsidence process before it becomes stable again. During the dynamic subsidence process, the magnitudes, natures and directions of the subsidence movements and deformations at the surface point change with time and their influences to structures are also time dependent. Very often the dynamic subsidence process plays a more important role in assessing and mitigating subsidence influences than final subsidence. Mathematical models have been developed to predict the entire dynamic subsidence process associated with longwall mining operations (Luo and Peng, 1992).
- *Final subsidence basin over a single and multiple longwall panels.* Most of the subsidence prediction methods have been developed for mining of a single panel only. They are unsuitable for the prediction of subsidence over multiple panels such as the longwall panels separated by chain pillar systems as normally practiced in the US. A mathematical model has been developed to predict the final subsidence basin over multiple longwall panels (Luo and Peng, 1990, 1991). This model is based on the finding that the convergence of the chain pillar systems between the longwall panels could contribute a very significant amount of subsidence in the area over and near the chain pillars.
- *Final subsidence caused by high extraction room-and-pillar mining method.* If the recovery ratio in a room-and-pillar panel is 70% or higher by partially or fully extracting the pillars in a room-and-pillar panel, immediate surface subsidence (versus the unpredictable subsidence events over low extraction room-and-pillar mines often seen as the abandoned mine subsidence) will be induced. The existing methods which have been derived from subsidence data collected over longwall panels are not suitable for subsidence prediction over high extraction room-and-pillar mines. Based on the available subsidence data collected over room-and-pillar panels, a method has been developed for the prediction of the final subsidence basin over high extraction room-and-pillar panels (Luo and Peng, 1993).
- *Studies of subsidence parameters.* The two basic components of a subsidence prediction method are the chosen mathematical models and the parameters involved in the mathematical model. The subsidence parameters often play a very important role in the prediction accuracy. However, the reported subsidence parameters often vary in very large ranges which are of little values in practical applications. Such large variations are often resulted from the use of inconsistent definitions of the subsidence parameters and inadequate determination methods. A great effort has been made in collecting subsidence data in the US coal fields, standardizing the definitions of and determining the subsidence parameters (Peng et al., 1995). Based on this study, the ranges of a number of commonly used final subsidence parameters have been greatly narrowed.

In additional to prediction of surface subsidence, tools are provided and self improvement mechanism is built in CISPM. They include data processing for subsidence survey, determination of subsidence parameters based on mining and geological information and deduction of parameters from collected subsidence data

Numerous field observations have demonstrated that complicated surface topography and steep surface slope in hilly regions have a profound impact on the ground subsidence process, often resulting in very different characteristics of subsidence basin from that on a relatively flat surface. Effort has been made to study the surface topography effects on ground subsidence process. A method has been developed for the prediction of final subsidence basin in hilly regions (Luo and Peng, 1990). Figure 1 shows a comparison of the calculated final horizontal displacement profiles with and without considerations of the surface topography. The surface elevation is also plotted at the top for reference. A much better agreement with the measured horizontal displacement in the steepest portion of the subsidence monument line has achieved when surface natural slope was considered. It should be noted that horizontal displacement often plays a much more important role in causing damages to surface structures than subsidence (i.e., vertical settlement).

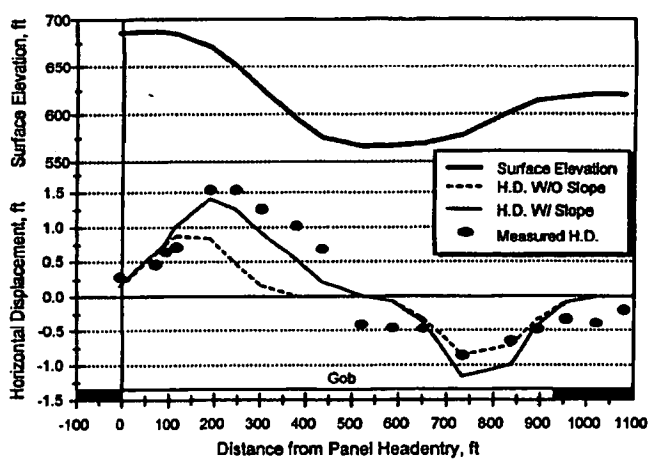

Fig. 1 Measured vs. calculated final horizontal displacement (H.D.) profiles along a cross-section over a longwall panel with relatively steep surface slope

TECHNIQUES FOR ASSESSMENT OF SUBSIDENCE INFLUENCES

Research emphasis has also been placed on monitoring the interaction between the subsiding surface and various surface structures. Based on the collected data, critical deformation values for various relatively simple structures have been

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established, techniques for assessing subsidence influences on those structures of large dimension and/or complexity have been developed.

A number of critical deformation values for typical residential structures (wood frame or brick super-structure on stone or concrete-block basement or foundation) in the northern Appalachian coal fields have been established. High surface tension and compression are generally responsible for cracks and buckling on the lower portion of the residential structures, respectively. High surface bending could causes problems to the super-structures such as sticky doors and windows, fissures on dry walls, peeling of old wall papers and paint. It is also found that a large tilting on floor could cause some inconveniences to the residents.

Ground cracks and bumps are caused by high surface tension and compression, respectively. Ground cracks as wide as 4 ft, though very rare, have been observed in certain locations over a few longwall panels. Generally ground cracks cause more problems (e.g., dewatering of surface streams or ponds) than the bumps. Criteria for initiating ground cracks on various ground surface have also been established.

For those structures of large dimensions and/or complicated design and construction, a more comprehensive and detailed assessment should be performed. However, due to the large variation of type, material, construction, dimension and functions of the structures, the techniques for assessing the subsidence influences on these types of structures vary considerably. Basic analysis should be performed to determine the nature and severity of the following three types of potential problems:

- *Structural integrity*: This is an indicator of mechanical failure of a structure of interest under the influence of subsidence. Ideally, the stress or strain field on the structures should be evaluated. The peak stress or strain are then compared to the permissible values of the structural material to determine the possibility of structural failure. For instance, a method has been proposed and successfully applied to assess the stress distribution on buried pipeline affected by subsidence (Peng and Luo, 1988). In cases where stress/strain fields are difficult or impossible to determine, the weakest components of the structure should be identified and empirical values are used to determine their integrity under the influence of surface subsidence.
- *Structural stability*: For those tall structures with small bases, the subsidence-induced slope could make them potentially unstable during or after subsidence process. Both the short and long term stability of the structure should be assessed. If the subsidence-induced slope could move the center of gravity of a structure out of its base, the structure is said to have lost its short-term stability. A structure loses its long-term stability if the strongest wind blowing in the direction of maximum slope caused by subsidence will be able to topple the structure.
- *Structural functionality*: The ability and level for the structures to perform their intended functions during and after subsidence may be affected by ground subsidence process. For example, subsidence could chan the grade of a railroad well above its permissible gra A conveyor belt could be rendered inoperable due vertical and lateral alignment problems caused by subsidence process.

The authors have applied the established criteria a the developed assessment techniques in various projects in a sessing subsidence influences on various surface structur Some examples of applying these assessment techniques a shown in Table 1.

TECHNIQUES FOR SUBSIDENCE MITIGATION

If the assessment indicates that a structure will be a versely affected, effective and efficient mitigation measur should be designed and implemented. The following three ap proaches can be used to design the mitigation measures: (1) re ducing surface movements and deformations in the area c concern to an acceptable level by modifying the mining pla (e.g., leaving a support area under the structure), (2) reducin transmission of movements and deformations from ground t the structure of interest (e.g., trenching and plan-fitting), an (3) reinforcing the structure so that it can tolerate highe

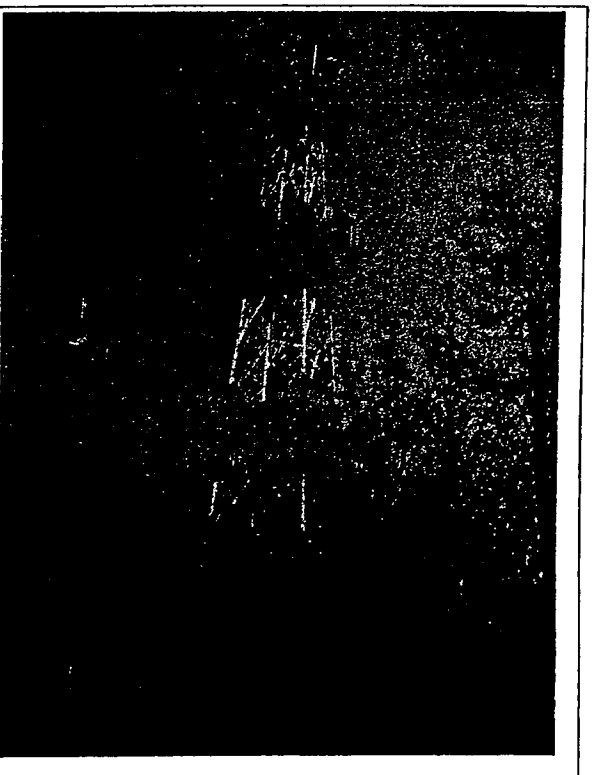

Fig. 2 This telecommunication transmission tower, about 200 ft tall, was located on a steep slope of a mountain peak. It was undermined by a longwall panel. In order to protect this tower, trench was dug around one of its legs and reinforcement beams were installed at the base. Despite of ground cracks observed nearby, there was no damage on thestructure and its service was kept open all time.

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Table 1 Some Examples of Subsidence Influence Assessments and Results

Structure or Feature	Descriptions	Major Concerns	Conculsions and Recommendations	Results
Residential Structures	More than 50 houses over or near longwall panels	Structural integrity and functionality	Verying damage potentials and mitigation measures recommended for about 30 structures	Accurate assessments and successful protection
Oil pipeline	Buried oil pipeline over 7 longwall panels	Structural integrity	Damage potential high. Mitigation measures recommended.	Feedback not available
Concrete water pipeline	Main transmission pipeline over 3 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures and alternatives recommended	Alternative plan adopted
Cast iron water pipeline	Two pipelines over 2 longwall panels	Structural integrity and functionality	Damage potential moderate. Mitigations recommended.	Not yet undermined
Steel water pipeline	Main water supply line over 4 longwall panels	Structural integrity and functionality	Damage potential high. Mitigation measures recommended.	Protection successful
Plastic and steel gas pipeline	Low pressure distribution line over 3 longwall panels	Structural integrity and functionality	Damage potential for the steel pipe portions. Mitigation recomeended.	Mining in progress
Lake	A large lake over 11 planned longwall panels	Land area to be submerged by water after subsidence	About 400 acres of land will be submerged or ponded	Successfully undermined
Water ponds	2 water ponds over 2 longwall panels	Stream dewatering, potential underground mine workings flooding	Possibility of dewatering is low	Accurate assessment
Streams	3 streams over 7 longwall panels	Stream dewatering, potential underground mine workings flooding	Varying potential of stream dewatering	Accurate assessment
Mine refuse facility	Over 3 longwall panels with high embankment	Feasibility of longwall mining under	Support area recommended under the embankment, feasible to mine under pond	Successfully undermined
Mine refuse facility	Over 3 longwall panels previously mined	Feasibility of building the facility over the mined panels, long-term subsidence	Effects of long-term subsidence is very minor. Construction is feasible.	Feedback not available
Mine refuse facility	Over 3 planned longwall panels with very shallow overburden	Feasibility of longwall mining under	Safety questionable. Alternative mining plans suggested.	Not yet undermined
Railroad and bridge	A railroad over 4 longwall panels	Subsidence influences and operation safety	Influences could be strong. Monitoring and Mitigations recommended	Successfully protected
Power transmission system	3 towers (80 to 120 ft tall) and one substation over two longwall panels	Integrity, stability, functionality and operation safety	Anticipated structural problem on one tower and stability problem on another	Accurate assessment
Telecommunication transmission tower	200-ft tall tower located over a longwall panels (Fig. 2)	Integrity, stability, functionality	Strong influences. Mitigation measures recommeneded and implemented	Accurate assessment and successful protection
Highway and bridge	Highway across the end areas of 3 longwall panels	Subsidence influences	Very minor influence on highway. Questionable on bridge	Accurate assessment
Primary and secondary roads	Four roads over 8 lonwall panels	Subsidence influences	Varying degrees of influences. mitigations recommended for 2 roads	Accurate assessment

movements and deformations without being damaged (e.g., tension cable method). Mitigation measures for various structures affected by subsidence have been developed and tested in field conditions. Table 2 shows some of the structures that have been successfully protected with direct involvement of the authors.

Design of Support Area

By leaving an adequate area of coal unmined or partially mined under the structure to be protected, the surface movements and deformations in the area of the structure can be kept below the permissible level of the structure. The Pennsylvania method for designing support area is one example of applying this concept. However, the PA method over-designs the support area when mining depth is more than 350 ft. Based on a large number of collected longwall subsidence cases, a new method for designing support area has been proposed as shown in Fig. 3 (Peng and Luo, 1993) and successfully applied for two large structures (Table 2).

Mitigation Techniques for Residential Structures

A number of simple but effective mitigation measures have been frequently applied by the authors in protection of nearly 30 residential structures (Table 2). Among them, *com-*

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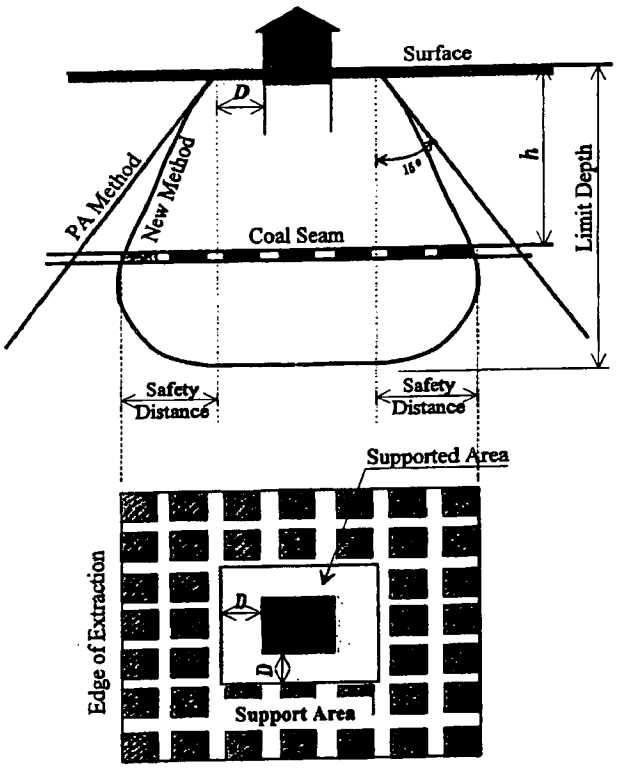

D - offset distance

Fig. 3 A method to design support area for surface structure has been developed based on the analysis of a large number of longwall subsidence cases. The support area designed using this method is usually smaller than that using PA method

pensation trench method is used to absorb surface tension c compression that could be transmitted to the structure from it surrounding ground. This method has been proven effective t reduce problems on the structural parts that have direct contac with the subsiding ground, such as basement and foundations *Plane-fitting method* is to protect the super-structure of house from being damaged by the bending and twisting action associated with subsidence process. During the implementa tion of this method, the house super-structure is placed on time-dependent inclined plane so that the super-structure is fre of stress while the required amount of adjustments are kep minimized. *Tension cable method* is used to strengthen th structures so that they can tolerate higher surface tension an bending. Figure 4 shows a brick house that were successfully protected using a compensation trench and two tension cables.

Mitigation Measures for Buried Pipelines

Ground subsidence process often has the potential to cause damages to buried pipelines. Assessments of subsidence influences on various buried pipelines have indicated that the strain transmitted from the surrounding soil to the pipeline is always the No. 1 source of stress on the pipeline (Luo et al., 1997). Therefore, reduction of the strain transmission is the most effective method in the protection of buried pipelines. Uncovering pipeline only in the sections where the estimated stress is higher than the permissible stress of the pipeline material can greatly reduce the pipeline stress contributed by the ground strain. Such partial uncovering method has been successfully applied in the protection of a 7,800-ft section of water supply pipeline undermined by four longwall panels (Table 2).

Mitigation Measures for Railroad

Ground subsidence is capable of causing serious problems to railroads if proper cautions are not taken. A partia

Table 2 Some Examples of Successfully Protected Structures

Structures Protected	Descriptions	Mitigation Measures Employed	Results	Monitoring Performed
Residential Structures	25 houses, 2 garages and 1 swimming pool over 19 longwall panels	plane-fitting, compensation trench, tension cable, external bracing	Very good rate of success. Figure 4 is one of the examples	Subsidence
Railroad	About 11,000 ft long over 4 longwall panels	Partial lifting	It was kept operating during subsidence. Great saving in material and labor costs	Subsidence
Railroad bridge	130 ft, three sections	A 440x510 ft^2 support area under the bridge	Bridge not affected at all	Subsidence
Water pipeline	About 7,800 ft long 12-inch steel pipeline over 4 longwall panels	Partial uncovering	Service has never been intrrupted	Subsidence, strain
Overland conveyor belt system	About 1,400 ft long erected between 16 and 50 ft above ground level with a 300-ton transfer tower over a longwall panel	Uncovering support bases, loosening bolts at the bases, lateral stabilization	Despite of large surface movement, it required only some minor repairs before being put into operation again	Subsidence, strain, tilting
Telecommunication transmission tower	About 200 ft high located on the top of high mountain and between two longwall panels	Compensation trench, strengthening tower base	Despite of ground cracks observed nearby, no damage observed on the structure and service not interrupted	Visual observation
Coal refuse disposal facility	Large slurry pond with an embankment nearly 200 ft high.	A 1,300x1,930 ft^2 support area under the embankment only	The integrity, stability and functionality of the facility not affected	Subsidence

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Fig. 4 This brick house was successfully protected by a compensation trench and two tension cables. The placements of the trench and cables and the required tension in the cables were determined by subsidence simulations.

lifting method has been developed. The original elevation profile of the railroad, the predicted final subsidence profile and the permissible railroad grade are considered in determining the required adjustment along the section of railroad to be affected. This method has been applied to protect a section of railroad about 11,000 ft long undermined by four longwall panels (Table 2). The maximum subsidence at the site was about 4.5 ft. Adjustment on the railroad was only recommended in some sections much shorter than the total length of the railroad affected by subsidence with the maximum adjustment being about 2.5 ft only. As a result of implementing the partial lifting method, the subsided and adjusted railroad was kept smooth for safe railroad operation while the required adjustment was kept to a minimum.

A CASE STUDY

This section shows a case of the protection of a railroad over a longwall panel. The longwall panel was 930 ft wide mining a coal seam of about 6.5 ft thick. The overburden depth at the site was about 680 ft. The layout of the railroad over the longwall panel is shown in Fig. 5. The predicted final subsidence at the site is also plotted in this figure with the maximum subsidence being about 4.2 ft which matched very well with the measurements. The elevation profile of this section of railroad before subsidence is shown in Fig. 6. Based on the predicted final subsidence, original elevation and the permissible grade of 0.7%, the final railroad profile requiring the minimum amount of vertical adjustment was determined before it was undermined. In preparation, a large proportion of the required amount of gravel to raise the railroad was shipped to the site and spread in the sections needing the most amount of adjustment. During the active subsidence period, the railroad was monitored and vertical adjustment was made accordingly. A temporary speed limit of 5 mph was also posted as a precaution. Figure 6 shows one set of recommended adjustment during the active subsidence period and the elevation profiles of the railroad before and after the implementation of the recommended adjustment. By implementing the recommended adjustment, the maximum railroad grade was reduced from about 1.0% to the permissible 0.7% (Fig. 7). The railroad service was never interrupted during the entire subsidence process. Figure 8 shows a fully loaded coal train was passing the section of subsiding and adjusted railroad.

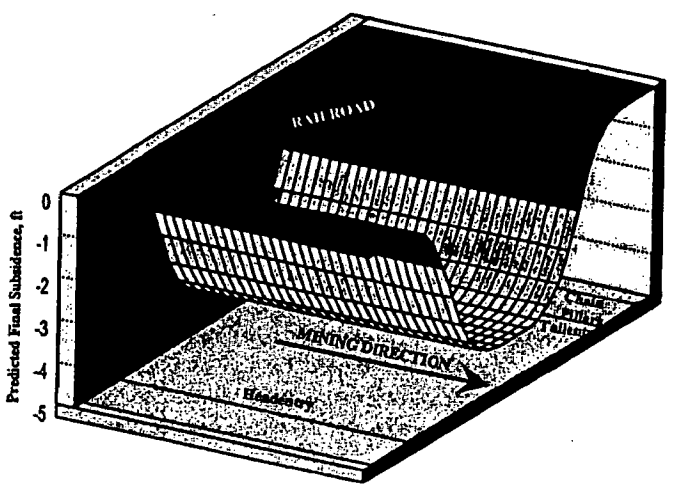

Fig. 5 Layout of the railroad over the longwall panel and predicted final surface subsidence at the site

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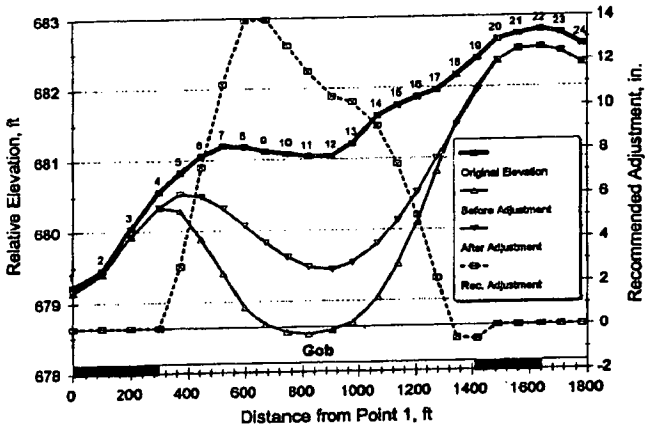

Fig. 6 Elevation profiles of the railroad and one set of recommended vertical adjustment during the active subsidence period. Using the partial lifting method, the required adjustment was kept to a minimum while the railroad was smooth.

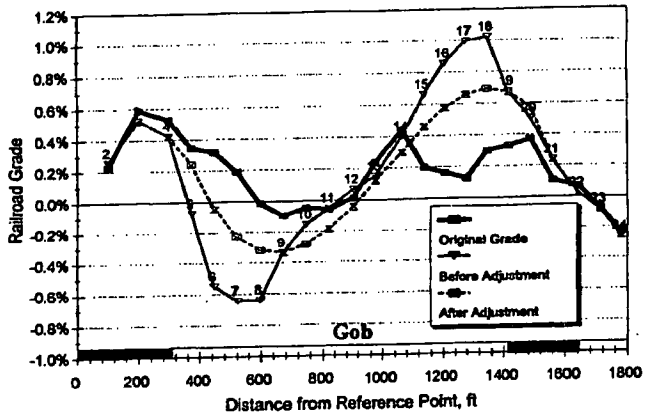

Fig. 7 Grade profiles of the subsiding railroad before and after implementing the recommended adjustement. The maximum grade of the adjusted railroad was kept within the permissible grade of 0.7%

SUMMARY

Subsidence prediction, influence assessment and damage control have come a long way. A systematic subsidence research program coupled with intensive field monitoring and extensive data collection during the past twenty years have produced vast amount of quality data and knowledge. Numerous case studies have demonstrated that using these research results, surface subsidence caused by full and high extraction mining methods and its effects can be predicted with confidence, and mitigation measures can be selected, designed and implemented successfully.

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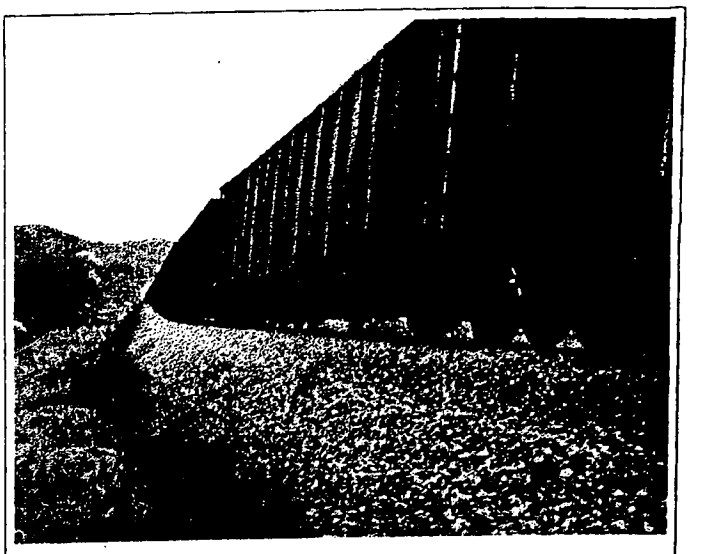

Fig. 8 This loaded coal train was passing through a section of subsiding railroad. The railroad was successfully protected using the partial lifting method.

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AEC 06116

APPROVED UNDERGROUND COAL MINING PERMIT APPLICATION

Applicant:

Name: AMERICAN ENERGY CORP
Address: 43521 Mayhugh Hill Rd.
Beallsville, OH 43716
Telephone: (740) 926-9152

Application Number: D-0425-5

Number of acres in underground workings: 3605.5

Number of surface acres to be affected: 0

The water monitoring plan for this permit shall be:

Quality: See Page 26, F3 of the Permit Application
Quantity: See Page 26, F3 of the Permit Application

Note: These monitoring requirements are separate from NPDES monitoring requirements.

This application is APPROVED since it demonstrates and the Division has found that the criteria in paragraph (E) of rule 1501: 13-5-01 of the Administrative Code have been met.

Signature: Mike Sparks by TM **Date:** 8-4-05

OPERATOR

F63 Rev: 07/01/2001

11/92

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
UNDERGROUND COAL MINING AND RECLAMATION
PERMIT APPLICATION

Applicant: **American Energy Corporation**

A. Type of Operation (check appropriate space (s)):

____ Shaft, ____ Slope, ____ Drift,
____ Room and Pillar, ____ Pillar Extraction,
__X__ Longwall, ____ Combined Surface and Underground

B. Type of Application (Check appropriate space (s)):

(1) ____ New
(2) ____ Initial Underground Workings to Existing Permit
(3) __X__ Additional Underground Workings

C. Address the following if applicable:

(1) Permit Number **D-0425**
(2) Date Issued **October 22, 1984**

D. Did a person other than an employee of the applicant prepare this application? ___ Yes, __X__ No. If Yes, provide:

Preparer's Name _____
Address
City _____ State _____ Zip _____
Telephone _____

E. I, the undersigned, a responsible official of the applicant, do hereby verify the information in the complete permit application as true and correct to the best of my information and belief.

Printed Name Robert D. Moore ; Title President

Signature _____ ; Date 7/2/04

Sworn before me and subscribe in my presence this
2nd day of July, 2004.

Denise R. Jackson Notary Public

DENISE R. JACKSON
Notary Public, State of Ohio
My Commission Expires 9-27-2005

F. For Revision Review Only. This item is to be completed after revision, if any, have been made to the permit application.

I the undersigned, a responsible official of the applicant, do hereby verify and acknowledge the revisions made during the permit review process as true and correct to the best of my information and belief.

Printed Name JAMES R. TURNER, JR ; Title TREASURER
Signature _____ ; Date 7-26-05
Sworn before me and subscribe in my presence this 26th day of July, 2005.

Notary Public

TERESA L. DEAL
Notary Public, State of Ohio
My Commission Expires 4/29, 2010
Recorded in Monroe County

PART 1, LEGAL, FINANCIAL, COMPLIANCE, AND RELATED INFORMATION

A. IDENTIFICATION OF INTERESTS

(1) Applicant's Name **American Energy Corporation**
Address **43521 Mayhugh Hill Road**
City **Beallsville** State **Ohio** Zip **43716**
Telephone 740 - 926 - 9152
Employer Identification No. (EIN) **31-1550443** ,or
Social Security No. (SSN) _____

(2) Indicate business structure of applicant and additional information:

_____ Single Proprietorship,
_____ Partnership (registration no. and date obtained) _____ ,
X Corporation (charter no. and date incorporated) **00842695, 4/12/1993** ,
_____ Association, _____ Other, specify _____

(3) If the applicant is a single proprietorship, provide the following:
Owner's Name _____
Address _____
City _____ State _____ Zip _____
Telephone _____-_____-_____
EIN _____ , or SSN _____
Beginning date of ownership _____

(4) If the applicant is a business entity other than a single proprietorship, provide the following for the applicants statutory agent and submit Attachment 1.

Agent's Name **American Energy Corporation**
Address **43521 Mayhugh Hill Road**
City **Beallsville** State **OH** Zip **43716**
Telephone **740 - 926 - 9152**
EIN **31-1550443** , or SSN (optional) _____

(5) Is the operator of the mine to be a person different from the applicant? _____ Yes, X No. If "yes," provide the operator's name and submit Attachment 17. (Note: if more than one operator, indicate operator's name and submit a separate attachment for each.)

Operator's Name _____

(6) Provide the following for the person who will pay the abandoned mine land reclamation fee for the applicant.

Name **American Energy Corporation**
Address **43521 Mayhugh Hill Road**
City **Beallsville** State **OH** Zip **43716**
Telephone **740 - 926 - 9152**
EIN **31-1550443** , or SSN (optional) _____

(7) Provide the following for all persons having the authority or ability to commit the financial, real property assets, or working resources of the applicant who are not otherwise identified as officers, directors, or owners of the applicant. If none, check box: [X].
If any person listed is a business entity and not an individual, also complete Attachment 1 for that person.

Name _____
Address _____
City _____ State _____ Zip _____
Telephone _____-_____-_____
EIN _____, or SSN _____
Date O & C relationship began/ended (if applicable)
_____/_____
Submit and identify additional pages necessary to complete response

11/92

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 1
(OWNERS AND CONTROLLERS)

Applicant's Name AMERICAN ENERGY CORPORATION

This attachment is to be completed and submitted with the permit application if the applicant is other than a single proprietorship. Provide the following for all partners, officers, directors, stockholders owning ten percent or more of any class of voting stock or other instruments of ownership, and any other person performing a function similar to a director. If any person listed is a business entity and not an individual, also complete an Attachment 1 for that person.

Name of business entity AMERICAN ENERGY CORPORATION

Name Robert D. Moore
Street address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43716
EIN 31-1550443, or SSN
Title of position within entity PRESIDENT & TREASURER
Date position assumed/ended (if applicable) 6/25/01
Percent of ownership 0% Date of ownership
Location in organizational structure PRESIDENT & TREASURER

Name MURRAY ENERGY CORPORATION
Street address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43713
EIN 34-1956752, or SSN
Title of position within entity SOLE SHAREHOLDER
Date position assumed/ended (if applicable)
Percent of ownership 100% Date of ownership 2/23/01
Location in organizational structure SOLE SHAREHOLDER

Name MICHAEL O. McKOWN
Street address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43713
EIN 31-1550443 or SSN
Title of position within entity SECRETARY
Date position assumed/ended (if applicable) 11/01/99
Percent of ownership Date of ownership
Location in organizational structure SECRETARY

Submit and identify additional pages necessary to complete response.

11/92

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 1
(OWNERS AND CONTROLLERS)

Applicant's Name AMERICAN ENERGY CORPORATION

This attachment is to be completed and submitted with the permit application if the applicant is other than a single proprietorship. Provide the following for all partners, officers, directors, stockholders owning ten percent or more of any class of voting stock or other instruments of ownership, and any other person performing a function similar to a director. If any person listed is a business entity and not an individual, also complete an Attachment 1 for that person.

Name of business entity AMERICAN ENERGY CORPORATION

Name Bruce Hill
Street address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43713
EIN 31-1550443 or SSN
Title of position within entity DIRECTOR
Date position assumed/ended (if applicable) 7/02/01-
Percent of ownership Date of ownership
Location in organizational structure DIRECTOR

Name Clyde Borrell
Street address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43716
EIN 31-1550443, or SSN
Title of position within entity Director
Date position assumed/ended (if applicable) 11/01/99-7/2/01
Percent of ownership 0% Date of ownership
Location in organizational structure Director

Name Coal Resources, Inc.
Street address 29325 Chagrin Blvd
City Pepper Pike State OHIO Zip 44122
EIN 31-1586390, or SSN
Title of position within entity OWNER
Date position assumed/ended (if applicable)
Percent of ownership 100% Date of ownership 11/01/99-2/23/01
Location in organizational structure SOLE SHAREHOLDER

Submit and identify additional pages necessary to complete response.

11/92

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 1
(OWNERS AND CONTROLLERS)

Applicant's Name AMERICAN ENERGY CORPORATION

This attachment is to be completed and submitted with the permit application if the applicant is other than a single proprietorship. Provide the following for all partners, officers, directors, stockholders owning ten percent or more of any class of voting stock or other instruments of ownership, and any other person performing a function similar to a director. If any person listed is a business entity and not an individual, also complete an Attachment 1 for that person.

Name of business entity MURRAY ENERGY CORPORATION

Name ROBERT E. MURRAY
Street address 29325 Chagrin Blvd., Suite 300
City Pepper Pike State OHIO Zip 44122
EIN 34-1956752, or SSN
Title of position within entity PRESIDENT CEO, AND SHAREHOLDER
Date position assumed/ended (if applicable) 2/23/01
Percent of ownership 100% Date of ownership 2/23/01
Location in organizational structure

Name MICHAEL D. LOIACONO
Street address 29325 Chagrin Blvd., Suite 300
City Pepper Pike State OHIO Zip 44122
EIN 34-1956752, or SSN
Title of position within entity TREASURER
Date position assumed/ended (if applicable) 2/23/01
Percent of ownership 0% Date of ownership
Location in organizational structure

Name MICHAEL O. McKOWN
Street address 29325 Chagrin Blvd., Suite 300
City Pepper Pike State OHIO Zip 44122
EIN 34-1956752 or SSN
Title of position within entity SECRETARY
Date position assumed/ended (if applicable) 2/23/01
Percent of ownership 0% Date of ownership
Location in organizational structure

Submit and identify additional pages necessary to complete response.

(8) Provide the following for all persons owning or controlling the c to be mined by another person under a lease, sublease, or other contract and (a) having the right to receive the coal after minin (b) having the authority to determine the manner in which another person conducts coal mining operations. If none, check box: [X] any person listed is a business entity and not an individual, als complete Attachment 1 for that person.

Name _____
Address _____
City _____ State _____ Zip _____
Telephone _____-_____-_____
EIN _____, or SSN _____
O & C relationship to entity _____
Date O & C relationship began/ended (if applicable)
_____/_____
Submit and identify additional pages necessary to complete respons

(9) List below the person or persons primarily responsible for ensuring that the applicant will comply with Chapter 1513. of the Revised Code and the rules adopted pursuant thereto while mining and reclaiming the area for which this permit is requested.
Robert D. Moore

(10) Has the applicant, any person listed under Items A(3), (7), and (8), or any person listed on Attachment 1 who "owned or controlled" or "owns or controls" as defined in 1501: 13-4-03(A), held a coal mining permit in the United States within the five years preceding the date of the application?
__X__ Yes, _____ No. If "yes," submit Attachment 5.
SEE ATTACHMENT 5

(11) Does the applicant, any person listed under Items A(3), (7), and (8), or any person listed on Attachment 1 have a pending coal mining application in any state of the United States?
__X__ Yes, _____ No. If "yes," submit Attachment 23.
SEE ATTACHMENT 23

(12) Indicate name of mine **Century Mine**

(13) List below the MSHA identification numbers for the mine and for all mine-associated structures requiring MSHA approval on the proposed permit area.

33-01070

(14) Submit Attachment 22, Certificate of Liability Insurance.
SEE ATTACHMENT 22

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: The Oklahoma Coal Company
Address: 29325 Chagrin Blvd, Suite 300
City: Pepper Pike State: OH Zip: 44122
Telephone: 216 - 765 - 1240
EIN: 34-1673480 or SSN:

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
D-0230	OH	DMRM	No MSHA number

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray, Director

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: Belmont Coal Company
Address: P. O. Box 146
City: Powhatan Point State: OH Zip: 43942
Telephone: 714 - 795 - 5200
EIN: 31-1536602 or SSN: _____

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
D-1020	OH	DMRM	33-04397 7/31/97
D-0241	OH	DMRM	33-03048 7/2/93

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray, Shareholder, 100%

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: Maple Creek Mining Company
Address: 981 Route 917
City: Bentleyville State: PA Zip: 15314
Telephone: 724 - 258 - 2056
EIN: 25-1755305 or SSN:

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
63841302	PA	DEP	36-00970 – June 30, 1995
63733706	PA	DEP	36-00970 – June 30, 1995
63723707	PA	DEP	36-00970 – June 30, 1995

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray – Director

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: MonValley Transportation Center, Inc.
Address: P.O. Box 135 – 1060 Ohio Ave.
City: Glassport State: PA Zip: 15045
Telephone: 412 - 673 - 1500
EIN: 25-1490495 or SSN: _____

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
02851602	PA	DEP	36-08678 06/08/95

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray - Director

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: The American Coal Company
Address: 29325 Chagrin Blvd Suite 300
City: Pepper Pike State: OH Zip: 43122
Telephone: 216 - 765 - 1240
EIN: 73-1543124 or SSN: _____

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
02	IL	Office of Mines And Minerals	11-02752 10/14/98
255	IL	Office of Mines And Minerals	11-02752 10/14/98
257	IL	Office of Mines and Minerals	11-02752 10/14/98
306	IL	Office of Mines and Minerals	11-02752 10/14/98
1410	IL	Office of Mines and Minerals	11-02752 10/14/98
352	IL	Office of Mines and Minerals	11-02752 10/14/98 (to replace #344 soon)

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray President

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: The Ohio Valley Coal Company
Address: 56854 Pleasant Ridge Road
City: Alledonia State: OH Zip: 43902
Telephone: 740 - 926 - 1351
EIN: 34-1041310 or SSN:

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
D-0360	OH	DMRM	33-01159 5/25/88

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray - Director

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: PENNAMERICAN COAL, LP
Address: PO Box 459
City: Black Lick State: PA Zip: 15716-0459
Telephone: 724 - 248 - 1327
EIN: 25-1800870 or SSN: _____

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
32951301	PA	PADEP	36-08525

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray, SHAREHOLDER

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: UMCO Energy, Inc.
Address: 981 Route 917
City: Bentleyville State: PA Zip: 15314
Telephone: 724 - 258 - 2056
EIN: 52-1615668 or SSN: _____

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
63921301	PA	DEP	36-08375 June 08, 1994

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray – Director

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

ATTACHMENT 5
(PERMIT LISTING)

Applicant's Name: AMERICAN ENERGY CORPORATION

Submit the following information for each coal mining operation owned or controlled by either the applicant or by any person who owns or controls the applicant.

Name of Business Entity: UtahAmerican Energy, Inc.
Address: P. O. Box 187
City: St. Clairsville State: OH Zip: 43950
Telephone: 435 - 613 - 0393
EIN: 34-1874726 or SSN:

Permit No.	State	Regulatory Authority	MSHA No. and Date Issued
ACT/007/013	UT	DOGM	Horse Canyon Mine 42-00100 12/24/78 Lila Canyon Mine 42-02241 4/15/99

If not previously provided, indicate the ownership or control relationship of the business entity with the applicant, including the percent ownership and location in organizational structure:

Robert E. Murray, Director

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES & RECLAMATION

ATTACHMENT 23
(PENDING PERMIT APPLICATIONS)

Applicant's Name AMERICAN ENERGY CORPORATION

Provide the following information for each pending coal mining application for either the applicant or any person who owns or controls the applicant.

Indicate the business entity for which this listing has been completed KENAMERICAN COAL COMPANY

Application No.	Name of Regulatory Authority	State
889-5009 R-8	natural resources & environmental cabinet - Dept of surface mining reclamation & enforcement	KY
889-9004	natural resources & environmental cabinet - Dept of surface mining reclamation & enforcement	KY

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES & RECLAMATION

ATTACHMENT 23
(PENDING PERMIT APPLICATIONS)

Applicant's Name AMERICAN ENERGY CORPORATION

Provide the following information for each pending coal mining application for either the applicant or any person who owns or controls the applicant.

Indicate the business entity for which this listing has been completed The Ohio Valley Coal Company

Application No.	Name of Regulatory Authority	State
D-0360-14	DMRM	OH

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES & RECLAMATION

ATTACHMENT 23
(PENDING PERMIT APPLICATIONS)

Applicant's Name AMERICAN ENERGY CORPORATION

Provide the following information for each pending coal mining application for either the applicant or any person who owns or controls the applicant.

Indicate the business entity for which this listing has been completed BELMONT COAL COMPANY INC.

Application No.	Name of Regulatory Authority	State
10168	DMRM	OH

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES & RECLAMATION

ATTACHMENT 23
(PENDING PERMIT APPLICATIONS)

Applicant's Name AMERICAN ENERGY CORPORATION

Provide the following information for each pending coal mining application for either the applicant or any person who owns or controls the applicant.

Indicate the business entity for which this listing has been completed UMCO ENERGY, INC. - HIGH QUALITY MINE

Application No.	Name of Regulatory Authority	State
63921301	PA DEP	PA

11-89

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 22
(CERTIFICATE OF LIABILITY INSURANCE)

Name of Insured American Energy Corporation

This is to certify that the policy of insurance listed below has been issued to the above named insured and is in force at this time. The policy provides bodily injury and property damage insurance for all coal mining and reclamation operations of the insured in the State of Ohio as required by paragraph (B) of rule 1501:13-7-07 of the Administrative Code stated below.

Name of Insurer	Federal Insurance Company
Policy Number	3710 44 10
Policy Period	6/1/04 - 6/1/05
Name of Underwriting Agent	Reschini Agency, Inc.
Address of Underwriting Agent	922 Philadelphia Street, Indiana, PA 15701
Telephone Number of Underwriting Agent	(800) 828 - 5040

In the event of cancellation or non-renewal of this policy, including non-payment of policy premiums, the insurer agrees to promptly notify:

The Division of Reclamation
Foundation Square
Columbus, OH 43224

5/26/04
Date

Karen Williams
Signature of Underwriting Agent

This certificate is issued as a matter of information only and confers no rights upon the Division of Reclamation. This certificate does not amend, extend, or alter the coverage afforded by the policy listed above.

1501:13-7-07(B) The Public Liability Insurance Policy shall:

1.) Be in effect during the term of the permit or any renewal, including the length of all reclamation operations;

2.) Provide for personal injury and property damage protection in amounts adequate to compensate any persons injured or property damaged as a result of coal mining and reclamation operations, including the use of explosives. The minimum insurance coverage for bodily injury and property damage shall be three hundred thousand dollars for each occurrence and five hundred thousand dollars in the aggregate; and

3.) Include a rider requiring that the insurer notify the Chief whenever substantive changes are made in the policy, including any termination or failure to renew.

COMPLIANCE INFORMATION

(1) Has the applicant, any subsidiary, affiliate, or persons controlled by or under common control with the applicant:

a) Had a federal or state coal mining permit suspended or revoked the five years preceding the date of submission of this application? _____ Yes, __X__ No. If "yes," submit Attachmen

b) Forfeited a mining bond or similar security deposited in lieu bond? _____ Yes, __X__ No. If "yes," submit Attachment 6.

(2) Has the applicant been issued a notice of violation (NOV) in connection with any coal mining and reclamation operation during th three years preceding the date of submission of this application fo violations of Chapter 1513. of the Revised Code or these rules, or any federal or state law, rule, or regulation pertaining to air or water environmental protection? __X__ Yes, _____ No. If "yes," submit Attachment 7A.

SEE ATTACHMENT 7A

(3) Have any unabated federal or state cessation orders (COs) and unaba air and water quality notices of violation (NOVs) been received pri to the submission date of this application by any coal mining and reclamation operation owned or controlled by either the applicant o by any person who owns or controls the applicant? _____ Yes, __X__ If "yes," submit Attachment 7B.

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 7A
(NOTICES OF VIOLATION)

Applicants Name AMERICAN ENERGY CORPORATION (CENTURY MINE)

Permit No.	Violation Number	Date of Issuance	Issuing Agency	State	Brief Description of N.O.V.	Action Taken to Abate N.O.V.	Current Status of N.O.V. (*)
D-0425	21575	9/26/01	ODNR	OHIO	DAMAGE HAS RESULTED AS THE OPERATOR HAS DISTURBED GROUND, GRUBBED AN AREA, BEYOND THE SOUTHERN PERMIT LIMITS.	EROSION AND SEDIMENT CONTROLS WERE ESTABLISHED AND AN IBR WAS SUBMITTED AND ISSUED	TERMINATED
D-0425	21542	9/26/01	ODNR	OHIO	DAMAGE HAS RESULTED AS SEDIMENT FROM THE DISTURBED AREA HAS DISCHARGED OFF OF THE PERMIT INTO THE RECEIVING STREAM.	EROSION AND SEDIMENT CONTROLS WERE ESTABLISHED AND AN IBR WAS SUBMITTED AND ISSUED	TERMINATED

(*) If administrative or judicial proceedings have been initiated concerning any of the violations, identify the violation and provided an addendum indicating the date, location, type of proceeding, and current status.

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 7A
(NOTICES OF VIOLATION)

Applicants Name AMERICAN ENERGY CORPORATION (CENTURY MINE)

Permit No.	Violation Number	Date of Issuance	Issuing Agency	State	Brief Description of N.O.V.	Action Taken to Abate N.O.V.	Current Status of N.O.V. (*)
D-0425	21579	3/5/03	ODNR	OHIO	Exceeded the Permits area by constructing a coal slurry Pipe line outside the Permit Limits (T-7N), (R-4W) Sections-34+35, T-5N, R-4W	Ron requested extensions forms and the informal request for an extension. (5-28-03) IBR submitted (4-7-03) revisions submitted-5-23-03)	TERMINATED
D-0425	21584	4/3/03	ODNR	OHIO	Operator commenced construction of phase 1 coarse refuse area prior to the completion of Drainage control system.		TERMINATED

(*) If administrative or judicial proceedings have been initiated concerning any of the violations, identify the violation and provided an addendum indicating the date, location, type of proceeding, and current status.

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 7A
(NOTICES OF VIOLATION)

Applicants Name AMERICAN ENERGY CORPORATION (CENTURY MINE)

Permit No.	Violation Number	Date of Issuance	Issuing Agency	State	Brief Description of N.O.V.	Action Taken to Abate N.O.V.	Current Status of N.O.V. (*)
D-0425	24364	7/2/03	ODNR	OHIO	Operator shall mail written notice to owners and occupants of surface property owners 6 months before mining is to occur.		TERMINATED
D-0425	24404	6/17/03	ODNR	OHIO	A landslide has occurred below access rd. between prep plant and mining opening, near pond 008-A		TERMINATED

(*) If administrative or judicial proceedings have been initiated concerning any of the violations, identify the violation and provided an addendum indicating the date, location, type of proceeding, and current status.

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 7A
(NOTICES OF VIOLATION)

Applicants Name AMERICAN ENERGY CORPORATION (CENTURY MINE)

Permit No.	Violation Number	Date of Issuance	Issuing Agency	State	Brief Description of N.O.V.	Action Taken to Abate N.O.V.	Current Status of N.O.V. (*)
D--0425	24515	12/9/03	ODNR	OHIO	The Topsoil stockpiles within watershed of impoundment num. 016 is not protected from erosion.		TERMINATED

(*) If administrative or judicial proceedings have been initiated concerning any of the violations, identify the violation and provided an addendum indicating the date, location, type of proceeding, and current status.

RIGHT OF ENTRY INFORMATION

(1)(a) Provide the following information for every legal or equitable owner of record, surface and mineral, of the property to be mined the permit area (i.e. areas affected by surface operations and facilities), indicating whether the ownership is of surface, coal noncoal mineral.

N/A - NO PERMIT AREA

Name _____
Address _____
City _____ State _____ Zip _____
Surface _____ , Coal _____ , Noncoal _____
Deed Parcel No.

Name _____
Address _____
City _____ State _____ Zip _____
Surface _____ , Coal _____ , Noncoal _____
Deed Parcel No.

Name _____
Address _____
City _____ State _____ Zip _____
Surface _____ , Coal _____ , Noncoal _____
Deed Parcel No.

Name _____
Address _____
City _____ State _____ Zip _____
Surface _____ , Coal _____ , Noncoal _____
Deed Parcel No.

C.(1)(b) Provide the following information for every legal or equitable owner of the property to be mined covered by the underground workings indicating whether ownership is for the surface or coal.

Name S. & B. Brandon
Address 45730 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 31 and Tract 32

Name R. Cline, Etal
Address 52936 Pugh Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 82

Name J. & V. Hranko
Address 52936 Pugh Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 82

Name B. Palmer
Address 52866 Pugh Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 82

Name S. Johnson
Address 52433 East Drive
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 80

Name P. Kehayas
Address P.O. Box 26
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name J. Smith, Jr.
Address P.O. Box 244
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name K. & R. Darby
Address P.O. Box 99
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name P. & S. Hoke
Address 46053 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name R. Thompson
Address 9921 South Chapel
City Garrettsville State Ohio Zip 44231
Surface X , Coal
Deed Parcel No. Tract 80

Name R. & M. Heller
Address 45801 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 31 and 154

Name M. Flynn
Address 45711 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tracts 31 and 154

Name M. Louden II
Address 45725 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 154 and 2-3-11

Name J. & J. Smith
Address 45751 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. 2-3-11

Name J. & V. Kernen
Address 45911 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. 2-3-11

Name R. & N. Perkins
Address 52319 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 80

Name M. Hoover
Address 52107 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 34

Name B. Johnson
Address Pugh Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name J. & L. Cox
Address 52368 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name W. & C. Ward
Address 46348 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name R. Perkins, Etal. c/o Pauline Perkins
Address 52080 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 34 and 67

Name L. & R. Gates
Address 270 Fellows Avenue
City West Jefferson State Ohio Zip 43162
Surface X , Coal
Deed Parcel No. Tract 82

Name L. & L. Burkhart
Address 46284 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 80

Name C. & R. Chadwell
Address 46270 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 80

Name Switzer Water Assoc., Inc. c/o Donald Miracle
Address 51111 State Route 556
City Clarington State Ohio Zip 43915
Surface X , Coal _____
Deed Parcel No. Tract 80

Name R. & G. Mallett
Address 46534 State Route 556
City Beallsville State Ohio Zip 43716
Surface _____ , Coal _____
Deed Parcel No. Tract 36

Name D. Atkins
Address 96 West Main St.
City Seville State Ohio Zip 44273
Surface X , Coal _____
Deed Parcel No. Tract 35 and Tract 50

Name S. Seebach
Address 46646 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 50

Name D. Mallett & R. Kirby
Address 46520 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal _____
Deed Parcel No. Tract 36

Name S. Mullett
Address 3064 U.S. Highway 50
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 26, 36, and 42

Name M. & K. Hoover
Address 51778 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 64

Name J. Van Pelt
Address 51865 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 64

Name P. & B. Marshall
Address 12026 Reeder Avenue
City Alliance State Ohio Zip 44601
Surface X , Coal
Deed Parcel No. Tracts 64 and 75

Name P. Ciccolini, Etal
Address 6750 Kepler Road
City Clinton State Ohio Zip 44216
Surface X , Coal
Deed Parcel No. Tract 64

Name E. Van Dyne c/o K.J. Tawney
Address 5554 Rockwood Court
City Columbus State Ohio Zip 43229
Surface X , Coal
Deed Parcel No. Tract 64

Name C. Decker & C. Warren
Address 46255 Decker Lane
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 55, 75, 93, and 94

Name R. Lovejoy c/o M.R. Hoover
Address 51505 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 75

Name M. Gates & B. Reed c/o J.R. Reed
Address 46490 Reed Lane
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 30, 67, and 115

Name L. & B. Dyer, Jr.
Address 51578 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 64

Name B. & E. Reed c/o J.R. Reed
Address 46490 Reed Lane
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 30, 69, and 115

Name W. Graff
Address 8211 Leatherman Road
City Wadsworth State Ohio Zip 44281
Surface X , Coal
Deed Parcel No. Tract 72

Name K. & L. Neiswanger
Address 51140 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 75

Name E. & C. Pittman
Address 48615 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 75

Name G. Riley, Etal
Address 45440 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 156 and 57-124

Name J. Riley
Address 45221 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 57-124

Name R. Reed
Address 51648 Atkinson Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 57-23, 57-29, 57-57, 57-58, 57-59, 57-26, 57-94, and 57-76

Name E. Pittman (c/o D.R. Pittman, Jr.)
Address 34950 S.R. 78
City Lewisville State Ohio Zip 43754
Surface X , Coal
Deed Parcel No. 57-26

Name R. & H. Larew
Address 34927 Harper Road
City Woodsfield State Ohio Zip 43793
Surface X , Coal
Deed Parcel No. 57-26, 57-95, 57-18, 57-106, and 57-120

Name F. & J. Mankin
Address 51201 Atkinson Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-107

Name F. & M. Atkinson, Sr
Address 51095 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26, 57-66, and Tract 81

Name S. & P. Ackerman
Address 51476 Atkinson Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-104.1, 57-104.2, 57-104.3, 57-104.4, and 57-112

Name G. & D. Mellott
Address 52005 Atkinson Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-59

Name I. Abbott
Address 51760 Atkinson Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-76

Name R. Kindelberger
Address 51965 Datkuliak Lane
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-76

Name J. Kindelberger
Address 51965 Datkuliak Lane
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-76

Name L. & E. Truex
Address 44380 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-29 and 57-76

Name C. & B. Datkuliak
Address 52836 Belmont Avenue
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-29, 57-76

Name D. Kindelberger, Etal
Address 51965 Datkuliak Lane
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-29

Name R. & D. Burrow C/O R. & C. Burrow
Address 43877 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-36, 57-36.2, 57-29, and 57-26

Name T. & P. Bier
Address 44145 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-29

Name E. & H. Barone
Address 51404 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26

Name J. Abrigg
Address 51425 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-58

Name B. & E. Craig
Address 51401 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26

Name W. & K. Bauer
Address 51385 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26

Name C. & T. Atkinson
Address 51373 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26

Name R. & C. Burrow
Address 43877 State Route 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-35 and 57-36.2

Name L. & B. Datkuliak
Address 53983 New Castle Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26 and 57-77

Name R. & S. Neiswonger
Address 51368 Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26 and 57-32.1

Name R. & C. Moore
Address 50269 Orchard Lane
City Clarington State Ohio Zip 43915
Surface X , Coal
Deed Parcel No. 57-26 and 57-32.2

Name R. & A. Howell
Address 50780 Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-11

Name C. & R. Kindelberger
Address 44757 Township Highway 142A
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-11

Name D. Mellott, Etal
Address 347 Alpha Avenue
City Akron State Ohio Zip 44312
Surface X , Coal
Deed Parcel No. 8-11, 57-97

Name F. & E. Dietz
Address 51001 Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-4, 57-97

Name A.Scheiderer
Address 50543 Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-97

Name R. & D. Kindelberger
Address 51965 Datkuliak Lane
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-12, 57-96

Name S. & B. Brandon, Jr.
Address S.R. 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 31

Name J. & K. Kernen, Jr.
Address 46387 S.R. 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tracts 26 and 36

Name N. Christman
Address 402 Eastern Avenue
City Woodsfield State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 81

Name J. Bibler
Address 3903 Wetmore Road
City Cuyahoga Fall State Ohio Zip 44223
Surface X , Coal
Deed Parcel No. 57-28, Tract 159

Name N. & D. Moore
Address 53676 Pugh Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 2-13-28, 2-13-29

Name N. Perkins
Address P.O. Box 7
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 2-13-95 and 2-13-169

Name D. & B. Haines
Address 3859 N. Vista
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 2-13-35

Name J. Davis
Address 5101 Thompson Road
City Gahanna State Ohio Zip 43230
Surface X , Coal
Deed Parcel No. 2-13-164

Name R. & A. Howell
Address 50780 Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-96

Name R. Pittman
Address 50925 Mellott Ridge Road C.R. 31
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-28

Name R. & D. Stephen
Address 50911 Mellott Ridge Road, P.O. Box 184A
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-28

Name D. Carpenter, L. Caldwell, & D. Ward C/O F.A. Carpenter
Address 50883 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-12, 57-22.1, 57-22.2, 57-28

Name R.I. Miller
Address 50406 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-99.5

Name L. McDougal, Sr.
Address 50890 Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-4

Name C. Clucas, Jr.
Address Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-4

Name R. & J. Pratt
Address 3549 Frawood Drive
City Uniontown State Ohio Zip 44683
Surface X , Coal
Deed Parcel No. 57-26

Name V. & D. Boughner
Address 46535 Township Highway 2214
City Clarington State Ohio Zip 43915
Surface X , Coal
Deed Parcel No. 57-22.1 and 57-28

Name R. & B. Sheedy
Address 49668 Bolon Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-11

Name D. & K. Bauer
Address 51355 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26

Name M. Shrewsbury
Address 50856 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 55

Name B. Followay
Address 10176 Daniels Road
City Creston State Ohio Zip 44217
Surface X , Coal
Deed Parcel No. Tract 61

Name G. Nolan II & W. Arnold
Address 50477 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 55

Name J. & W. Arnold
Address 50714 Headley Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 55

Name D. Tubaugh, Etal C/O Harry Tubaugh
Address 46420 S.R. 556
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. Tract 36

Name D. & B. Crall
Address 51130 Run Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 8-4

Name F. & M. Atkinson, Jr.
Address 51339 Mellott Ridge Road
City Beallsville State Ohio Zip 43716
Surface X , Coal
Deed Parcel No. 57-26

Name Consolidated Land Company

Address P.O. Box 505, 34208 Aurora Road

City Solon State Ohio Zip 44139

Surface _____ , Coal X

Deed Parcel No. 2-3-11, 2-13-29, 2-13-35, 2-13-95, 2-13-164, 2-13-169; Tracts 26, 30, 31, 32, 34, 35, 36, 42, 50, 55, 61, 64, 67, 69, 72, 75, 80, 81, 82, 93, 94, 115, 154, 156, and 159; 8-4, 8-11, 8-12, 57-18, 57-22.1, 57-22.2, 57-23, 57-26, 57-28, 57-29, 57-32.1, 57-32.2, 57-35, 57-36.2, 57-57, 57-58, 57-59, 57-66, 57-76, 57-77, 57-94, 57-95, 57-96, 57-97, 57-99.5, 57-104.1, 57-104.2, 57-104.3, 57-104.4, 57-106, 57-107, 57-112, 57-120, 57-124

Name B. & L. Baker

Address 49971 Run Road

City Beallsville State Ohio Zip 43716

Surface _____ , Coal X

Deed Parcel No. 57-36.2

Name F. & L. Lucido

Address Mellott Ridge Road

City Beallsville State Ohio Zip 43716

Surface _____ , Coal X

Deed Parcel No. 57-26

C. (2) Provide either of the following information for the holders of record of any leasehold interest in the coal to be mined or property to be affected by surface operations or facilities, indicating whether the held interest is of surface, coal, or noncoal rights.

Name **Consolidated Land Company**
Address **29325 Chagrin Boulevard, Suite 300**
City **Pepper Pike** State **Ohio** Zip **44122**
Surface _____ , Coal **X** , Noncoal

Name **American Energy Corporation**
Address **43521 Mayhugh Hill Road**
City **Beallsville** State **Ohio** Zip **43716**
Surface _____ , Coal **X** , Noncoal
Submit and identify additional pages necessary to complete response.

(3) Are there purchasers of record under a real estate contract of the coal to be mined or property to be affected by surface operations and facilities? ____ Yes, **X** No. If yes, submit Attachment 2.

(4) Is any owner, holder, or purchaser listed in items C(1)(a and b), (2), or (3) respectively, a business entity other than a single proprietorship? **X** Yes, ____ No. If yes, submit Attachment 3.
SEE ATTACHMENT 3

(5) Is any part of the proposed permit area adjacent to any lands which are not owned by those persons identified in item C(1)(a)? ____ Yes, **X** No. If yes, submit Attachment 4.

(6) Does the applicant hold lands, interests in lands, options, or pending bids on interests in lands which are contiguous to the property to be mined? ____ Yes, **X** No. If yes, provide a description of the lands.
There are lands contiguous to the D-0425-3 permit. See D-0425-3 for map of these lands

(7) Is it anticipated that individual mining permits will be sought for any of those lands described in item C(6) above? ____ Yes, **X** No. If yes, submit as an addendum and identify those lands to include the size, sequence and timing of future mining permits, utilizing a map pursuant to 1501:13-4-13(J)(20), Ohio Administrative Code.

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES & RECLAMATION

ATTACHMENT 3
(IDENTIFICATION OF OTHER BUSINESS ENTITIES)

Applicant's Name AMERICAN ENERGY CORPORATION

This attachment is to be completed and submitted with the permit application if the response to item C.(4) in Part 1 of the permit application is "yes." A separate attachment is to be submitted for each business entity.

Name of business entity CONSOLIDATED LAND COMPANY

Statutory agent A. H. STATUTORY AGEN CORP. #842696

Street Address 925 EUCLID AVENUE, SUITE 1100

City CLEVELAND State OHIO Zip 44115

Person's name PETER VULJANIC Position PRESIDENT

Street Address 29325 Chagrin Blvd., Suite 300

City Pepper Pike State OHIO Zip 44122

Person's name MICHAEL E. ELLIOT Position SECRETARY

Street Address 29325 Chagrin Blvd., Suite 300

City Pepper Pike State OHIO Zip 44122

Person's name ROBERT D. MOORE Position TREASURER AND ASSISTANT SECRETARY

Street Address 29325 Chagrin Blvd., Suite 300

City Pepper Pike State OHIO Zip 44122

Person's name MAYNARD R. ST. JOHN Position VICE PRESIDENT

Street Address 29325 Chagrin Blvd., Suite 300

City Pepper Pike State OHIO Zip 44122

12/95

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES & RECLAMATION

ATTACHMENT 3
(IDENTIFICATION OF OTHER BUSINESS ENTITIES)

Applicant's Name **AMERICAN ENERGY CORPORATION**
This attachment is to be completed and submitted with the permit application if the response to item C.(4) in Part 1 of the permit application is "yes." A separate attachment is to be submitted for each business entity.

Name of business entity **AMERICAN ENERGY CORPORATION**

Statutory agent AMERICAN ENERGY CORPORATION
Street Address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43716

Person's name ROBERT D. MOORE Position PRESIDENT/TREASURER

Street Address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43716

Person's name MICHAEL O. MCKOWN Position SECRETARY

Street Address 43521 MAYHUGH HILL ROAD
City BEALLSVILLE State OHIO Zip 43716

Person's name _____ Position

Street Address

City _____ State _____ Zip

Person's name _____ Position

Street Address

City _____ State _____ Zip

C. (8)(a) Provide either of the following to allow for coal mining operations on the permit area:

N/A - NO PERMIT AREA

(i) A copy of the documents, or
(ii) An affidavit wherein the documents are described.

AFFIDAVIT

State of Ohio, _____ County, ss. _____ being first duly sworn, says that the following described documents convey to the applicant the legal right explained below and is a subject of litigation as shown below.

Typed of document
Execution Date
Expiration Date
Parties: From _____ To
Description of land: No. Acres
County _____ Township
Sections _____ Lots
Parcel #
Explanation of legal rights claimed

Pending litigation _____ Yes, _____ No.

Signature of Affiant Date

Position

Sworn before me and subscribed in my presence this _____ day of _____, 20 ____.

Notary Public

c. (8)(b) Provide either of the following to allow for coal mining operations within the underground workings:

(i) A copy of the documents or
(ii) An affidavit wherein the documents are described. For all documents or affidavits provided for the underground workings, the specific parcels are to be identified on the application map.

AFFIDAVIT

State of Ohio, Monroe County, ss. Robert D. Moore being first duly sworn, says that the following described documents convey to the applicant the legal right explained below and is a subject of litigation as shown below.

Type of document LEASE
Execution Date
Expiration Date NONE
Parties: From CONSOLIDATED LAND COMPANY To AMERICAN ENERGY CORPORATION

Description of land: No. Acres 3611
County Monroe Township Sunsbury
Sections 4, 5, 19, 22, 23, 24, 25, 28, 29, 30, 34, 35
Lots N/A
Parcel #
Explanation of legal rights claimed
SEE ATTACHED ADDENDA

Pending litigation _____ Yes, X No.

Signature of Affiant Date 7/02/04

PRESIDENT
Position

Sworn before me and subscribed in my presence this 2nd day of July, 2004.

Notary Public

Denise R. Jackson

DENISE R. JACKSON
Notary Public State of Ohio
My Commission Expires 9-27-2005

Addendum to Page 10, Part C(8)(b)

Item 1 – Lease rights to parcel 57-22.1, 57-22.2, 57-23, 57-26, 57-28, 57-29, 57-32.1, 57-32.2, 57-35, 57-36.2, 57-57, 57-58, 57-59, 57-66, 57-76, 57-77, 57-95, 57-96, 57-106, 57-107, 57-120, Tract 26, Tract 30, Tract 31, Tract 32, Tract 34, Tract 35, Tract 36, Tract 42, Tract 50, Tract 55, Tract 61, Tract 64, Tract 67, Tract 72, Tract 81, Tract 82, Tract 154.

Together with the free and uninterrupted right of way into, upon and under said land at such points and in such manner as may be proper and necessary for the purpose of digging, mining, coking, draining, ventilating and carrying away said coal, etc. (hereby waving all surface damages or damages of any sort arising there from or from the removal of all of said coal), together with the privileges of mining and removing through said described premises other coal belonging to the Grantee, his heirs and assigns, or which may hereafter be acquired by said Grantee, his heirs and assigns.

Said Grantors, for themselves and their heirs and assigns, reserve the right to drill and operate through said coal for oil and gas.

It is understood and agreed between the parties hereto that the said Grantors and their heirs shall be paid at the rate of one-hundred dollars per acre for all surface land taken and used for mining said coal by said Grantee, his heirs or assigns.

Item 2 – Lease rights to parcel 57-18, Tract 115.

Together with the rights and privileges necessary and useful in the mining and removing of the said coal including the right of mining the same without leaving any support to the overlying strata and without liability for any injury which may result to the surface from the breaking of said strata the right of ventilation and drainage and of access to the mines for men and materials; the shafts or openings for such purposes, however to be in the ravines and waste places upon said land, and not nearer than 165.00 feet of the principal buildings thereon. Any surface ground required for building and operating switches and railroads, shafts, openings, machinery, ways, roads, houses for employees, etc., may also be taken but shall be paid for before being occupied at the rate of one-hundred and fifty dollars per acre, which payment shall thereupon entitle the Grantee, his heirs and assigns, to a deed in fee for the same. Also the right of mining, ventilating, draining and transporting the coal of other lands through the mines and openings in and upon the said land of the Grantors.

Item 3 – Lease rights to parcel 57-112, 57-124, Tract 93, Tract 94, Tract156.

Together with all the rights and privileges necessary and useful in the mining and removing of said coal including the right of mining the same without leaving any support for the overlying strata and without liability for any injury which may result to the surface form the breaking of said strata, the right of ventilation and drainage and generally freed clear and discharged of any servitude whatever to the overlying land or to

anything therein, thereon or there under, and also the right of access to the mines for men and materials; the shafts or openings for such purposes, however, to be in the ravines and waste places upon said land and not nearer than 165.00 feet of the principal buildings thereon, and any surface ground required for operating or manufacturing of any kind may be taken, but shall be paid for before being occupied at the rate of one-hundred dollars per acre, which payment shall entitle the party of the second part to a deed in fee for the same. Also the right of mining, ventilating, draining and transporting the coal of other lands through the mines and openings in and upon the lands of the party of the first part. Grantor reserves, however, the right to drill through said coal for oil and gas.

Item 4 – Lease rights to parcel 57-94.

Together with the free and uninterrupted right of way into, upon and under said land, at such points and in such manner as may be proper and necessary for the purpose of digging, mining, coking, draining and ventilating and carrying away said coal, etc., (hereby waiving all surface damages or damages of any sort arising there from or from the removal of all of said Coal Services Group) together with the privilege of mining and removing through said described premises other coal belonging to the Grantee, his heirs and assigns.

Item 5 – Lease rights to parcel 57-104.1, 57-104.2, 57-104.3, 57-104.4, Tract 69.

Together with all the rights and privileges necessary and useful in the mining and removing of said coal, including the right of mining the same without leaving any support for the overlying strata, and without any liability for any injuries which may result to the surface from the breaking of said strata, the right of ventilation and drainage and of access to the mines for men and materials; the shafts or openings for ventilation and drainage, however, to be in the ravines and waste places upon said lands and not nearer than 330.00 feet of the principal buildings thereon. Any surface ground required for shafts or openings or machinery, ways, roads, houses for employees, etc., may also be taken by Grantee, his heirs or assigns, but shall be paid for before being occupied at the rate of one-hundred dollars per acre, which payment shall thereupon entitle the Grantee, his heirs or assigns, to a deed in fee for the same. Also the exclusive right of way for the purpose of mining, ventilating, draining and transporting the coal of other lands through the mines and openings in, upon and over the said lands of the Grantor. Said Grantor reserves the right to drill and operate through said coal for oil and gas and other minerals.

Item 6 – Lease rights to parcel 8-11, 8-12, 8-4.

Together with the free, uninterrupted use and enjoyment of the right of way into and under said land at such points and in such manner as may be considered proper and necessary for the advantageous and economical operation of and in the digging, mining and carrying away said coal; and without liability therefore, and hereby waiving any and all damages that might or could arise there from by reason of such digging, mining and carrying away of said coal together with the privilege of carrying, transferring and removing through said described premises this and other coal now owned or hereafter

acquired by said Grantee, his heirs or assigns, and generally freed, cleared and discharged of any servitude whatever to the overlying land or anything therein or thereon. Grantor reserves, however, the right to drill through said coal for oil or gas and other minerals. The Grantee, heirs or assigns, to have the right to purchase at any time as much of the surface of said land as may be necessary in mining, manufacturing or marketing said coal at the price of three-hundred dollars per acre, which payment shall entitle him to a deed in fee for the same.

Item 7 – Lease rights to parcel 57-99.5, 57-97.

It is hereby agreed that said Grantee, his heirs and assigns, have the right to mine and carry away all of said coal and with the mining rights and privileges necessary or convenient to such mining and removal of the same, without being required to provide for the support of the overlying strata, and without liability for injury to the said surface, or to anything therein or thereon, by reason of the mining and removal of said coal or the manufacture of the same or other coal into coke or other products at such places as may be selected by said Grantee, his heirs or assigns, together with the right of mining and removing under said described premises, other coal or matter belonging to or that may hereafter belong to said Grantee, his heirs and assigns, to purchase at any time any number of acres of the surface of said land by paying therefore at the rate of one-hundred dollars per acre, upon which payment the owners of the land under which the coal is hereby conveyed their heirs and assigns shall execute and deliver to the said Grantee, his heirs and assigns, a deed therefore in fee simple, free of encumbrances. But it is understood and agreed between the parties hereto that the owners of said land, or their lessees shall have the right to drill oil and gas wells through the coal hereby conveyed at any and all times.

Item 8 – Lease rights to parcel Tract 75.

Together with all the rights and privileges necessary and useful in the mining and removing of said coal, including the right of mining the same without leaving any support for the overlying strata, and without any liability for any injuries which may result to the surface from the breaking of said strata, the right of ventilation and drainage and of access to the mines for men and materials; the shafts or openings for ventilation and drainage, however, to be in the ravines and waste places upon said lands, and not nearer than twenty rods of the principal buildings thereon. Any surface ground required for shafts or openings, or machinery, ways, roads, houses for employees etc., may also be taken by the grantee, his heirs or assigns, but shall be paid for before being occupied at the rate of three-hundred dollars per acre, which payment shall thereupon entitle the grantee, his heirs or assigns, to a deed in fee for the same. Also the exclusive rights of way for the purpose of mining, ventilating, draining and transporting the coal of other lands through the mines and openings in, upon and over the said lands of Grantor. Said grantor reserves the right to drill and operate through said coal for oil and gas and other minerals.

Item 9 – Lease rights to parcel Tract 80.

Together with all the rights and privileges necessary and useful in the mining and removing of said coal, including the right of mining the same without leaving any support for the overlying strata, and without any liability for any injuries which may result to the surface from the breaking of said strata, the right of ventilation and drainage and of access to the mines for men and materials; the shafts or openings for ventilation and drainage, however, to be in the ravines and waste places upon said lands, and not nearer than twenty rods of the principal buildings thereon. Any surface ground required for shafts or openings, or machinery, ways, roads, houses for employees etc., may also be taken by the grantee, his heirs or assigns, but shall be paid for before being occupied at the rate of five-hundred dollars per acre, which payment shall thereupon entitle the grantee, his heirs or assigns, to a deed in fee for the same. Also the exclusive rights of way for the purpose of mining, ventilating, draining and transporting the coal of other lands through the mines and openings in, upon and over the said lands of Grantor. Said grantor reserves the right to drill and operate through said coal for oil and gas and other minerals.

Item 10 - Mining rights for tract- 2-13-35, 2-13-95, 2-13-28, 2-13-29, 2-13-11

"Together with the free and uninterrupted rights of way into, upon and under said described land, at such points, and in such manner as may be useful for the purpose of digging, draining and ventilating, and mining and removing said coal, together with the privilege of mining and removing through said described premises other coal belonging to said Grantees, their heirs and assigns, or which may hereafter be acquired, together with the right and privilege to make drains on the surface, and air holes, and change the same as the convenience of mining may require, together with all mining privileges on said surface or under it necessary for the removal of all of the Pittsburgh Vein underlying the same and neighboring properties now owned, or hereafter acquired by said Grantees, their heirs and assigns; and said Grantees, their heirs and assigns, shall in no wise be liable for damages for failure to support the overlying surface, or for the sinking or falling in of said surface, or for destroying any spring or well of water, or for diverting any water flow or natural stream by reason of the removal of said coal or the exercise of any of the above mining privileges."

"It is expressly understood and agreed that the enumeration herein is in enlargement and not in restriction of the incidental rights accruing to said Grantees, by virtue of the within grant of coal and mining privileges."

"And together with the right to use and occupy such amount of surface of the above described land as may in the opinion of said Grantees, their heirs and assigns, from time to time, be useful for the purpose of mining said coal or exercising any rights incidental thereto, or that may be useful for the deposit of gob or refuse from said mines, or for

carrying on the coal business and for the erection of buildings and machinery and tenant houses, and all other buildings needful or useful to carry on the coal business, or for the construction thereon of tracks, shafts, mine openings and other structures, and for the operation of railroads; and the said Grantors do, for themselves and their heirs, executors, administrators and assigns, covenant and agree that Grantors will upon demand and payment of, at the rate not exceeding One Hundred Dollars per acre, by the Grantees, their heirs and assigns, execute and deliver unto said Grantees, their heirs, and assigns, a good and sufficient deed of General Warranty, (and furnish therewith a complete Abstract of Title showing said lands to be free and clear of liens and encumbrances), conveying in fee simple, clear of liens and encumbrances, such amount of the above described land as Grantees in their opinion may require for the purposes herein next above set forth, And said Grantees agree to purchase the same at not exceeding said above stipulated price per acre."

Item 11 - Mining rights for tract 2-13-169

"Together with the free and uninterrupted rights of way into, upon and under said land at such points and in such manner as may be proper for the purpose of digging, draining and ventilating, and mining and removing said coal, together with the right of mining and removing through said premises other coal belonging to said grantees, their heirs and assigns, or which may be hereafter acquired, together with the right to make drains on the surface, and air holes, and change the same as the convenience of mining may require, together with all mining privileges on said surface, or under it, necessary for the removal of all said coal underlying the same and neighboring properties now owned or hereafter acquired by said grantees, their heirs and assigns, and waiving and releasing said grantees, their heirs and assigns, from all liability for damages for failure to support the overlying surface, or for sinking or falling in of such surface, or for destroying any spring or well of water, or for diverting any water flow or natural stream by reason of the removal of such coal or the exercise of any of the above mining privileges, together with all incidental rights that shall or may accrue to the said grantees, their heirs and assigns, by virtue of the within grant of coal and mining privileges."

"And the said grantors do for themselves and their heirs, executors, administrators and assigns, covenant and agree that grantors will upon demand and payment of at the rate of One Hundred Dollars per acre by the grantees, their heirs and assigns, convey in fee simple unto the said grantees, their heirs and assigns, such amount of said above described surface as may, in the opinion of said grantees, their heirs and assigns, from time to time, be useful for the purpose of mining said coal or exercising any right incidental thereto, or that may be useful for the deposit of gob or refuse from said mines or for carrying on the coal business, or for the erection of necessary buildings and machinery and tenant houses, and all other buildings necessary to carry on the coal business, or for the construction thereon of tracks, shafts, mine openings and necessary structures, and for the operation of railroads."

"And the said grantees do for themselves, their heirs and assigns, agree to pay for such real estate as may be used for the purpose herein next above set forth at the rate of $100 per acre."

Item 12 - Mining rights for tract 2-13-164

"Together with the free and uninterrupted rights of way into, upon and under said land at such points and in such manner as may be proper for the purpose of digging, draining, and ventilating, mining and removing said coal, together with the right of mining and removing through said premises, other coal belonging to said Grantees, their heirs and assigns, or which may be hereafter acquired, together with the right and privilege to make drains on the surface, and air holes, and change the same as the convenience of mining may require, together with all mining privileges on said surface or under it necessary for the removal of all the Pittsburgh vein underlying the same and neighboring properties now owned, or hereafter acquired, by said grantees, their heirs and assigns, and said Grantees, their heirs and assigns, shall in no wise be liable for damages for failure to support the overlying surface, or for the sinking or falling in of said surface, or for destroying any spring or well of water, or for diverting any water flow or natural stream by reason of the removal of said coal or the exercise of any of the above mining privileges."

"It is expressly understood and agreed that the enumeration herein is an enlargement and not a restriction of the incidental rights accruing to said grantees, by virtue of the within grant of coal and mining privileges."

"And the said grantor for himself and his heirs, executors, administrators and assigns, covenants and agrees with said grantees, their heirs and assigns, that he will upon demand and the payment therefor by said grantees, their heirs or assigns, at the rate of One Hundred Dollars per acre, convey by good and sufficient deed of general warranty in fee simple to said grantees, their heirs or assigns, such amount of said above described surface as may, in the opinion of said grantees, their heirs or assigns, from time to time, be useful for the purpose of mining said coal, or for exercising any right incidental thereto, or that may be useful for the deposit of gob or refuse from said mines, or for carrying on the coal business, or for the erection of the necessary buildings and machinery and tenement houses, and all other buildings necessary to carry on the coal business, or for the construction thereon of tracks, shafts, mine openings and necessary structures, and for the operation of railroads."

Item 13 - Mining rights for tract 2-13-164

"Together with all the rights and privileges necessary and useful in the mining and removing of said coal, including the right of mining the same without leaving any support for the overlying strata, and without any liability for any injuries which may result to the surface from the breaking of said strata, the right of ventilation and drainage and of access to the mines for men and materials; the shafts or openings for ventilation and

drainage, however, to be in the ravines and waste places upon said lands and not nearer than ten rods of the principal buildings thereon. Any surface ground required for shafts or openings or machinery, ways, roads, houses for employees, etc., may also be taken by Grantee, his heirs or assigns, but shall be paid for before being occupied at the rate of $150.00 per acre, which payment shall thereupon entitle the Grantee, his heirs or assigns, to a deed in fee for the same. Also the right of mining, ventilating, draining and transporting the coal of other lands through the mines and openings in, and upon the said lands of the Grantors. Said Grantor reserves the right to drill and operate through said coal for oil and gas and other minerals.

(9)(a) List below the following information for each surface owner of land within the proposed permit area.

N/A - NO PERMIT AREA

OWNER NAME	COUNTY	TOWNSHIP	SEC./LOT	T- , R-

C. (9) (b) List below the following information for each surface owner of land within the proposed underground workings.

LANDOWNER	COUNTY	TOWNSHIP	SEC.	T.	R.
R. Cline, Etal	Monroe	Sunsbury	30	4	4
J. & V. Hranko	Monroe	Sunsbury	30	4	4
B. Palmer	Monroe	Sunsbury	24 & 30	4	4
S. Johnson	Monroe	Sunsbury	24 & 30	4	4
P. Kehayas	Monroe	Sunsbury	30	4	4
J. Smith, Jr.	Monroe	Sunsbury	30	4	4
K. & R. Darby	Monroe	Sunsbury	30	4	4
P. & S. Hoke	Monroe	Sunsbury	30	4	4
R. Thompson	Monroe	Sunsbury	30	4	4
R. & M. Heller	Monroe	Sunsbury	30	4	4
M. Flynn	Monroe	Sunsbury	30	4	4
M. Louden II	Monroe	Sunsbury	30	4	4
J. & J. Smith	Monroe	Sunsbury	30	4	4
J. & V. Kernen	Monroe	Sunsbury	30	4	4
R. & N. Perkins	Monroe	Sunsbury	30	4	4
M. Hoover	Monroe	Sunsbury	30	4	4
B. Johnson	Monroe	Sunsbury	30	4	4
J. & L. Cox	Monroe	Sunsbury	30	4	4
W. & C. Ward	Monroe	Sunsbury	24 & 30	4	4
R. Perkins, Etal (c/o Pauline Perkins)	Monroe	Sunsbury	24 & 30	4	4
L. & R. Gates	Monroe	Sunsbury	24	4	4
L. & L. Burkhart	Monroe	Sunsbury	24	4	4
C. & R. Chadwell	Monroe	Sunsbury	24	4	4
Switzer Water Association, Inc. (c/o Donald Miracle)	Monroe	Sunsbury	24	4	4
R. & G. Mallett	Monroe	Sunsbury	24	4	4
D. Atkins	Monroe	Sunsbury	24	4	4

C. (9) (b) List below the following information for each surface owner of land within the proposed underground workings.

LANDOWNER	COUNTY	TOWNSHIP	SEC.	T.	R.
S. Seebach	Monroe	Sunsbury	24	4	4
D. Mallett & R. Kirby	Monroe	Sunsbury	24	4	4
S. Mullett	Monroe	Sunsbury	24	4	4
M. & K. Hoover	Monroe	Sunsbury	23	4	4
J. Van Pelt	Monroe	Sunsbury	23 & 29	4	4
P. & B. Marshall	Monroe	Sunsbury	23 & 29	4	4
P. Ciccolini, Etal	Monroe	Sunsbury	23	4	4
E. Van Dyne, (c/o K.J. Tawney)	Monroe	Sunsbury	23	4	4
C. Decker & C. Warren	Monroe	Sunsbury	22, 23, 28, & 29	4	4
R. Lovejoy (c/o M.R. Hoover)	Monroe	Sunsbury	23	4	4
M. Gates & B. Reed (c/o J.R. Reed)	Monroe	Sunsbury	23	4	4
L. & B. Dyer, Jr.	Monroe	Sunsbury	23	4	4
B. & E. Reed (c/o J.R. Reed)	Monroe	Sunsbury	23	4	4
W. Graff	Monroe	Sunsbury	23	4	4
K. & L. Neiswanger	Monroe	Sunsbury	23	4	4
E. & C. Pittman	Monroe	Sunsbury	23	4	4
G. Riley, Etal	Monroe	Sunsbury	29	4	4
J. Riley	Monroe	Sunsbury	29	4	4
R. Reed	Monroe	Sunsbury	29 & 35	4	4
E. Pittman (c/o D.R. Pittman, Jr.)	Monroe	Sunsbury	29 & 35	4	4
R. & H. Larew	Monroe	Sunsbury	28, 29, & 35	4	4
F. & J. Mankin	Monroe	Sunsbury	29	4	4
F. & M. Atkinson, Sr.	Monroe	Sunsbury	22, 28, 29, & 35	4	4
S. & P. Ackerman	Monroe	Sunsbury	29	4	4
G. & D. Mellott	Monroe	Sunsbury	35	4	4

C. (9) (b) List below the following information for each surface owner of land within the proposed underground workings.

LANDOWNER	COUNTY	TOWNSHIP	SEC.	T.	R.
I. Abbott	Monroe	Sunsbury	35	4	4
R. Kindelberger	Monroe	Sunsbury	35	4	4
J. Kindelberger	Monroe	Sunsbury	35	4	4
L. & E. Truex	Monroe	Sunsbury	35	4	4
C. & B. Datkuliak	Monroe	Sunsbury	35	4	4
D. Kindelberger, Etal	Monroe	Sunsbury	35	4	4
R. & D. Burrow (c/o R. & C. Burrow)	Monroe	Sunsbury	35	4	4
T. & P. Bier	Monroe	Sunsbury	35	4	4
E. & H. Barone	Monroe	Sunsbury	35	4	4
J. Abrigg	Monroe	Sunsbury	35	4	4
B. & E. Craig	Monroe	Sunsbury	35	4	4
W. & K. Bauer	Monroe	Sunsbury	35	4	4
C. & T. Atkinson	Monroe	Sunsbury	35	4	4
D. & K. Bauer	Monroe	Sunsbury	35	4	4
R. & J. Pratt	Monroe	Sunsbury	35	4	4
R. & D. Burrow	Monroe	Sunsbury	5	5	5
R. & C. Burrow	Monroe	Sunsbury	5	5	5
N. & D. Moore	Belmont	Washington	25	5	4
N. Perkins	Belmont	Washington	19 & 25	5	4
D. & B. Haines	Belmont	Washington	19	5	4
J. Davis	Belmont	Washington	19	5	4
L. & B. Datkuliak	Monroe	Sunsbury	5	5	5
L. & B. Datkuliak	Monroe	Sunsbury	35	4	4
R. & S. Neiswonger	Monroe	Sunsbury	5 & 35	4	4
R. & C. Moore	Monroe	Sunsbury	35	4	4
C. Howell	Monroe	Sunsbury	34	4	4
C. & R. Kindleberger	Monroe	Sunsbury	34	4	4

C. (9) (b) List below the following information for each surface owner of land within the proposed underground workings.

LANDOWNER	COUNTY	TOWNSHIP	SEC.	T.	R.
D. Mellott, Etal	Monroe	Sunsbury	34	4	4
D. Mellott, Etal	Monroe	Sunsbury	4	5	5
A. Scheiderer	Monroe	Sunsbury	4	5	5
A. Scheiderer	Monroe	Sunsbury	34	4	4
R. & D. Kindelberger	Monroe	Sunsbury	34	4	4
F. & L. Lucido	Monroe	Sunsbury	34	4	4
S. Otto	Monroe	Sunsbury	34	4	4
N. Christman	Monroe	Sunsbury	22	4	4
J. Bibler	Monroe	Sunsbury	28	4	4
F. & E. Dietz	Monroe	Sunsbury	4	5	5
R. Pittman	Monroe	Sunsbury	34	4	4
R. & D. Stephen	Monroe	Sunsbury	34	4	4
R. & A. Howell	Monroe	Sunsbury	34	4	4
D. Carpenter, L. Caldwell, & D. Ward (c/o F.A. Carpenter)	Monroe	Sunsbury	28 & 34	4	4
R.I. Miller	Monroe	Sunsbury	28	4	4
L. McDougal, Sr.	Monroe	Sunsbury	4	5	5
C. Clucas, Jr.	Monroe	Sunsbury	4 & 5	5	5
R. & B. Sheedy	Monroe	Sunsbury	34	4	4
V. & D. Boughner	Monroe	Sunsbury	28 & 34	4	4
B. & L. Baker	Monroe	Sunsbury	5	5	5
M. Shrewsbury	Monroe	Sunsbury	22	4	4
B. Followay	Monroe	Sunsbury	22	4	4
G. Nolan II & W. Arnold	Monroe	Sunsbury	22	4	4
J. & W. Arnold	Monroe	Sunsbury	22	4	4
D. Tubaugh, Etal (c/o Harry Tubaugh)	Monroe	Sunsbury	22	4	4

C. (9) (b) List below the following information for each surface owner of land within the proposed underground workings.

LANDOWNER	COUNTY	TOWNSHIP	SEC.	T.	R.
D. & B. Crall	**Monroe**	**Sunsbury**	**4 & 5**	**5**	**5**
S. & B. Brandon, Jr.	**Monroe**	**Sunsbury**	**30**	**4**	**4**
J. & K. Kernen, Jr.	**Monroe**	**Sunsbury**	**24**	**4**	**4**

D. (7) Will operations in the permit area conducted under this permit affect land within three hundred feet of any occupied dwelling? ____ Yes, ____ No. If yes, list the name of the owner(s) in the space below and submit Attachment 10 or proof of valid existing right.

N/A, NO PERMIT AREA

(8) Will operations in the permit area conducted under this permit affect land within three hundred feet of any public building, school church, community or institutional building, or public park? Yes, ____ No. If yes, submit proof of valid existing right.

N/A, NO PERMIT AREA

(9) Will operations in the permit area conducted under this permit affect land within one hundred feet of a cemetery? ____ Yes, ____ No If yes, submit proof of valid existing right or appropriate authorization to relocate the cemetery.

N/A, NO PERMIT AREA

(10) Will operations conducted during this permit result in the extension of any part of the pit within fifty feet of horizontal distance to any adjacent land or water in which the applicant does n own either the surface or mineral rights? ____ Yes, ____ No. If ye list below the name(s) of the adjacent owner(s) and submit Attachment 11.

N/A, NO PERMIT AREA

E. AREAS WHERE MINING IS PROHIBITED OR LIMITED -**Permit and Shadow Area**

Are there areas within the proposed permit area, shadow area, or adjacent areas designated unsuitable for coal mining operations under rule 1501:13-3-07 of the Administrative Code or under study for designation in an administrative proceeding under this rule? ____ Yes, **X** No.

(1) If yes to the item above, did the applicant make substantial legal and financial commitments in the proposed areas prior to January 4, 1977? ____ Yes, ____ No.

(2) If yes to item (1) above, submit as an addendum to the permit application information supporting the assertions that the commitments were made prior to January 4, 1977.

F. PERMIT TERM AND EXTENT -**Permit and Underground Workings**

(1) Anticipated/actual date for:
(a) Starting mining operations **JANUARY 1, 2005**

(b) Terminating mining operations **JANUARY 1,2010**

(2) Does the applicant propose a permit term in excess of five (5) years? _ Yes, **X** No. If yes, submit an addendum with the information required by 1501:13-4-03(E)(3), Ohio Administrative Code.

(3) Indicate the following acreage figures:
(a) Total Acres **N/A** (Permit area)
(b) Total Acres **3605.5** (Underground Workings)

(4) Horizontal extent of underground workings over life of permit in acres:
(a) Full coal Recovery **2555.0**
(b) Room and Pillar **N/A**

G. PUBLIC NOTICE-**Permit and Shadow Area**

(1) In the space below, provide the name and address of the public office where a complete copy of this permit application is to be filed.
SEE ADDENDUM TO PAGE 15(G)(2)

(2) In the space below, list name and address of the newspaper and submit an addendum providing the text of the advertisement that is to be published in a newspaper of general circulation in the locality of the proposed operation. Note: The advertisement is to provide the information required by paragraph (A) of rule 1501:13-5-01 of the Administrative Code.
THE TIMES LEADER
200 SOUTH 4TH STREET
MARTINS FERRY, OH 43935

MONROE COUNTY BEACON
103 E. COURT STREET
WOODSFIELD, OHIO 43793

ADDENDUM TO PART 1, PAGE 15, ITEM G(2)
AMERICAN ENERGY CORPORATION

PUBLIC NOTICE

Pursuant to Section 1501:13-5-01 of the Ohio Administrative Code, notice is hereby given that AMERICAN ENERGY CORPORATION, 43521 Mayhugh Hill Road, Beallsville, has submitted an Adjacent Area Application to the Ohio Department of Natural Resources, Division of Mineral Resources Management.

AMERICAN ENERGY CORPORATION, 43521 Mayhugh Hill Road, Beallsville, Ohio, 43716 has submitted an underground coal mining application designated as D-0425-5 to the Ohio Department of Natural Resources, Division of Mineral Resources Management. The proposed underground application area is located in sections 4, 5, in T-5 R-5, and sections 22, 23, 24, 28, 29, 30, 34, 35 T-4 R-4 in Sunsbury Township, Monroe County, and sections 25 and 19 in T-5 R-4 Washington Township, Belmont County. The area is located in Cameron and Woodsfield Quads 7 – ½ minute U. S. G. S. Quadrangle maps 4.3 miles along State Route 556, immediately South and East of Beallsville, Ohio. The proposed underground workings encompass 3604.0 Acres. Coal in this underground area will be removed using full coal recovery, also know as the longwall mining method. The Adjacent Area Application is on file at the Belmont County Courthouse, Recorders Office, Main Street, St.Clairsville, Ohio, 43950, and Monroe County Courthouse, Recorders Office, 101 North Main Street, Woodsfield, Ohio, 43793 for public viewing. Written comments or requests for informal conference may be sent to the Chief, Department of Natural Resources, Division of Mineral Resources Management, 1855 Fountain Square Court, Columbus, Ohio 43224, within thirty (30) days of the last date of publication of this notice.

PROOF OF PUBLICATION

The State of Ohio
County of Belmont, ss:

The undersigned, being sworn, says that he or she is an employee of Eastern Ohio Newspapers, Inc., A Corporation, publisher of the Times Leader a newspaper published in Martins Ferry, Belmont County, Ohio, each day of the week and of general circulation in said city and county; that it is a newspaper meeting the requirements of sections 7.12 and 5721.01 Ohio Revised Code as amended effective September 24, 1957; that affiant has custody of the records and files of said newspaper; and that the advertisement of which the annexed is a true copy, was published in said newspaper on each of the days in the month and year stated, as follows:

Aug 31, Sept 7, 14, 21 2004

Audrey Blanco

Subscribed by Affiant and sworn to before me, this 21st day of Sept, A.D. 2004.

Rebecca L Anderson
Notary Public

NOTARIAL SEAL STATE OF OHIO

REBECCA L. ANDERSON
Notary Public, State of Ohio
My Commission Expires Nov. 25, 2006

Printer's Fee $ 385.32

Notary's Fee $_____

The Times Leader
Martins Ferry, Ohio

Addendum to Part 1, Page 15, Item G(2)
American Energy Corporation

Public Notice

Pursuant to Section 1501:13-5-01 of the Ohio Administrative Code, notice is hereby given that AMERICAN ENERGY CORPORATION, 43521 Mayhugh Hill Road, Beallsville, has submitted an Adjacent Area Application to the Ohio Department of Natural Resources, Division fo Mineral Resources Management.

AMERICAN ENERGY CORPORATION, 43521 Mayhugh Hill Road, Beallsville, Ohio, 43716 has submitted an underground coal mining application designated as D-0425-5 to the Ohio Department of Natural Resources, Division of Mineral Resources Management. The proposed underground application area is located in sections 4, 5, in T-5 R-5, and sections 22, 23, 24, 28, 29, 30, 34, 35 T-4 R-4 in Sunsbury Township, Monroe County, and sections 25 and 19 in T-5 R-4 Washington Township, Belmont County. The area is located in Cameron and Woodsfield Quads 7-½ minute U.S.G.S. Quadrangle maps 4.3 miles along State Route 556, immediately South and East of Beallsville, Ohio. The proposed underground workings encompass 3604.0 Acres. Coal in this underground area will be removed using full coal recovery, also know as the longwall mining method. The Adjacent Area Application is on file at the Belmont County Courthouse, Recorders Office, Main Street, St. Clairsville, Ohio, 43950, and Monroe County Courthouse, Recorders Office, 101 North Main Street, Woodsfield, Ohio, 43793 for public viewing. Written comments or requests for informal conference may be sent to the Chief, Department of Natural Resources, Division of Mineral Resources Management, 1855 Fountain Square Court, Columbus, Ohio 43224, within thirty (30) days of the last date of publication of this notice.

TL Adv.- 4 Tues.- Aug. 31, Sept. 7, 14, 21

ADDENDUM TO PART 1, PAGE 15, ITEM G(2)
AMERICAN ENERGY CORPORATION
PUBLIC NOTICE

Pursuant to Section 1501:13-5-01 of the Ohio Administrative Code, notice is hereby given that AMERICAN ENERGY CORPORATION, 43521 Mayhugh Hill Road, Beallsville, has submitted an Adjacent Area Application to the Ohio Department of Natural Resources, Division of Mineral Resources Management.

AMERICAN ENERGY CORPORATION, 43521 Mayhugh Hill Road, Beallsville, Ohio, 43716 has submitted an underground coal mining application designated as D-0425-5 to the Ohio Department of Natural Resources, Division of Mineral Resources Management. The proposed underground application area is located in sections 4,5, in T-5 R-5 and sections 22, 23, 24, 28, 29, 30, 34, 35 T-4 R4 in Sunsbury Township, Monroe County, and sections 25 and 19 in T-5 R-4 Washington Township, Belmont County. The area is located in Cameron and Woodsfield Quads 7 1/2 minute U.S. G.S. Quadrangle maps 1.4 miles along SR 556 immediately South and East of Beallsville, Ohio. The proposed underground workings encompass 3604.0 acres. Coal in this underground area will be removed using full coal recovery, also known as the longwall mining method. The Adjacent Area Application is on file at the Belmont County Courthouse, Recorder's Office, Main Street, St. Clairsville, Ohio 43950 and Monroe County Courthouse, Recorder's Office, 101 North Main Street, Woodsfield, Ohio 43793 for public viewing. Written comments or requests for informal conference may be sent to the Chief, Department of Natural Resources, Division of Mineral Resources Management, 1855 Fountain Square Court, Columbus, Ohio 43224, within thirty (30) days of the last date of publication of this notice.

Sept. 9, 16, 23, 30, 2004

I, Arlean Selvy do solemnly swear that the notice, a copy of which is hereto attached, was published for four (4) consecutive weeks on/or after September 9, 2004 in

MONROE COUNTY BEACON
a newspaper of general circulation in
Monroe County, Ohio

Arlean Selvy, publisher

Printer's Fee $290.00

~~~~~~~~~~~~~~~~

Sworn to and subscribed before me this 12th day of October, 2004.

Sheila J. McKee

Sheila J. McKee
Notary Public, State of Ohio
My Commission Expires 11-08-05
~~~~~~~~~~~~~~~~

PART 2 ENVIRONMENTAL RESOURCES INFORMATION

CULTURAL, HISTORIC, AND ARCHEOLOGICAL INFORMATION -**Permit and Planned Subsidence Area**

(1) Are there any cultural or historic resources or structures listed or eligible for listing on the National Register of Historic Places within the proposed permit or planned subsidence area? **X** Yes, No. If yes, submit an addendum describing the resources and structures including the location and submit Attachment 27 or 27A as appropriate.
SEE ATTACHMENT 27A AND ADDENDA

(2) Are there any known archeological sites within the proposed permit or planned subsidence area? Yes, X No. If yes, submit an addendum describing the site including the location and submit Attachment 27 or 27A as appropriate.

(3) If applicable, based upon the review of the proposed planned subsidence areas and the completed Attachment 27A for the initial six months of projected mining, have any properties listed or eligible for listing on the National Register of Historic Places been identified? Yes, ____No. If yes, submit an addendum listing each property identified.
SEE ATTACHMENT 27A AND ADDENDA

(4) Submit an addendum indicating the method to be used to identify historic properties on planned subsidence areas as mining progresses.
SEE ADDENDUM TO PAGE 16, A(4)

B. GEOLOGY DESCRIPTION - **Permit and Shadow Area**

(1) Submit an addendum describing the geology within the proposed permit area and shadow area down to and including the first stratum below the lowest coal seam to be mined or any aquifer below the lowest coal seam to be mined which may be adversely affected by mining. The description shall also include information on the areal and structural geology of the permit and shadow area and any other geologic parameters which may influence the probable hydrologic consequences and protection of the hydrologic balance from material damage outside of the permit area.
SEE ORIGINAL PERMIT D-0425 AND ADDENDUM TO PART 2, PAGE 16, ITEM B(1)

(2) Submit an addendum describing how the areal and structural geology may affect the occurrence, availability, movement, quantity, and quality of potentially affected surface and ground waters per paragraph (C) of rule 1501:13-4-13 of the Administrative Code.
SEE ORIGINAL PERMIT D-0425 AND ADDENDUM TO PART 2, PAGE 16, ITEM B(2)

2/89

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
Planned Subsidence Areas - Underground Mining Operations

ATTACHMENT 27A
(HISTORIC AND PREHISTORIC PROPERTIES)

1. Applicant's Name AMERICAN ENERGY CORPORATION Permit # D-0425-5

   Address 43521 MAYHUGH HILL ROAD, TWP. ROAD 88

   City BEALLSVILLE State OHIO Zip 43716

2. Contact Person MELANIE HOMAN Phone (740) 926-9152

3. Location and Acreage Information

   County BELMONT / MONROE Township WASHINGTON / SUNSBURY

   Section(s) / Lots 19 & 25 Washington Twp., T- 5 R- 4
   22, 23, 24, 28, 29, 30, 34 & 35 Sunsbury Twp. T-4, R-4
   4 & 5 Sunsbury Twp., T- 4 R- 5

   USGS Quadrangle CAMERON & WOODSFIELD Acreage 3604

4. Full Coal Recovery Area Map Attached: (USGS Quadrangle with full coal recovery area delineated)

5. Historic and Prehistoric Structures:

   Definitions

   A historic or prehistoric structure is a work made up on interdependent And interrelated parts in a definite pattern of organization. Constructed by humans, and 50 years or older, it is usually an engineering project.

   Types

   Historic structures include, but are not limited to dwellings, buildings, barns, farmstead outbuildings, bridges, culverts, churches, schools, halls, iron furnaces, (and associated buildings), canals, forts, abandoned coal mine buildings, mine entrances, tipples, and related structures, etc.

   Prehistoric structures include, but are not limited to, earthworks and mounds.

List all known historic and prehistoric structures below and locate eac one on the map to be sent to the SHPO including corresponding labeled black and white front and rear photographs of each structure. Attach addendum, if necessary.

Structure Type	Construction Date	Map Reference	Photo# Front	Photo# Rear

SEE ADDENDUM TO ATTACHMENT 27A

6. Previous Historic and/or Archeological Surveys: (describe any surveys known to the applicant on the planned subsidence areas)

NONE KNOWN TO APPLICANT

7. **SHPO please send this form to:**

Dr. Jeffrey C. Reichwein
Division of Mines and Reclamation
Fountain Square, Building B-3
Columbus, OH 43224

FOR USE BY THE STATE HISTORIC PRESERVATION OFFICE ONLY

(check appropriate spaces)

A. _____ This is a recommendation for an archeological survey of the proposed full coal recovery area based on the following reasons (attached addendum, if necessary):

A SHPO review of the area shown on the map has provided a listing below of all known historic and prehistoric properties listed and eligible for listing on the "National Register of Historic Places" and known historic and prehistoric sites on the permit and adjacent areas (in a 1.5 mile radius). The listing includes, when appropriate, those historic and prehistoric structures identified by the applicant in items 5. and 6. above.

Listed and Eligible National Register Sites

Site Name	(#)	Type	Proposed Area	Adjacent Area

Known Historic and Prehistoric Sites

Site Name	(#)	Type	Proposed Area	Adjacent Area

B. _____ A SHPO review of the area shown on the application map and information contained in this attachment finds that the proposed mining does not have a reasonable probability of affecting and properties listed or eligible for listing on the "National Register of Historic Places." Therefore, no further coordination will be necessary with this office unless the scope of the proposed application area changes.

State Historic Preservation Officer

SHPO #

Date

ADDENDUM TO PART 2, PAGE 16, A(4)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

METHOD USED TO IDENTIFY HISTORIC PROPERTIES AS MINING PROGRESSES

Potential historic properties have been identified in Attachment 27A submitted with this application. Properties that are deemed eligible for listing on the National Register for Historic Places will be identified by SHPO and will be noted as such by AEC. As mining progresses, AEC will identify properties to be undermined six months prior to undermining, and proper mitigative efforts will be implemented.

ADDENDUM TO ATTACHMENT 27A
COMPANY: AEC
MINE: Century Mine
PERMIT: Area 5

STRUCTURE TYPE	CONST. DATE	MAP REF	PHOTO FRONT	PHOTO BACK	OWNER
Barn	1950's	1-5	1-1	1-2	R & D Burrow
House	Early 1900	2-5	2-3	2-4	D. Kindleberger
Garage	1958	2-5	2-5	2-6	"
Shed	1900's	2-5	2-7	2-8	"
Outbuilding 1	1900's	2-5	2-9	2-10	"
Outbuilding 2	1900's	2-5	2-11	2-12	"
Barn	1900's	3-5	3-13	3-14	C & B Datkuliac
Machine Shed	1900's	3-5	3-15	3-16	"
Chicken Coupe	1900's	3-5	3-17	3-18	"
Outbuilding	1900's	3-5	3-19	3-20	"
Cow Barn	1900's	4-5	4-21	4-22	R. Kindleberger
Outbuilding	1900's	4-5	4-23	4-24	"
House	1890's	5-5	5-25	5-26	J. Johnson
Barn 1	1890's	5-5	5-27	5-28	"
Barn 2	1890's	5-5	5-29	5-30	"
Summer Kitchen	1950's	6-5	6-31	6-32	R. Perkins
Privy	1950's	6-5	6-33	6-34	"
Barn	1950's	6-5	6-35	6-36	"
Outbuilding 1	1950's	6-5	6-37	6-38	"
Outbuilding 2	1950's	6-5	6-39	6-40	"
Outbuilding 3	1950's	6-5	6-41	6-42	"
Outbuilding 4	1950's	6-5	6-43	6-44	"
Garage	1950's	7-5	7-45	7-46	D. Mallett & R. Kirby
Barn	1900's	8-5	8-47	8-48	R & G Mallett
Shed 1	1900's	8-5	8-49	8-50	"
Shed 2	1900's	8-5	8-51	8-52	"
Outbuilding 1	1950's	9-5	9-53	9-54	R & M Heller
Outbuilding 2	1950's	9-5	9-55	9-56	"
Barn	1950's	10-5	10-57	10-58	S. Secbach
Outbuilding 1	1950's	10-5	10-59	10-60	"
Outbuilding 2	1950's	10-5	10-61	10-62	"
Outbuilding 3	1950's	10-5	10-63	10-64	"

ADDENDUM TO ATTACHMENT 27A
AMERICAN ENERGY CORP.
CENTURY MINE
PERMIT D-0425-5

House	1900's	11-5	11-65	11-66	S. Mullett
Barn	1900's	11-5	11-67	11-68	"
Spring House	1900's	11-5	11-69	11-70	"
Outbuilding 1	1900's	11-5	11-71	11-72	"
Outbuilding 2	1900's	11-5	11-73	11-74	"
Outbuilding 3	1900's	11-5	11-75	11-76	"
House	1884	12-5	12-77	12-78	J. Van Pell
Barn	1894	12-5	12-79	12-80	"
Machine Shed	1894	12-5	12-81	12-82	"
Chicken Coupe	1894	12-5	12-83	12-84	"
Hog Shed	1894	12-5	12-85	12-86	"
Shed 1	1894	12-5	12-87	12-88	"
Shed 2	1894	12-5	12-89	12-90	"
Outbuilding 1	1894	12-5	12-91	12-92	"
Garage	1894	12-5	12-93	12-94	"
Machine Shop	1894	12-5	12-95	12-96	"
Outbuilding 2	1894	12-5	12-97	12-98	"
House 1	1900's	13-5	13-99	13-100	M. Gates & B. Reed
Coal Reservoir	1900's	13-5	13-101	13-102	"
Barn 1	1900's	13-5	13-103	13-104	"
Shed	1900's	13-5	13-105	13-106	"
Privy	1900's	13-5	13-107	13-108	"
Ruins	1900's	13-5	13-109	Blank	"
House 2	1900's	13-5	13-110	13-111	"
Barn 2	1900's	13-5	13-112	13-113	"
Cow Barn	1900's	13-5	13-114	13-115	"
House 1	1890's	14-5	14-116	14-117	C. Decker & C. Warren
Barn & Silo	1890's	14-5	14-118	14-119	"
Machine Shed 1	1900's	14-5	14-120	14-121	"
Shed 1	1900's	14-5	14-122	14-123	"
House 2	1800's	14-5	14-124	14-125	"
Log House	1800's	14-5	14-126	14-127	"
Shed 2	1900's	14-5	14-128	14-129	"
Barn	1800's	14-5	14-130	14-131	"
Outbuilding	1900's	15-5	15-132	15-133	M. Shrewsbury
Corn Crib	1900's	15-5	15-134	15-135	"
Well House	1900's	15-5	15-136	15-137	"
Barn	1900's	16-5	16-138	16-139	Ciccolini
House	1900's	17-5	16-140	17-141	Flynn
House	1939	18-5	16-142	18-143	I. Abbott

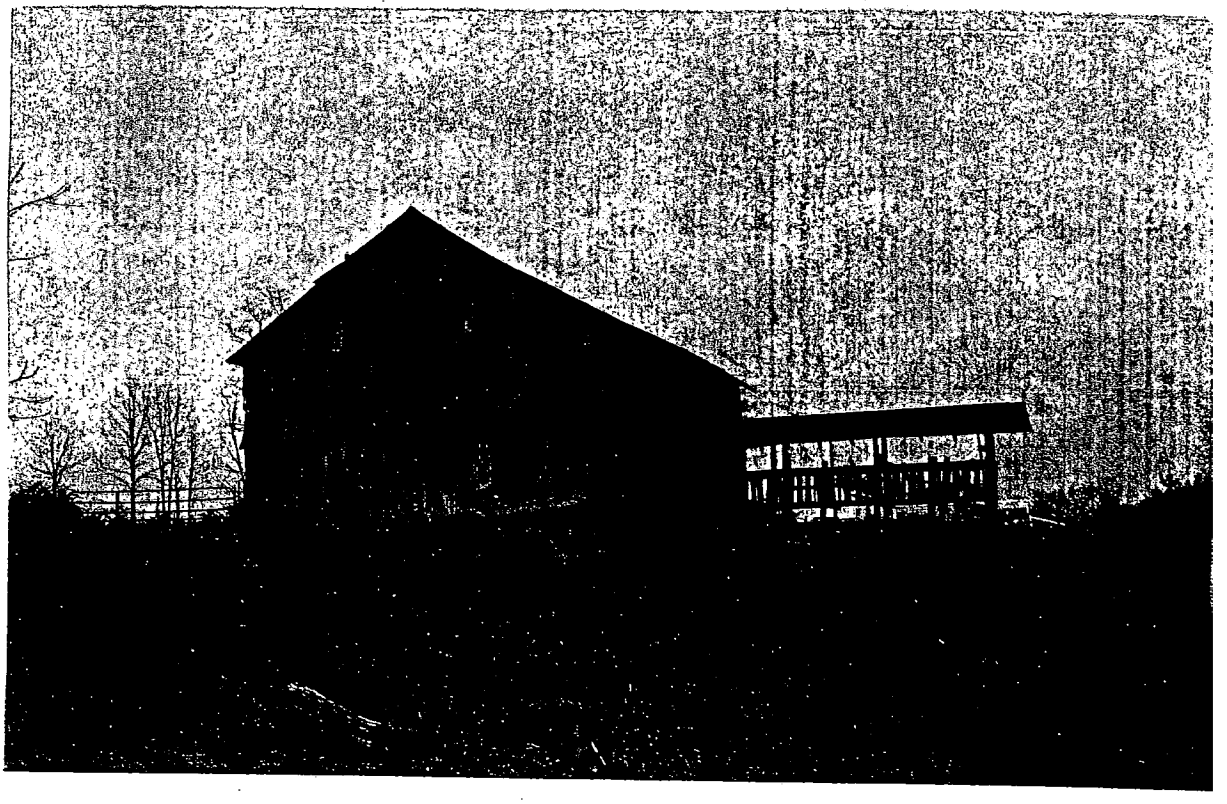
ADDENDUM TO ATTACHMENT 27A
AMERICAN ENERGY CORP.
CENTURY MINE
PERMIT D-0425-5

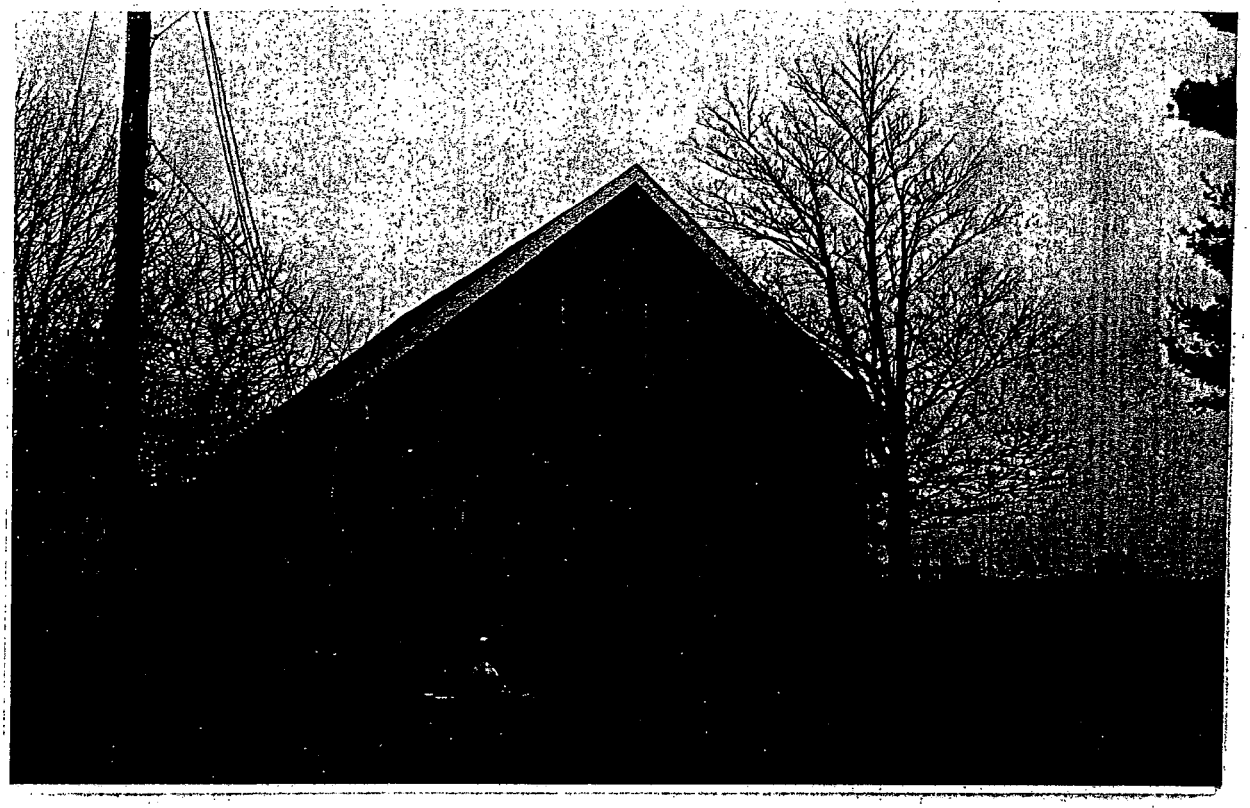
Barn	1900's	19-5	19-144	19-145	S. & P. Ackerman
House	1900's	19-5	19-146	19-147	"
Privy	1900's	19-5	19-148	19-149	"
Cow Barn	1800's	20-5	20-150	20-151	R. Reed
House	1800's	20-5	20-152	20-153	"
Barn	1800's	20-5	20-154	20-155	"
Hay Barn	1900's	20-5	20-156	20-157	"
Shed	1900's	20-5	20-158	20-159	"
Outbuilding	1900's	20-5	20-160	20-161	"
Machine Shed 1	1900's	20-5	20-162	20-163	"
Machine Shed 2	1900's	20-5	20-164	20-165	"
House	1900's	21-5	21-166	21-167	E. Pittman
Machine Shed	1900's	21-5	21-168	21-169	"
Barn	1900's	21-5	21-170	21-171	"
Shed	1900's	21-5	21-172	21-173	"
House	1900's	22-5	22-174	22-175	F. & M. Atkinson
Barn	1900's	22-5	22-176	22-177	"
Garage	1900's	22-5	22-178	22-179	"
Shed	1900's	22-5	22-180	22-181	"
Outbuilding	1900's	22-5	22-182	22-183	"

AEC 06193

1-1 Barn Front

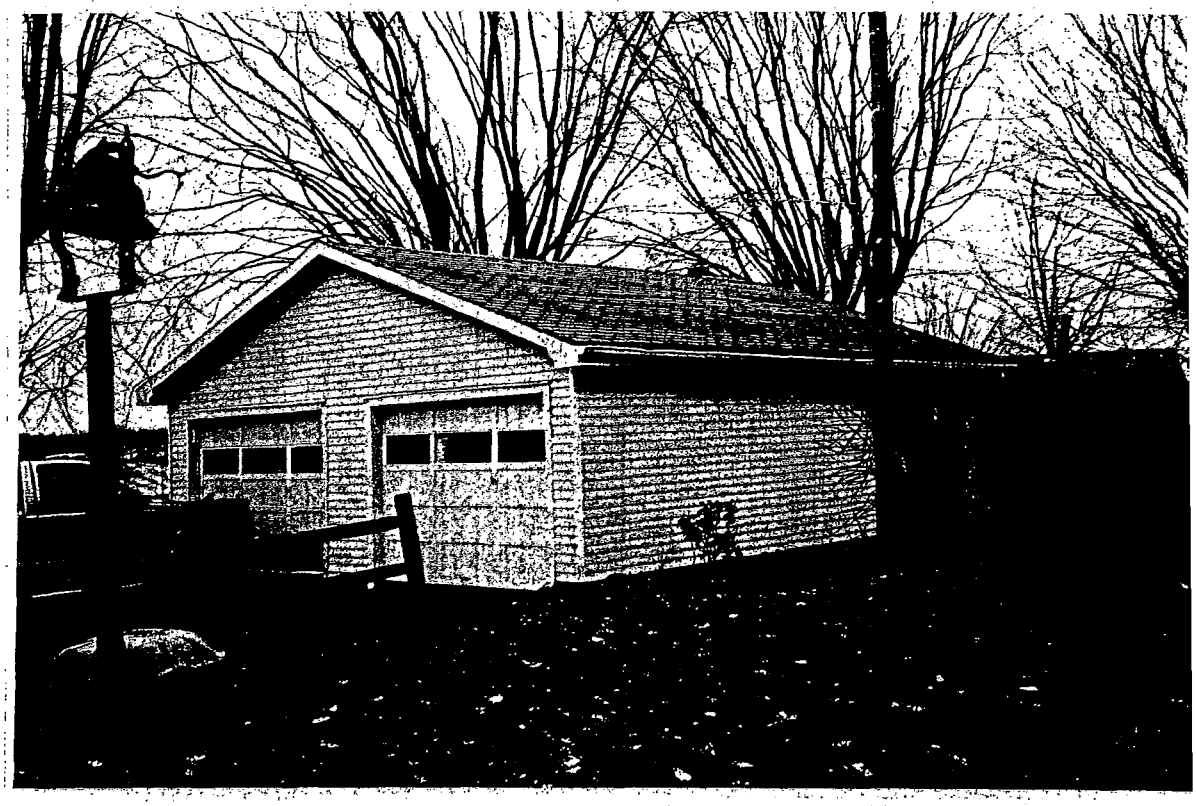
1-2 Barn Back





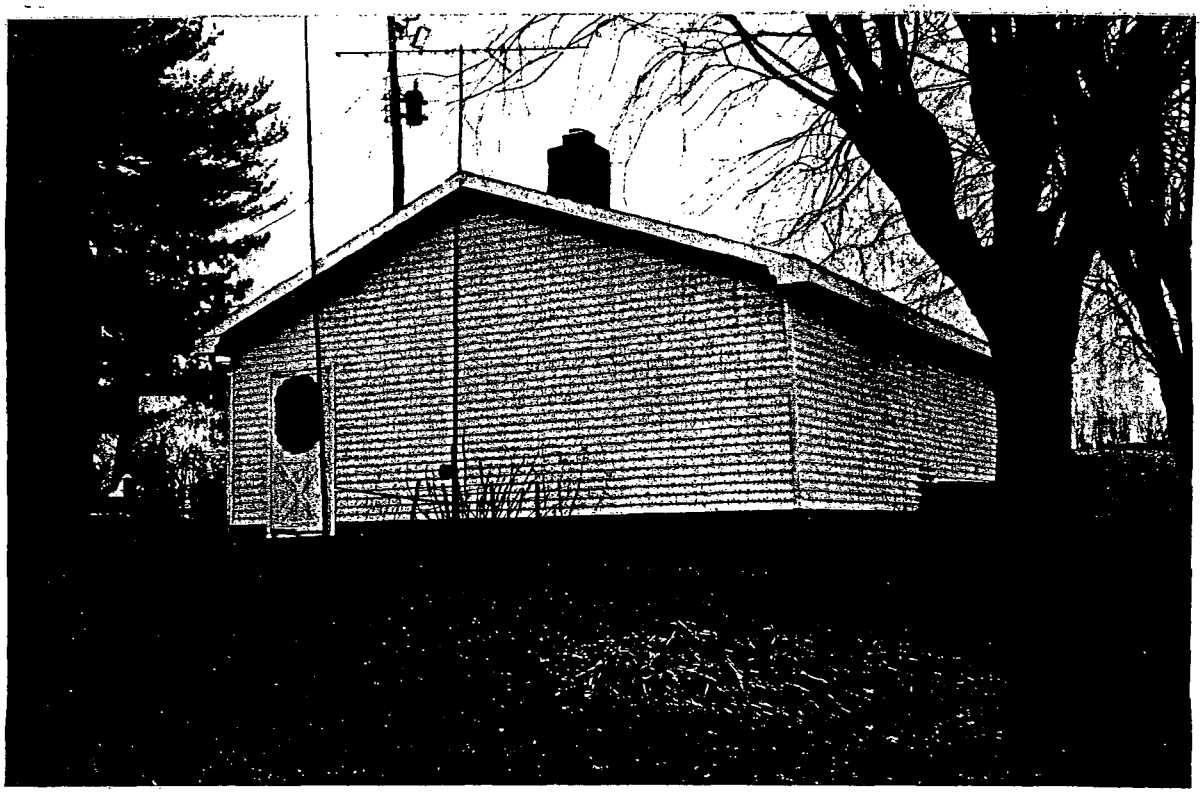
2-3 House Front

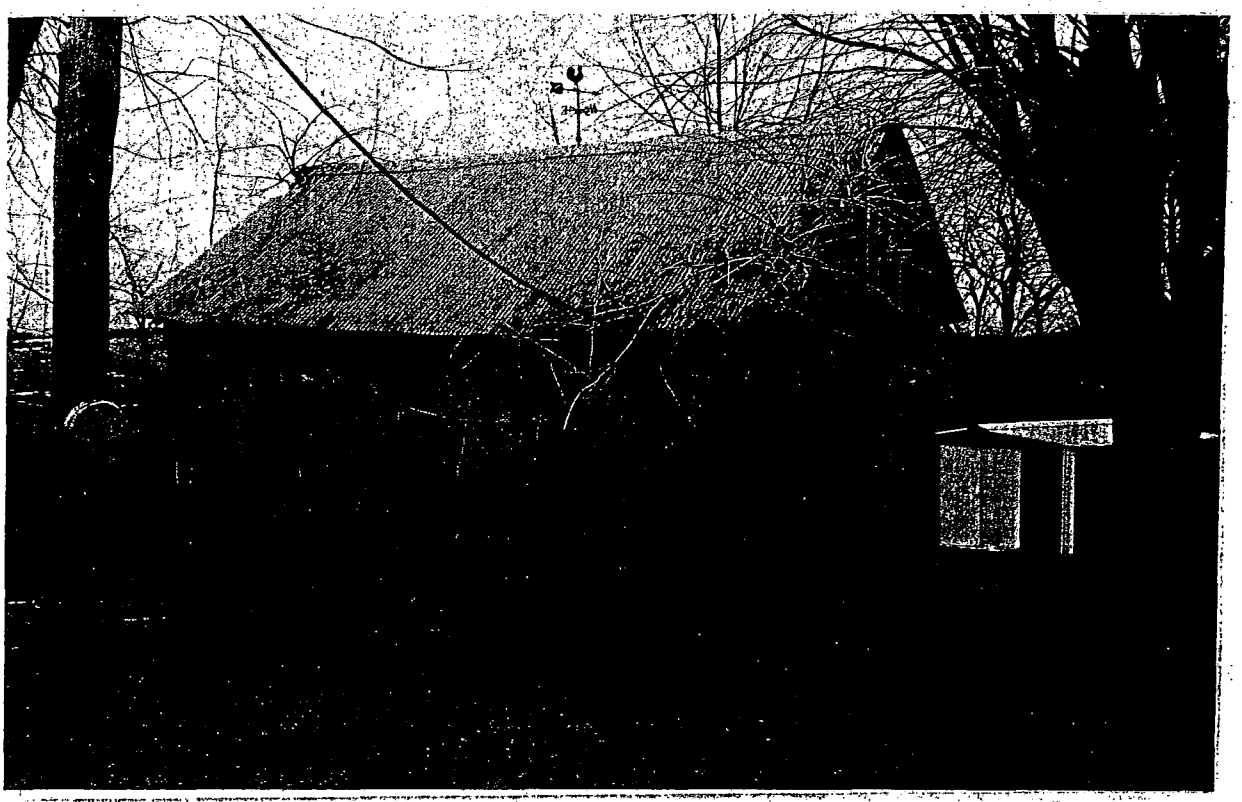
2-4 House Back



2-5 Garage Front

2-6 Garage Back



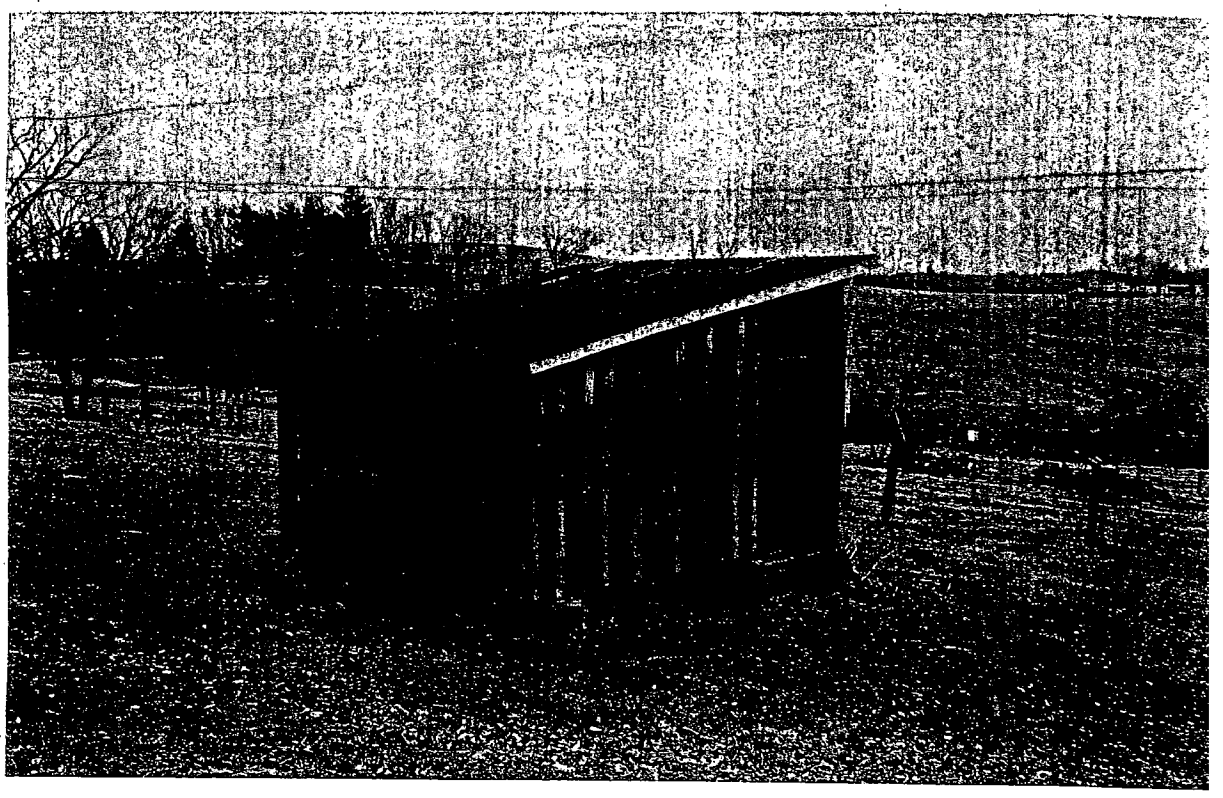


2-7 Shed Front

2-8 Shed Back

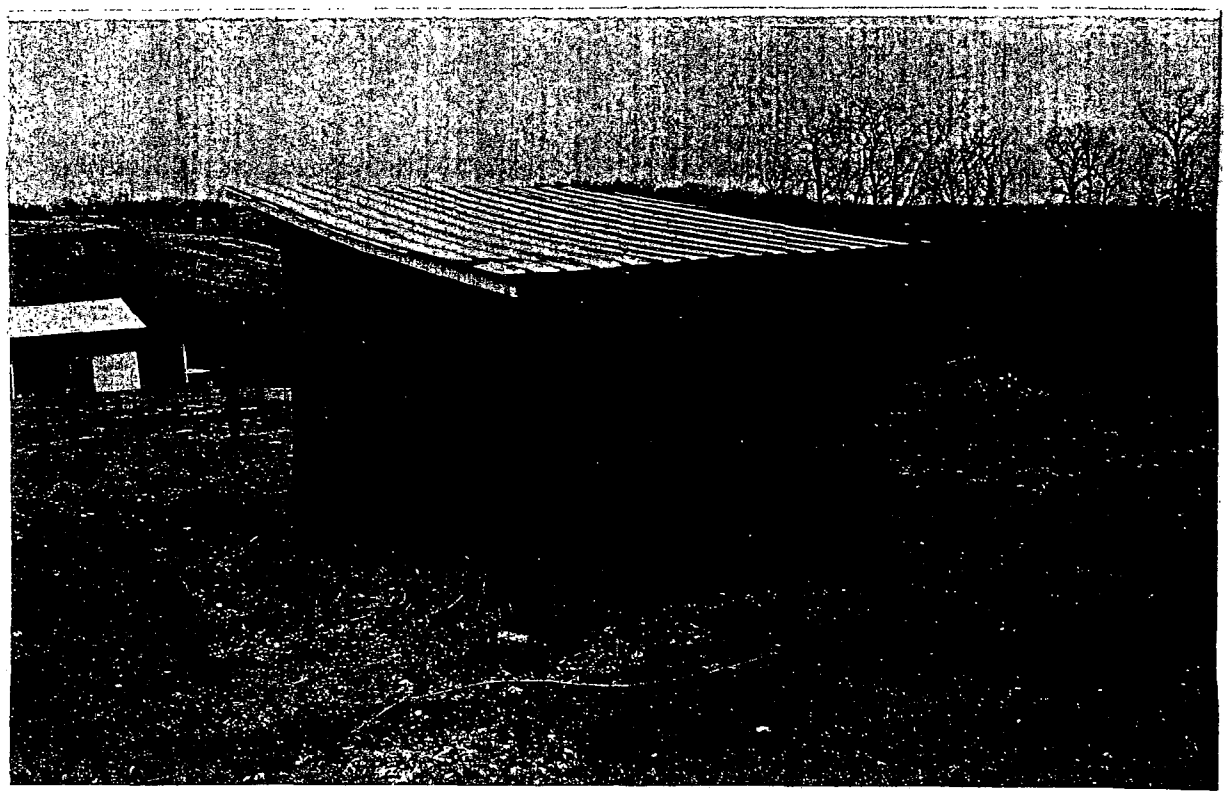
2-9 Outbuilding 1 Front

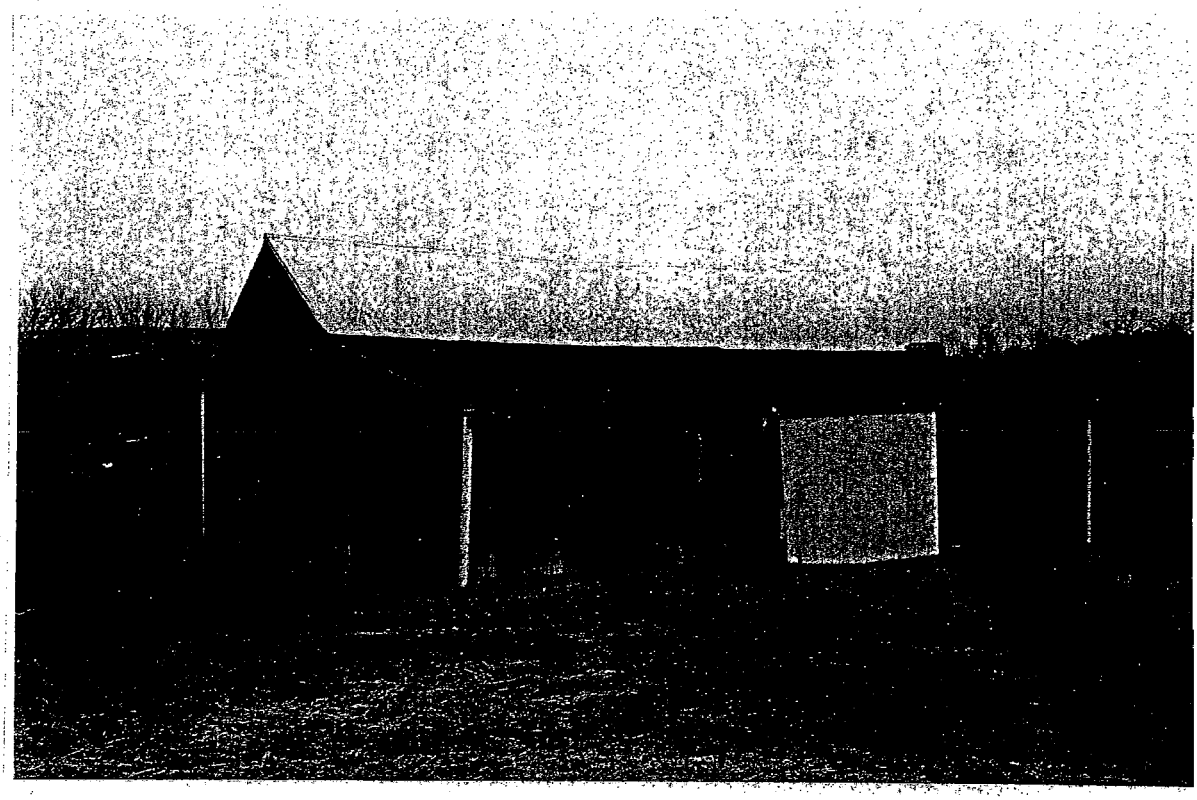
2-10 Outbuilding 1 Back



2-11 Outbuilding 2 Front

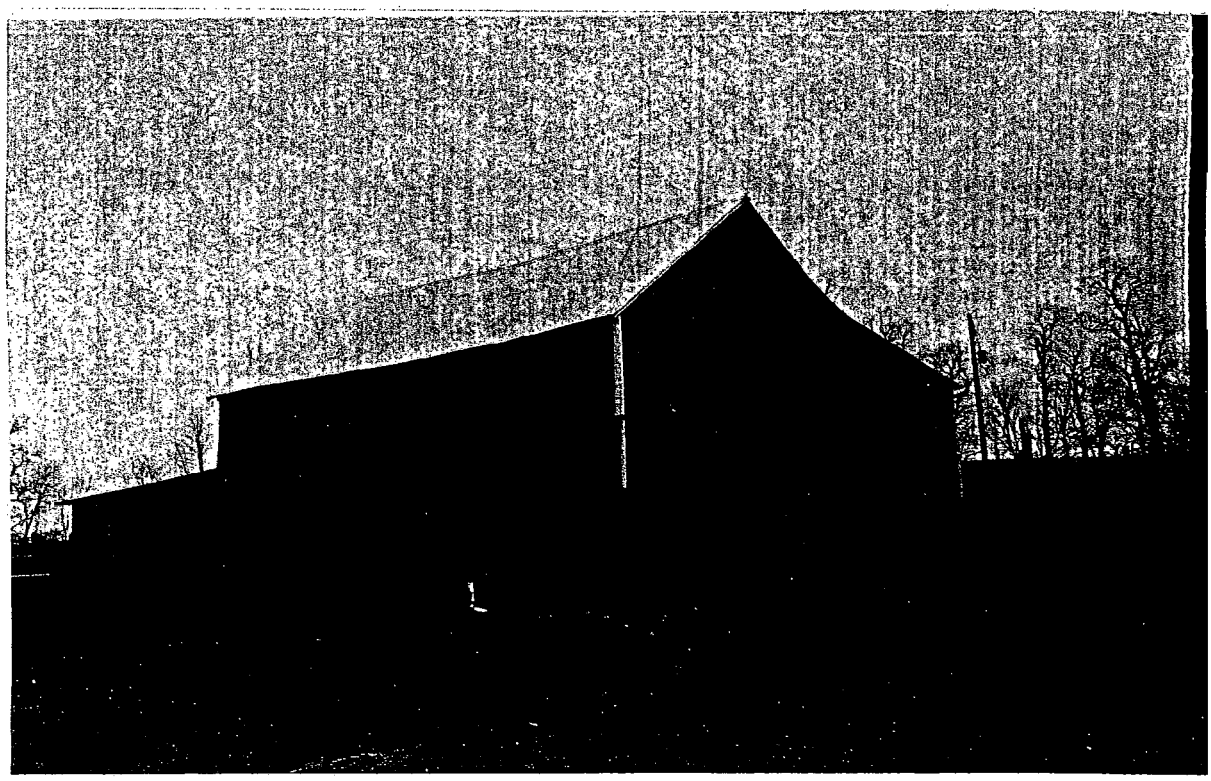
2-12 Outbuilding 2 Back

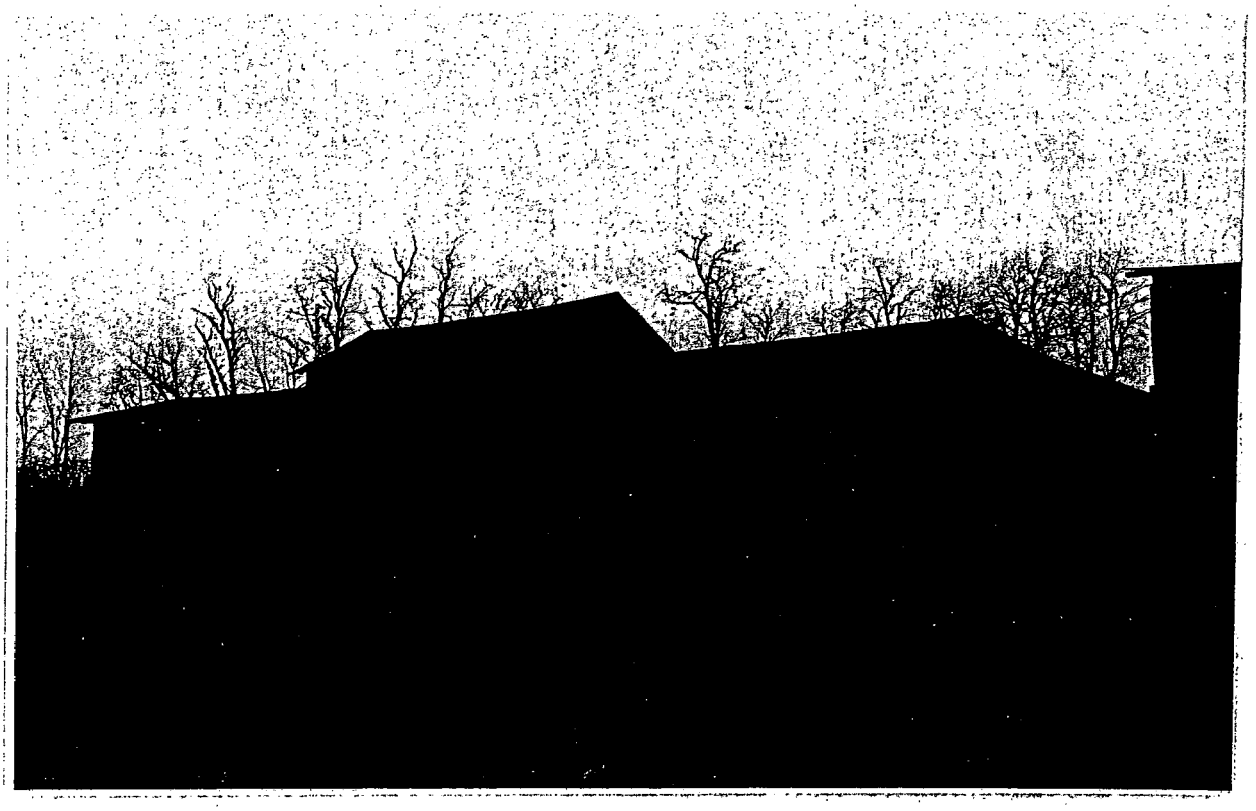




3-13 Barn Front

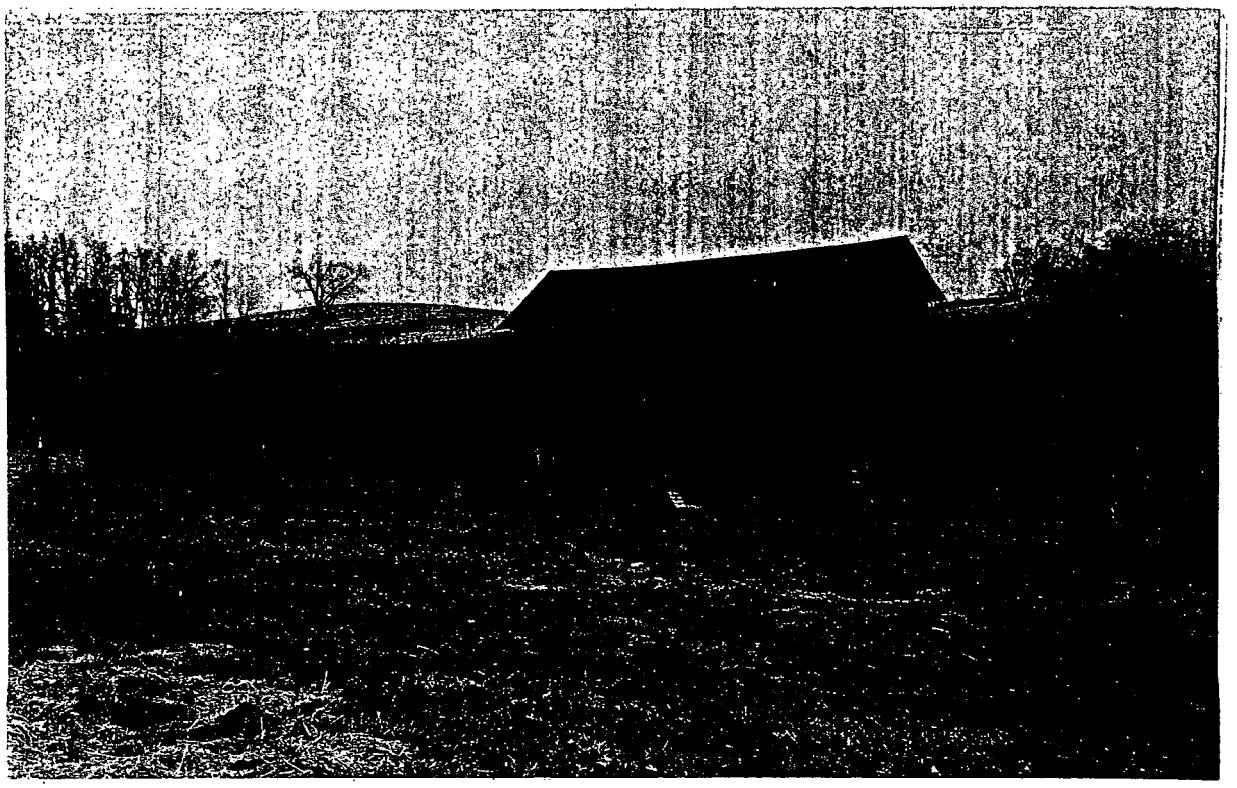
3-14 Barn Back





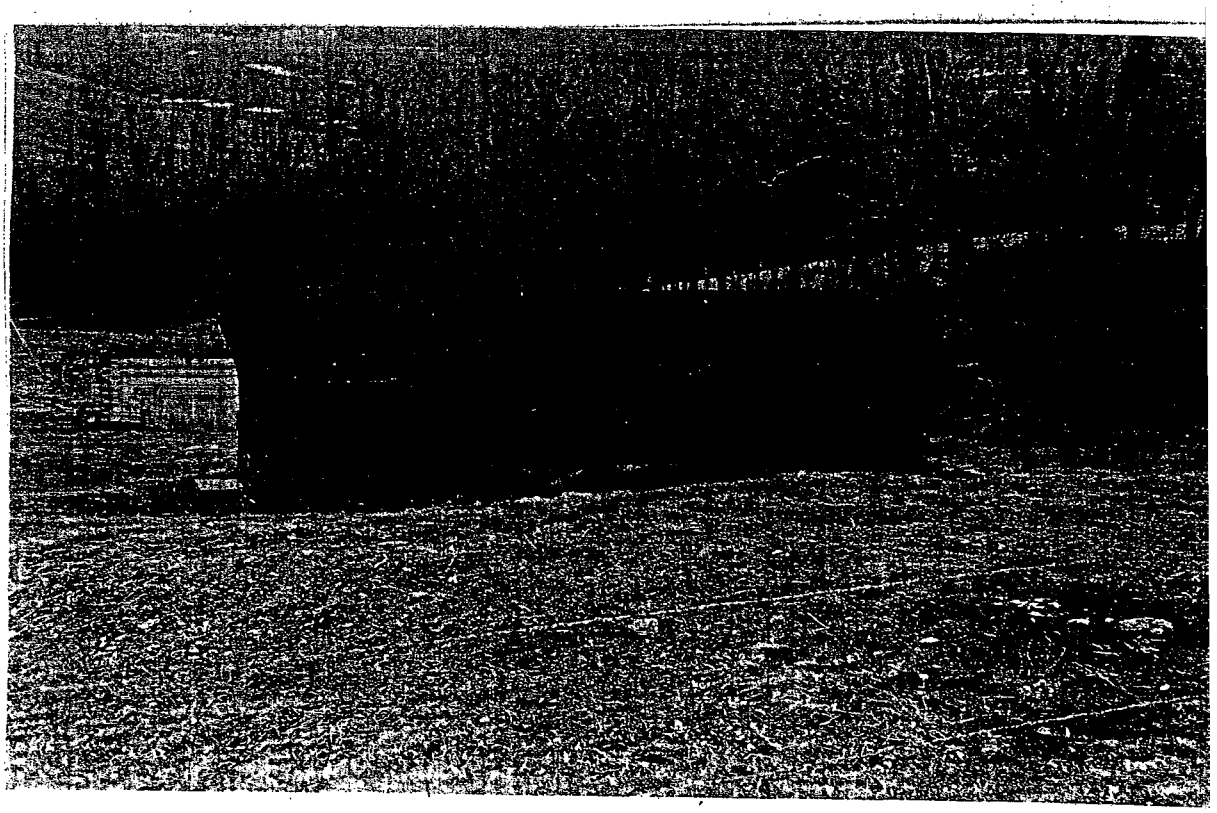
3-15 Machine Shed Front

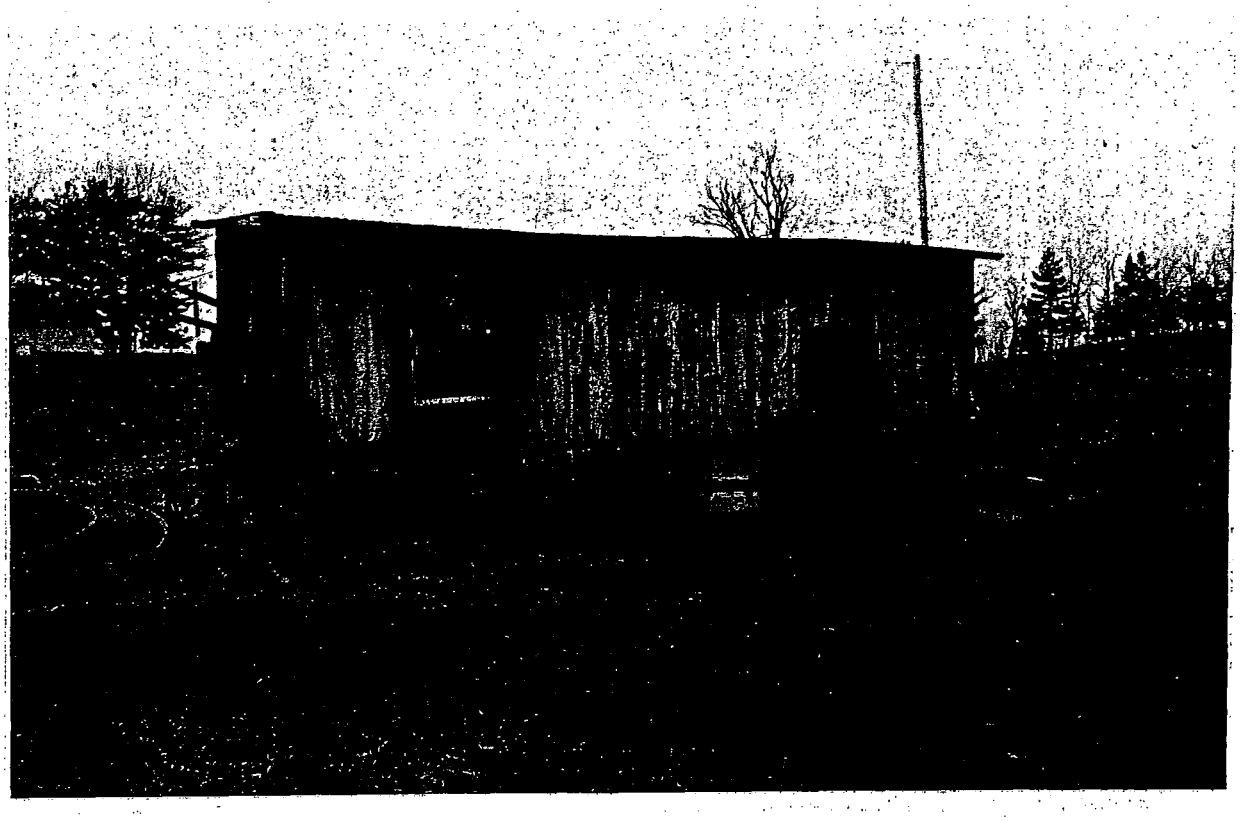
3-16 Machine Shed Back



3-17 Chicken Coupe Front

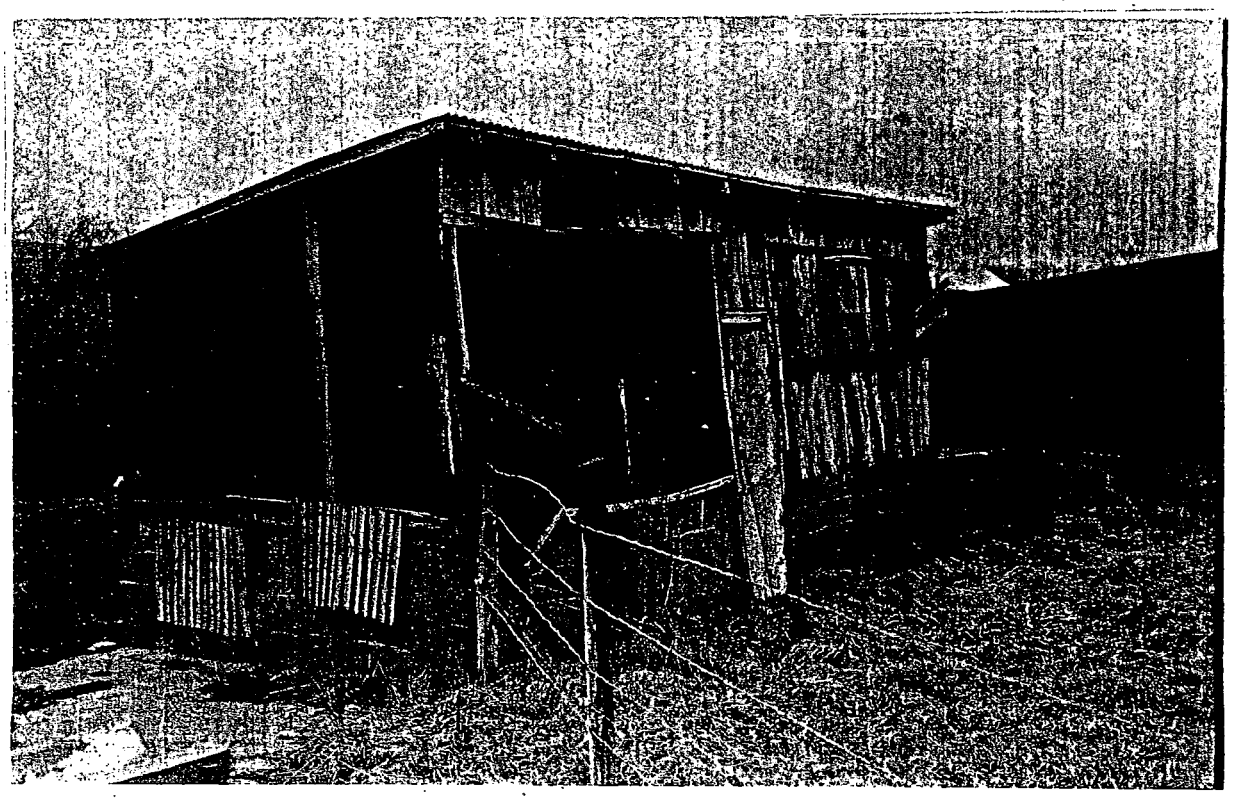
3-18 Chicken Coupe Back





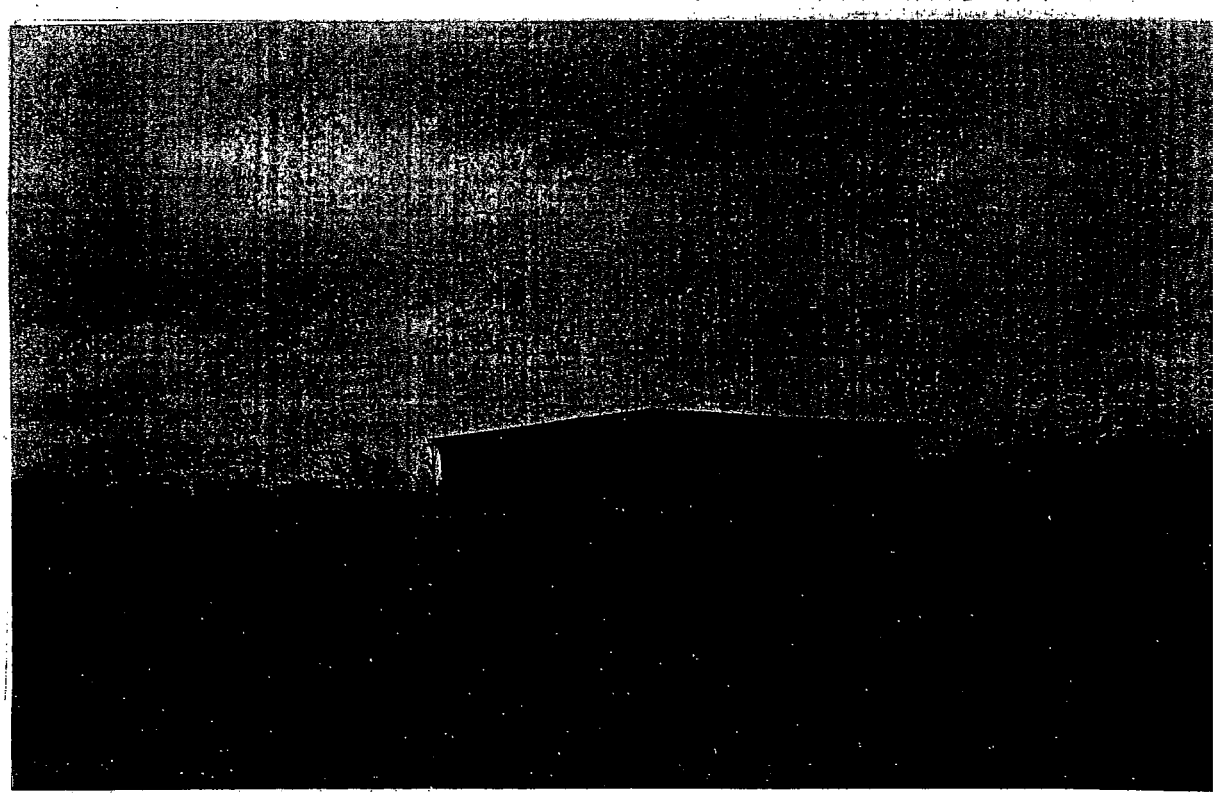
3-19 Outbuilding Front

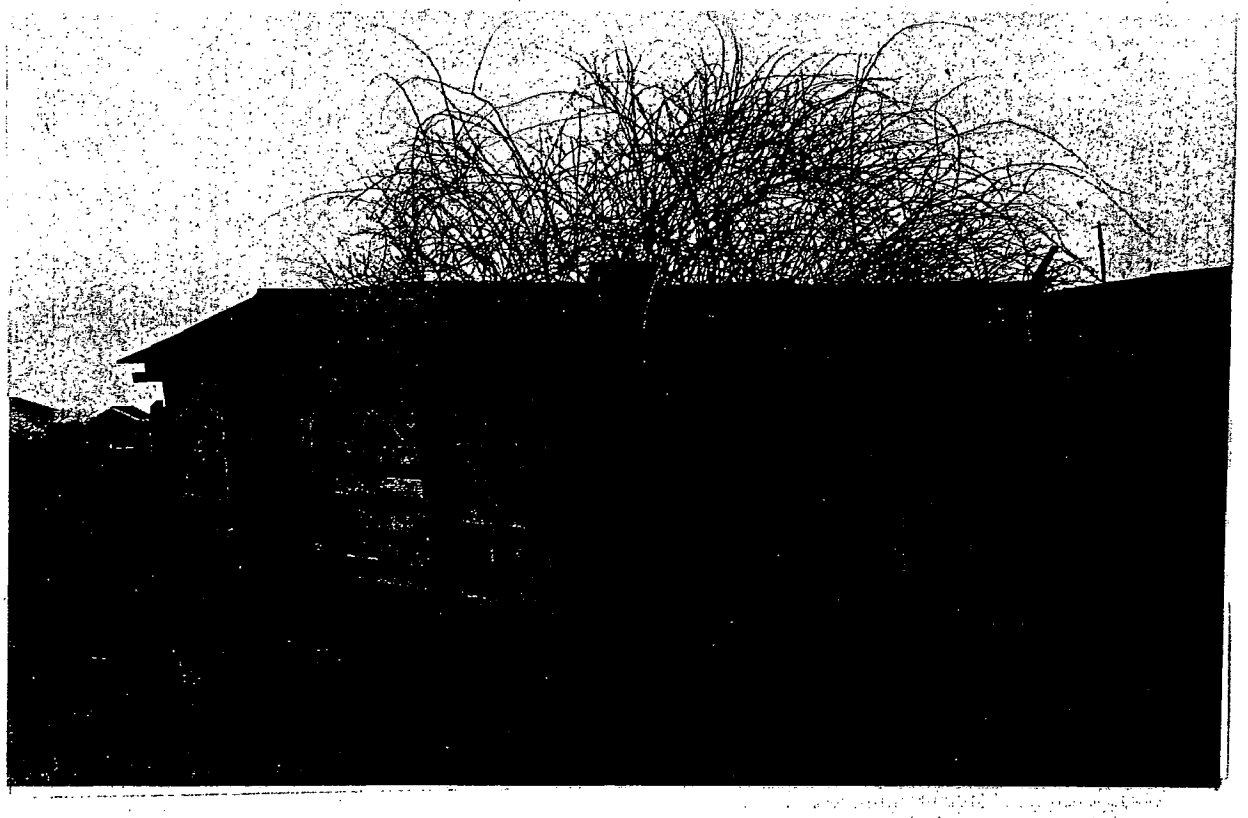
3-20 Outbuilding Back



4-21 Cow Barn Front

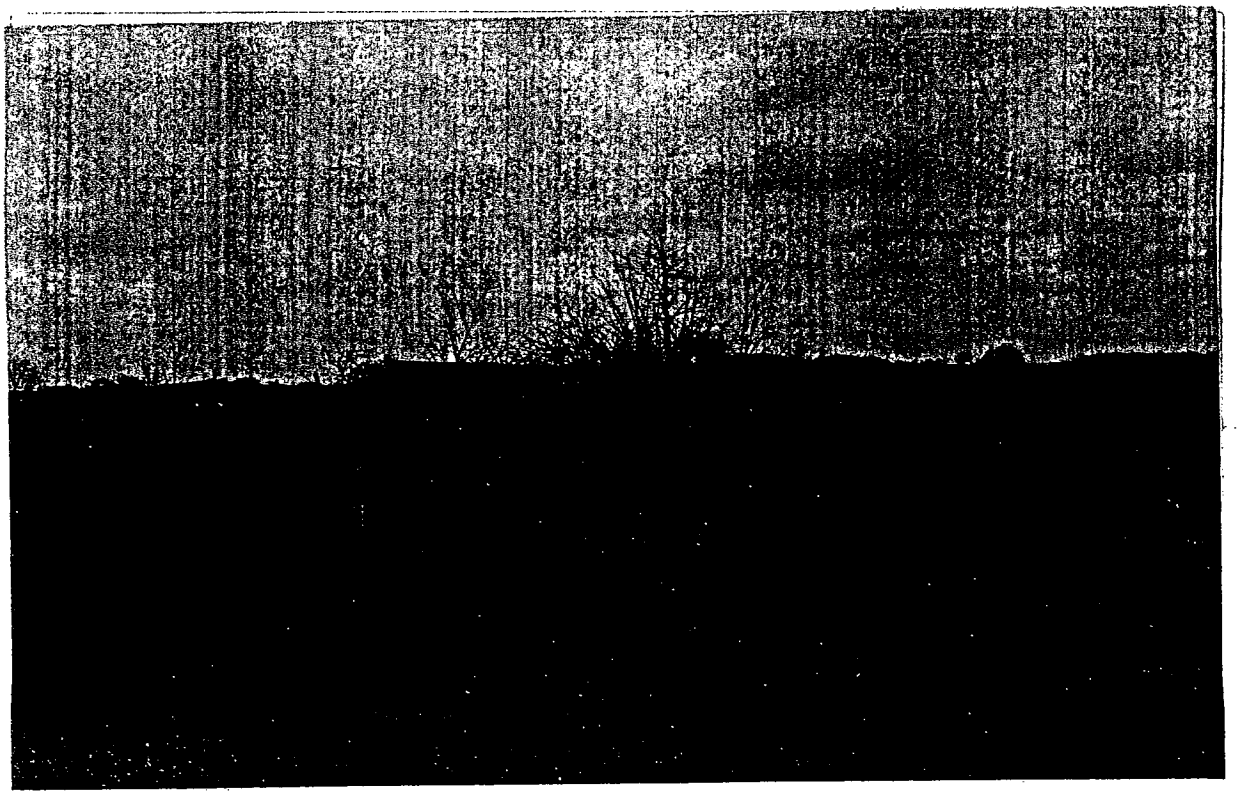
4-22 Cow Barn Back

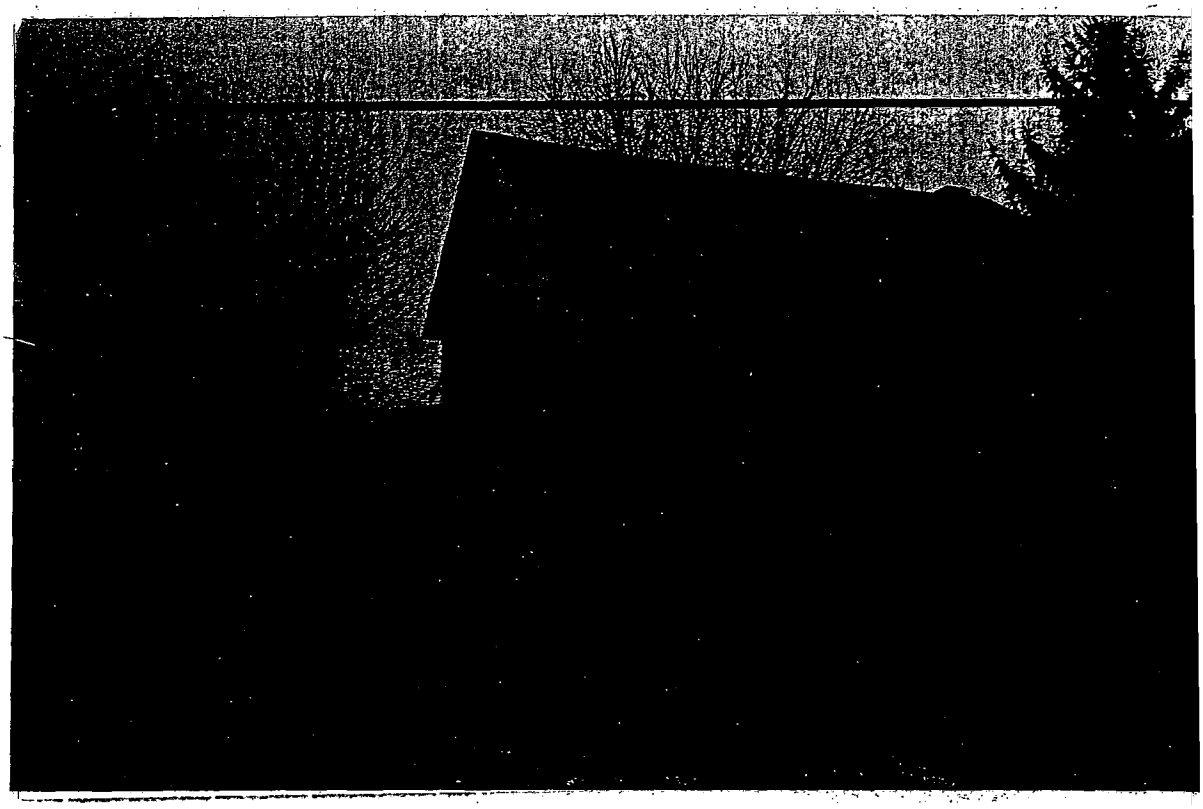




4-23 Outbuilding Front

4-24 Outbuilding Back



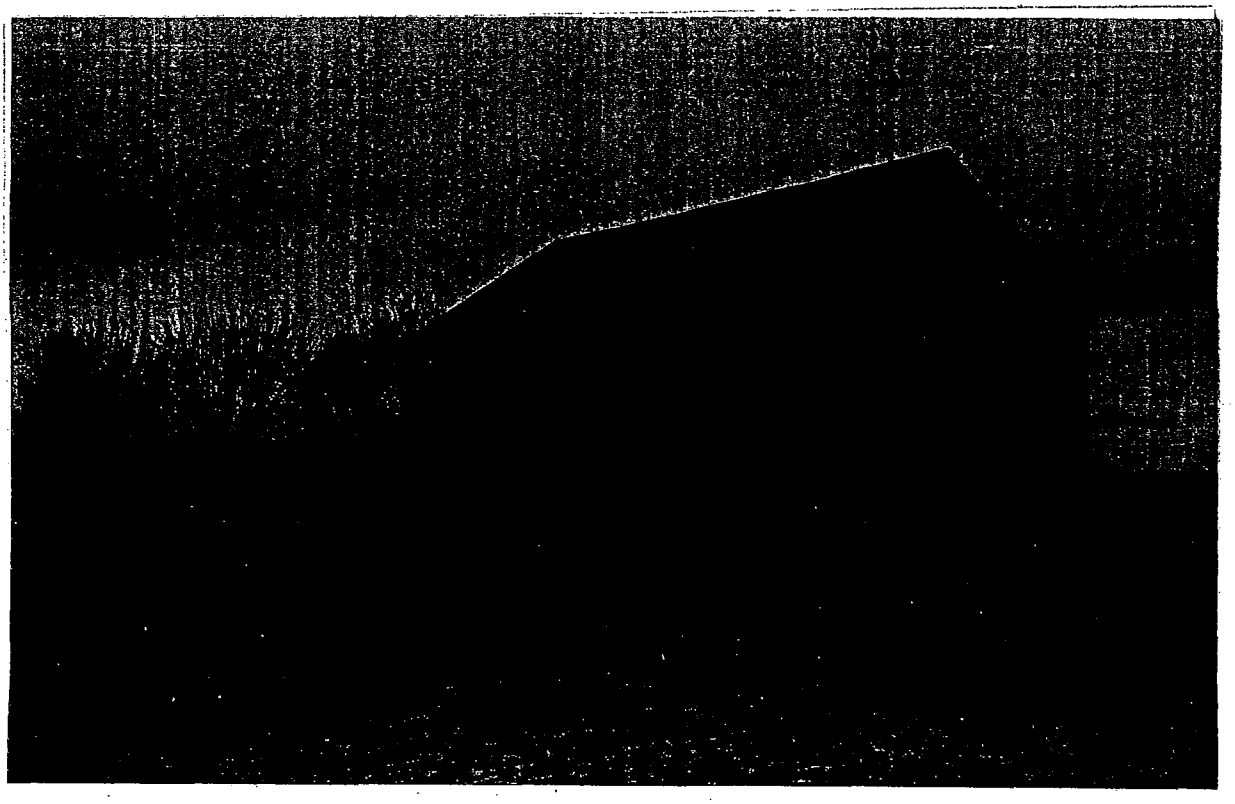


5-25 House Front

5-26 House Back

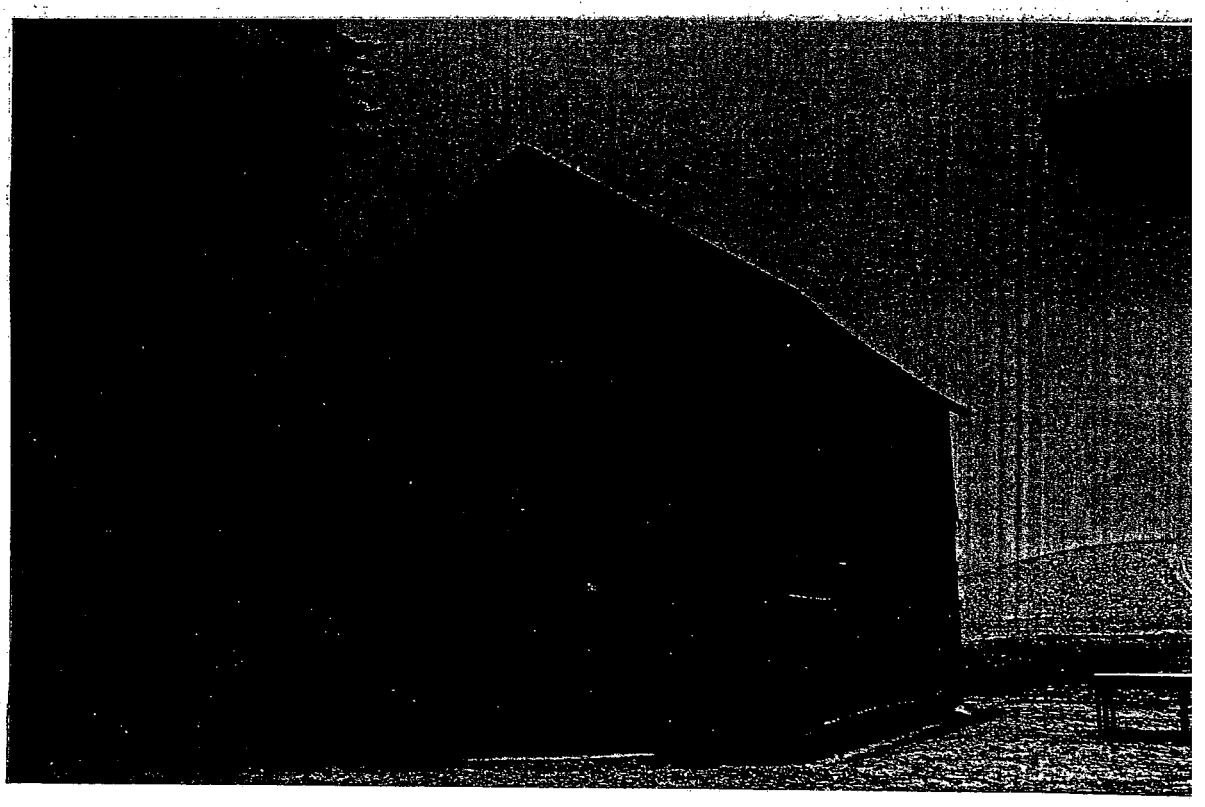
5-27 Barn 1 Front

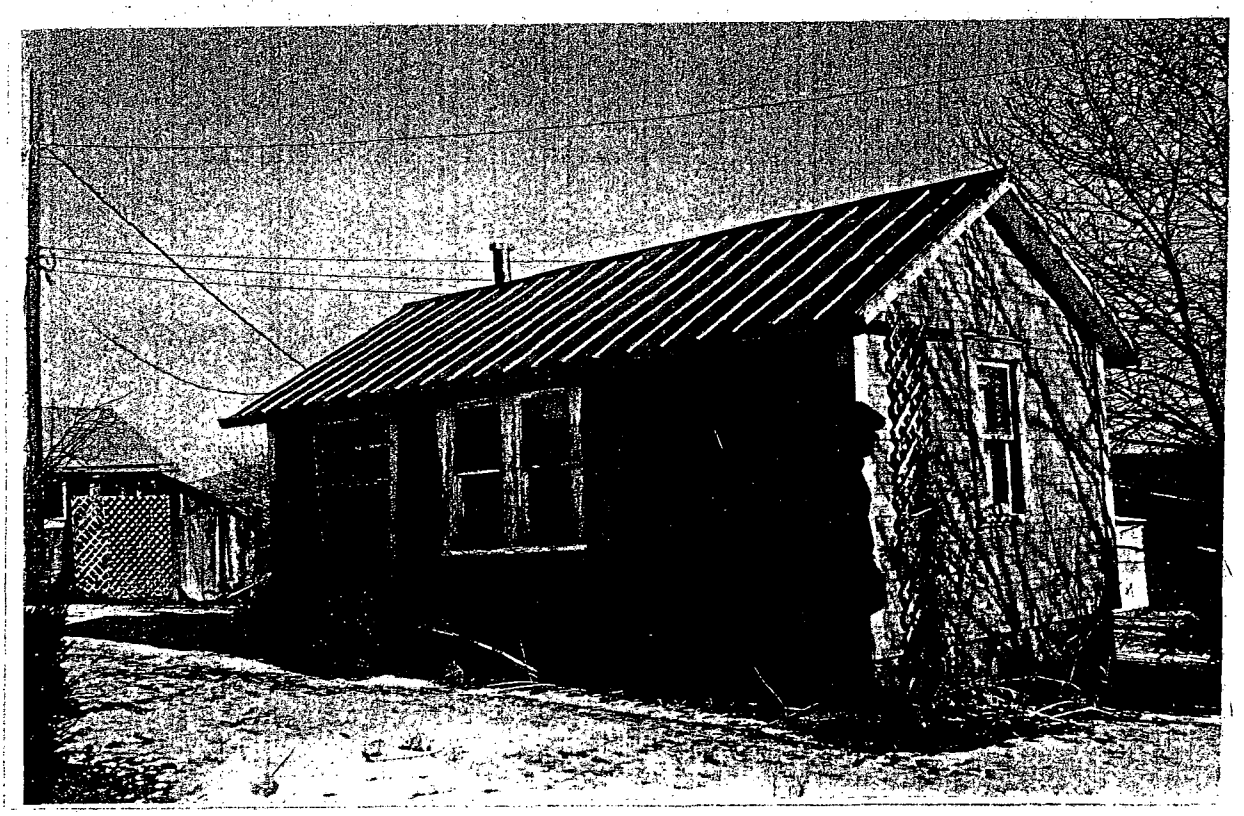
5-28 Barn 1 Back



5-29 Barn 2 Front

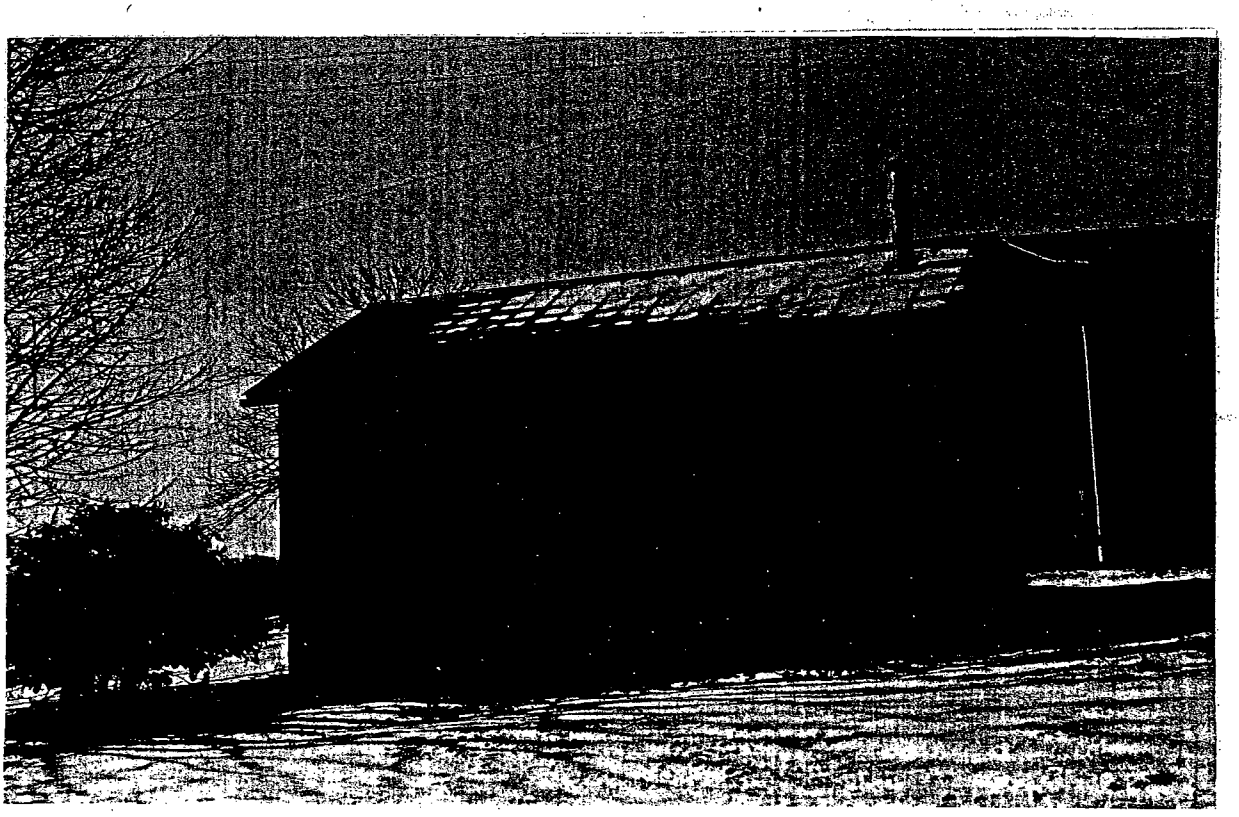
5-30 Barn 2 Back

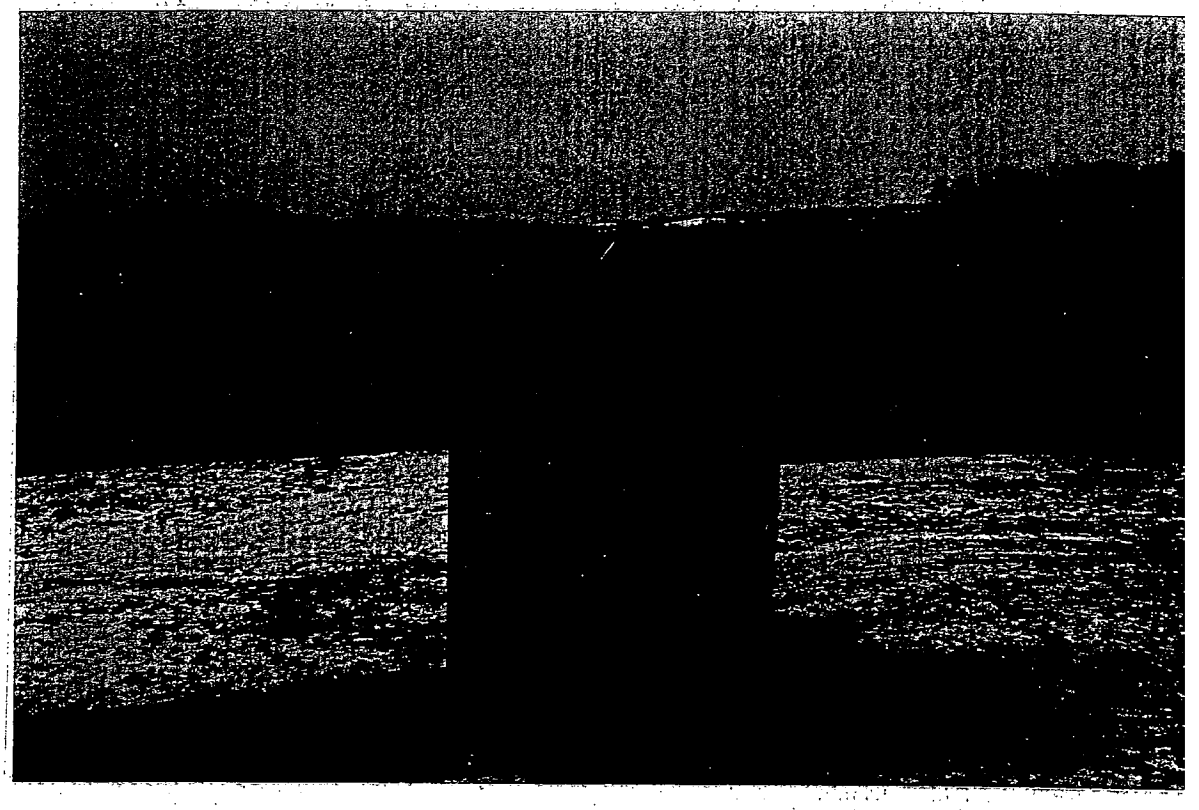




6-31 Summer Kitchen Front

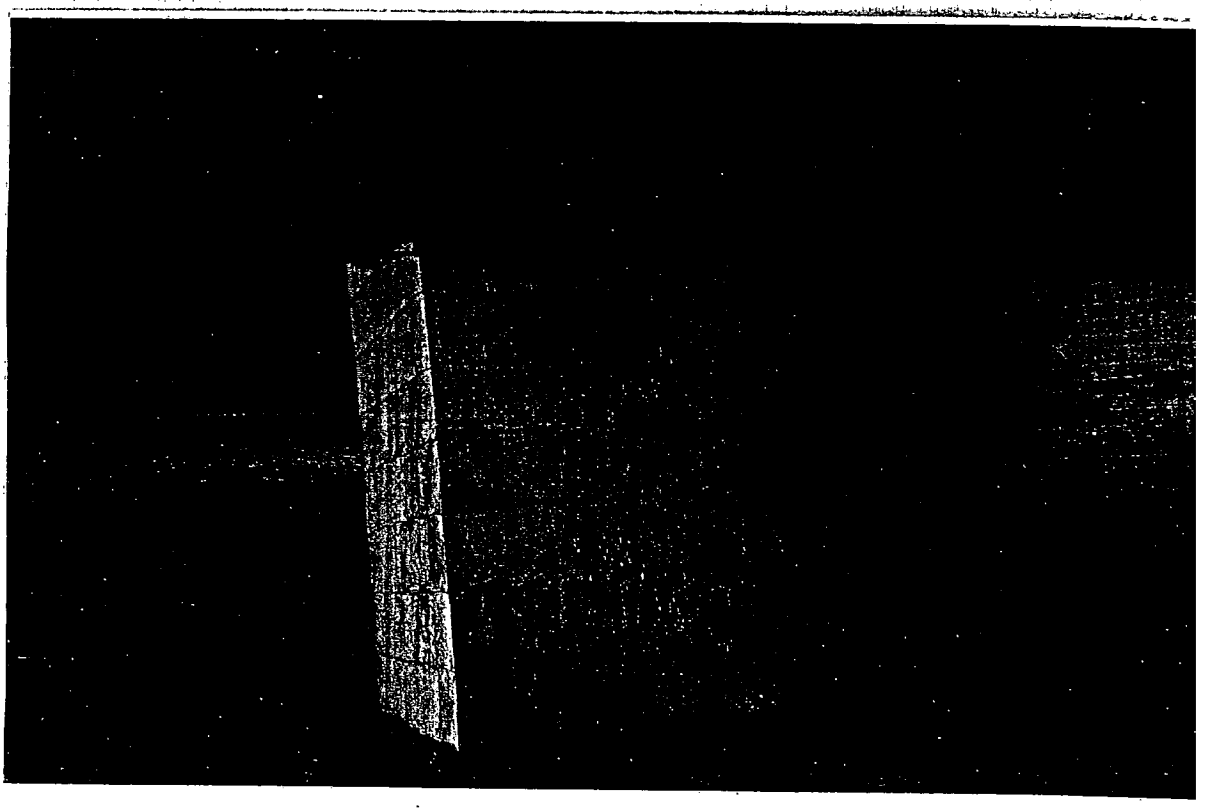
6-32 Summer Kitchen Back

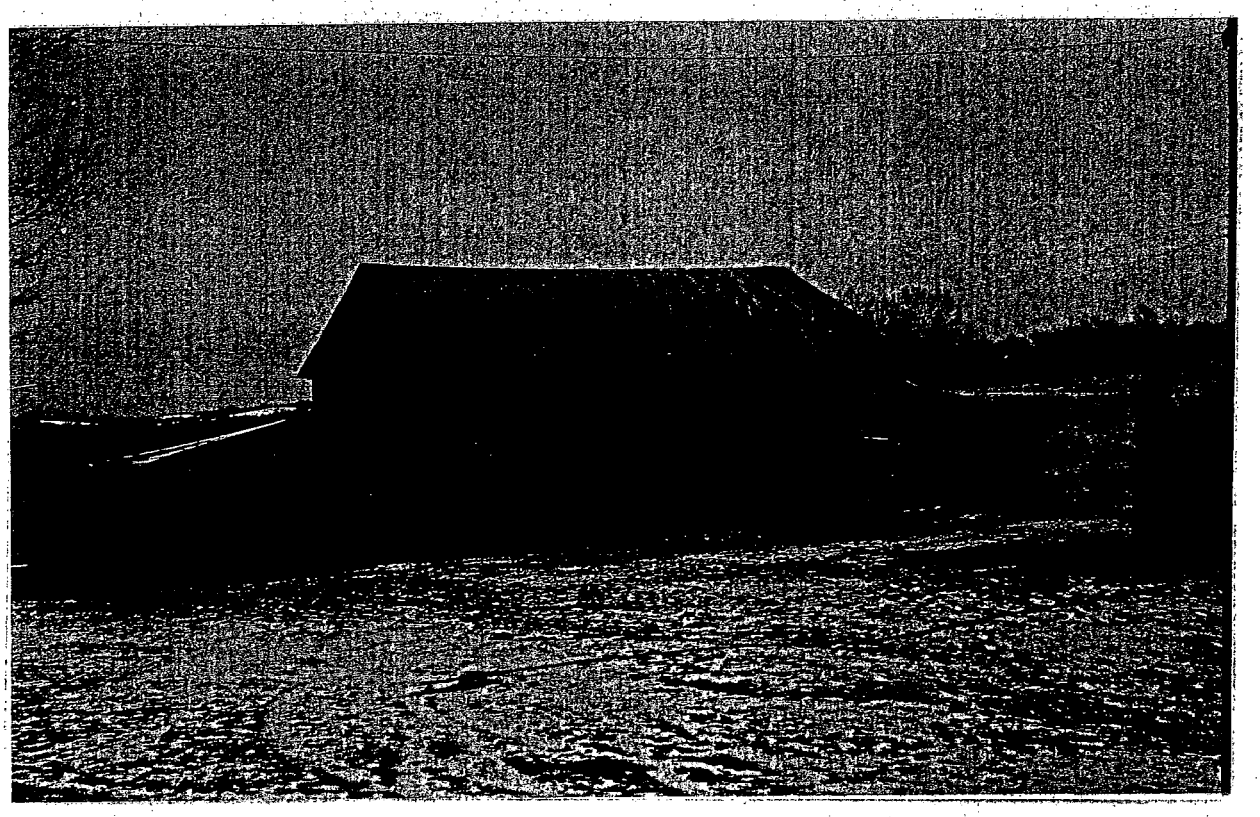




6-33 Privy Front

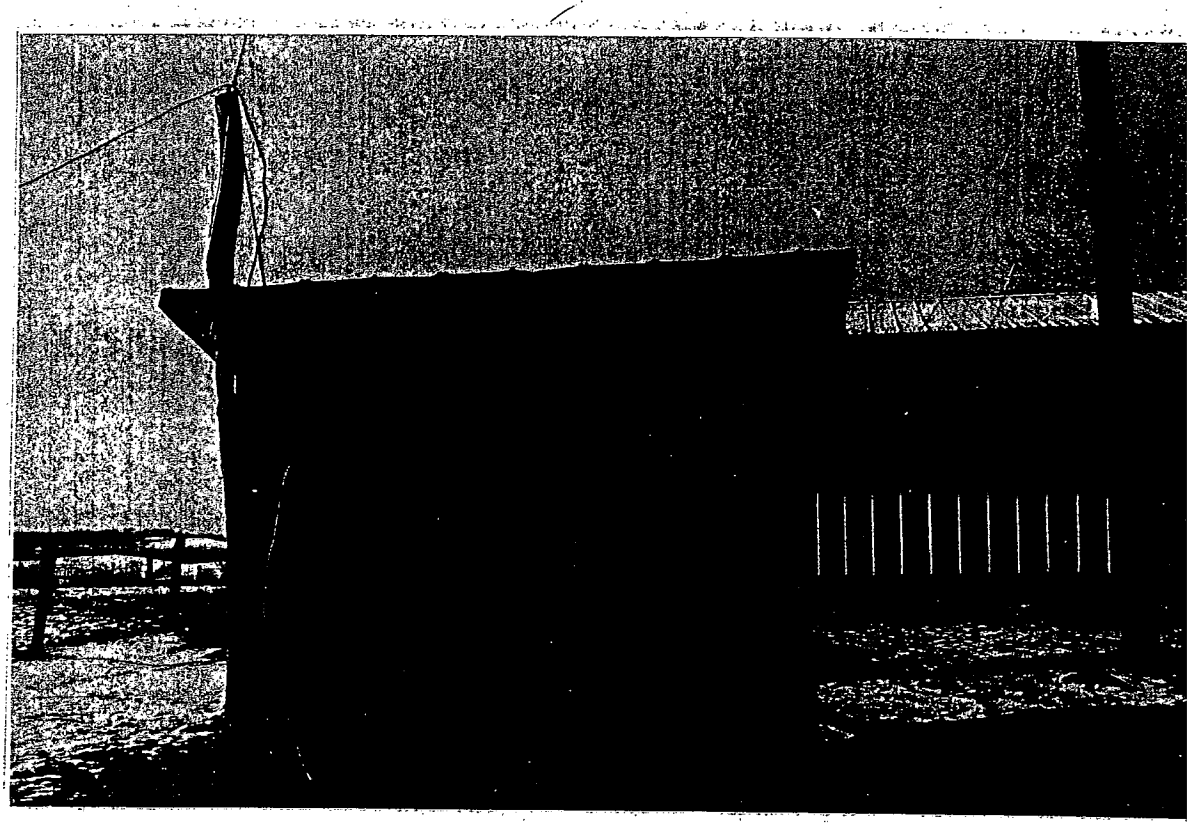
6-34 Privy Back





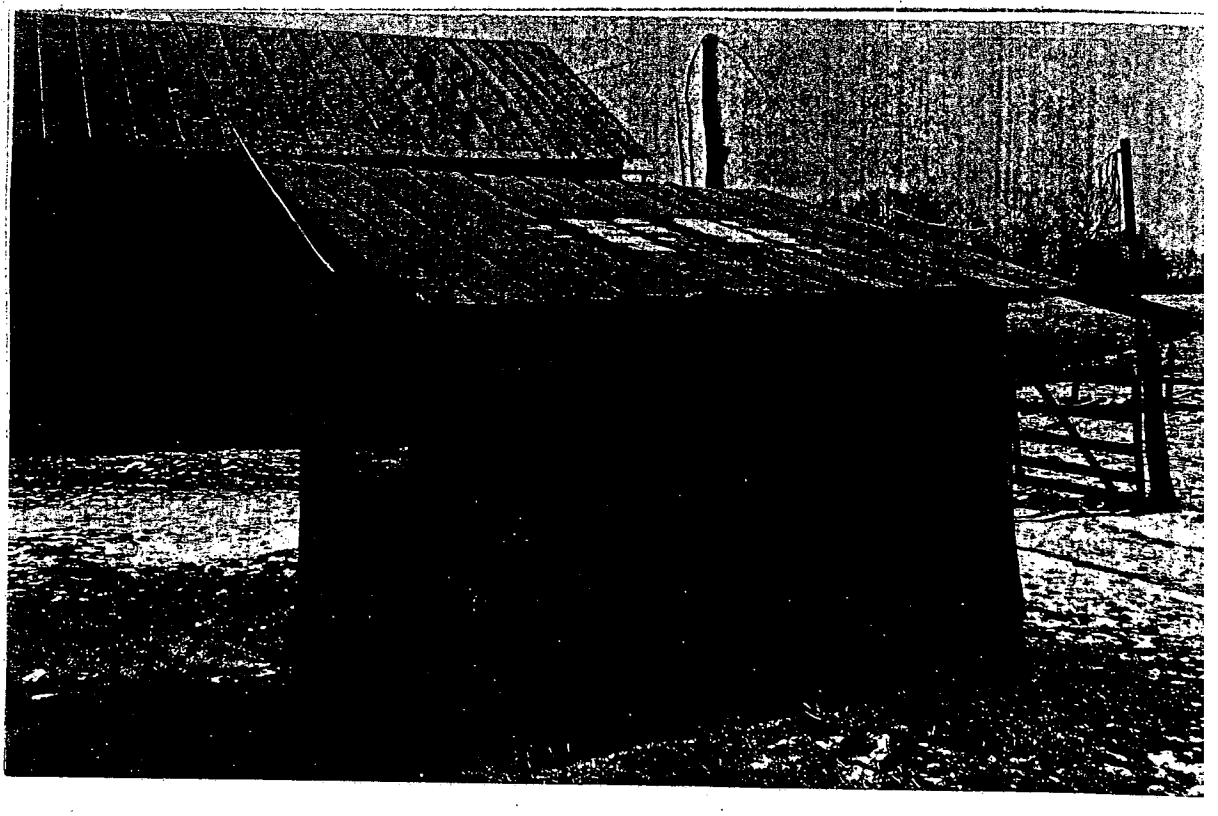
6-35 Barn Front

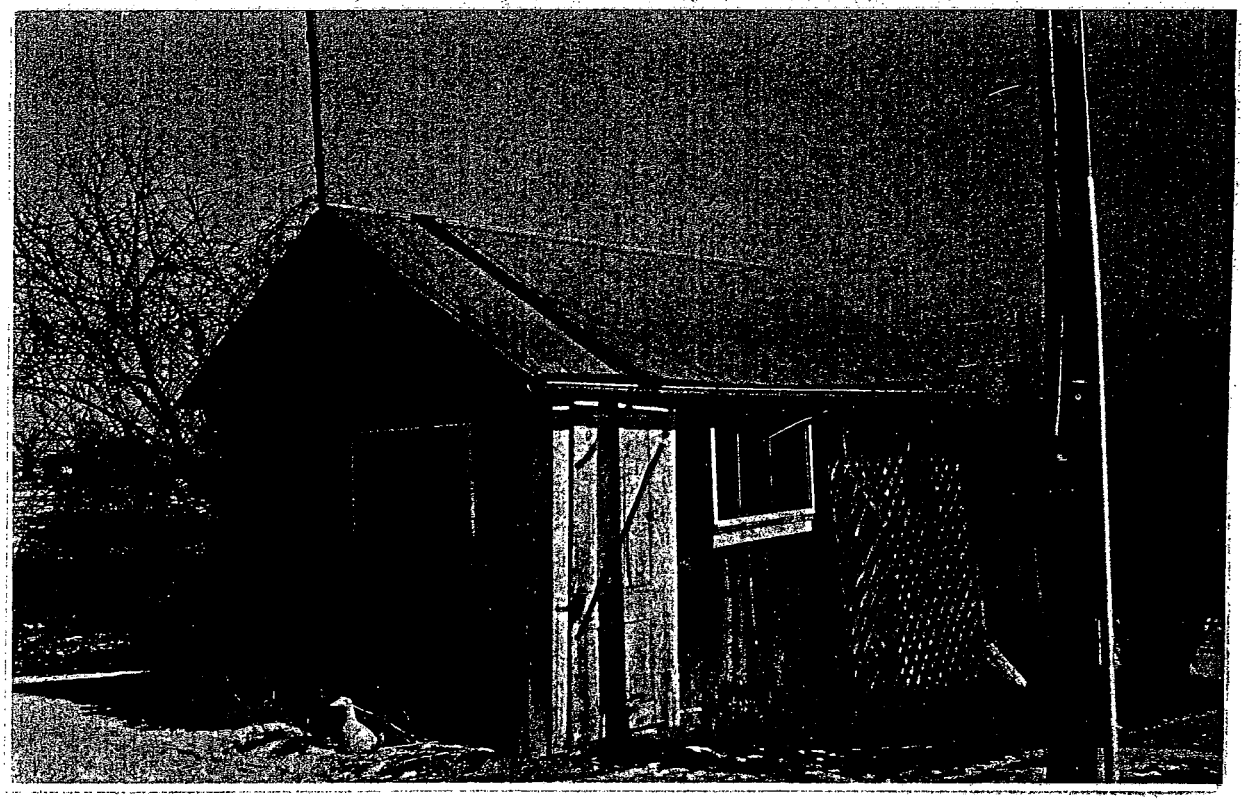
6-36 Barn Back



6-37 Outbuilding 1 Front

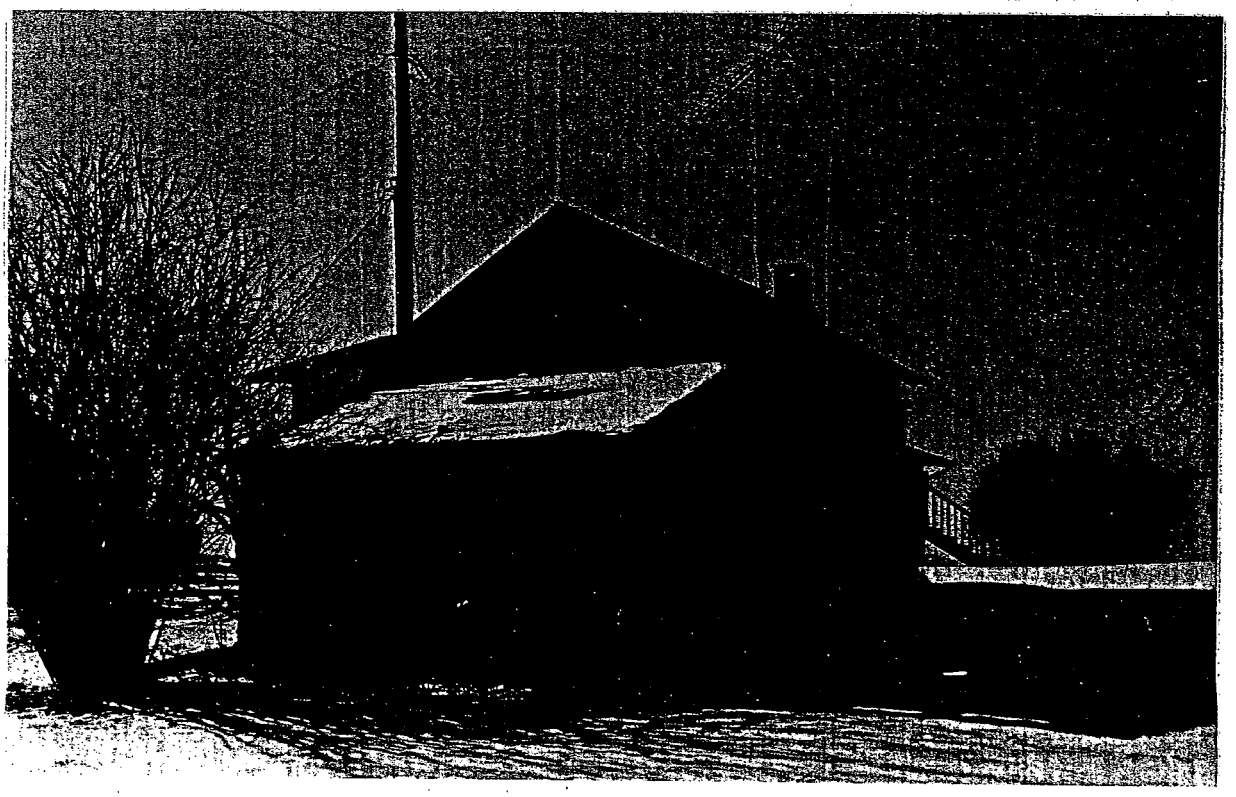
6-38 Outbuilding 1 Back

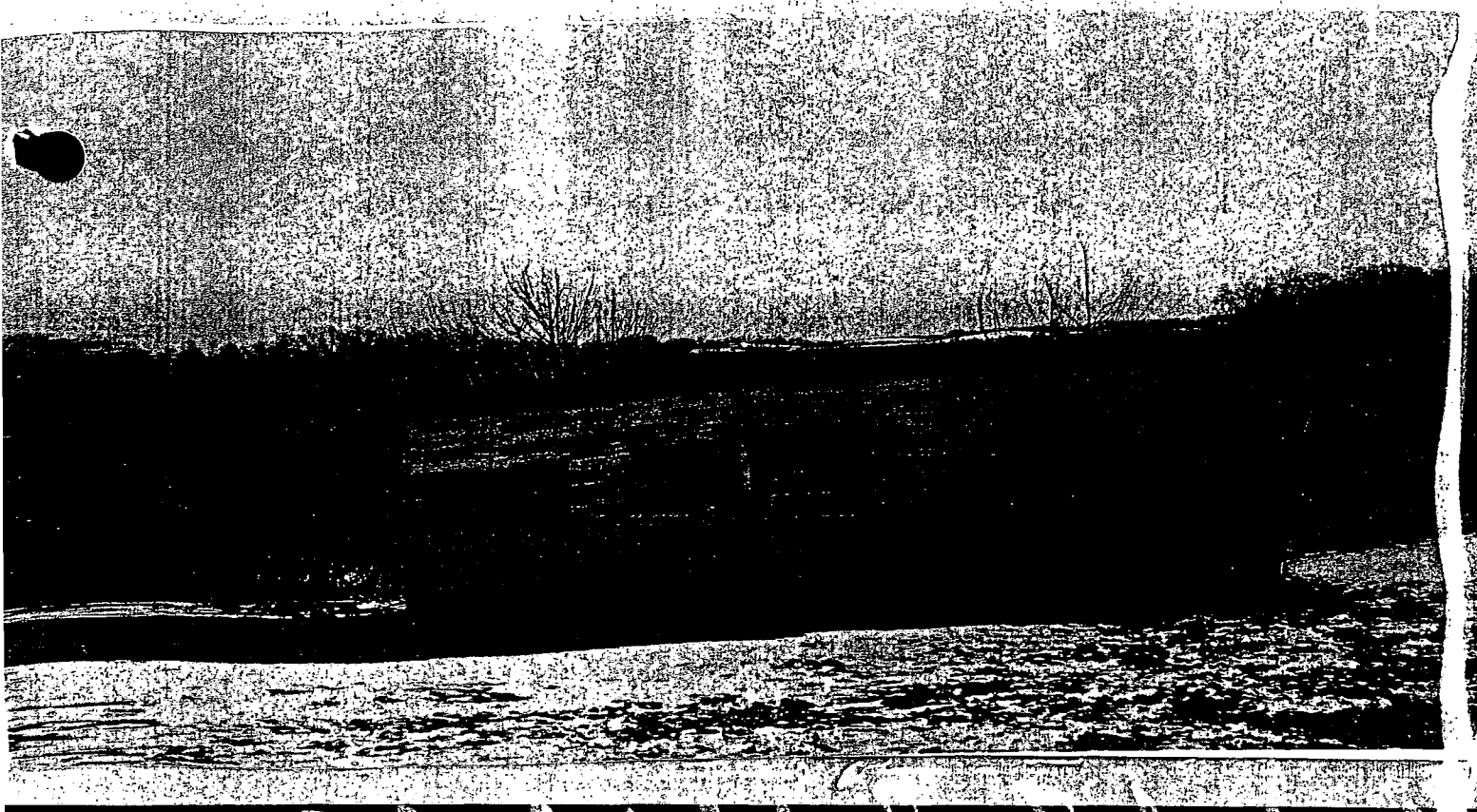




6-39 Outbuilding 2 Front

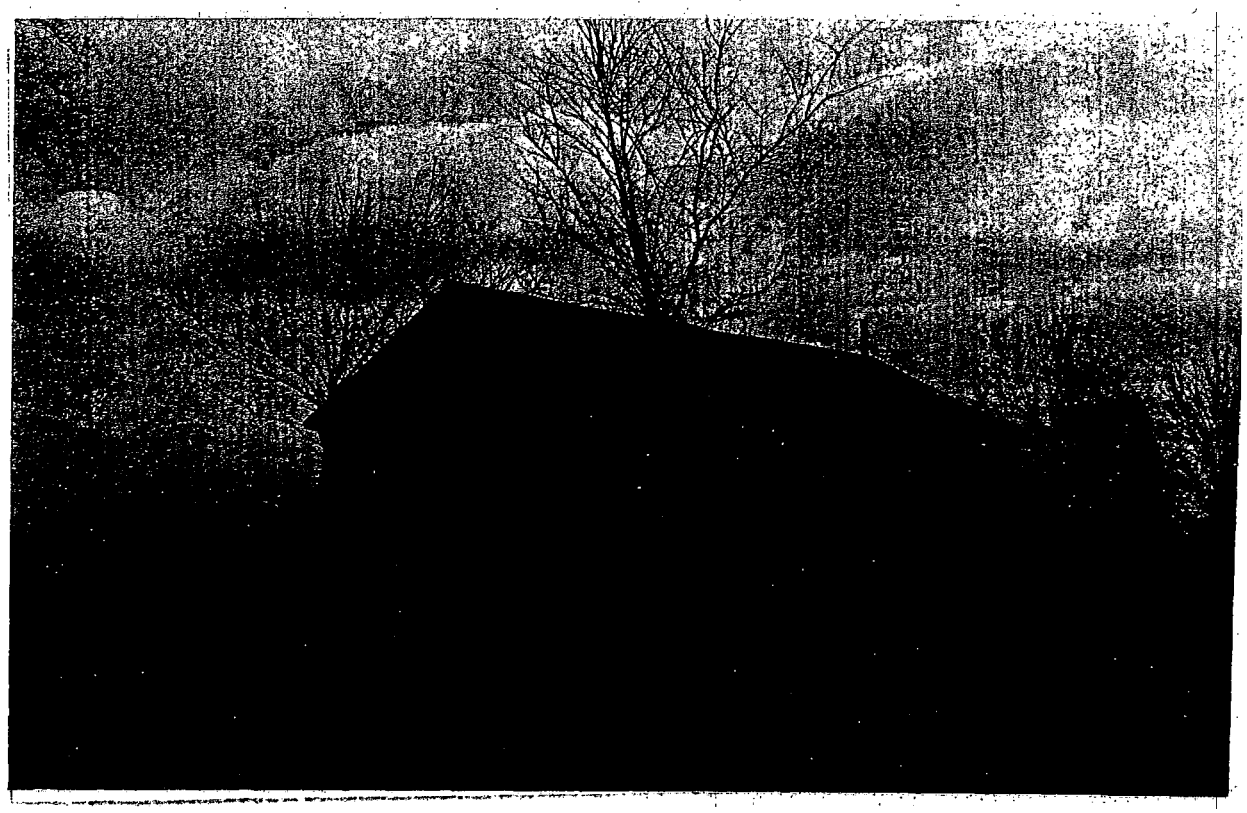
6-40 Outbuilding 2 Back





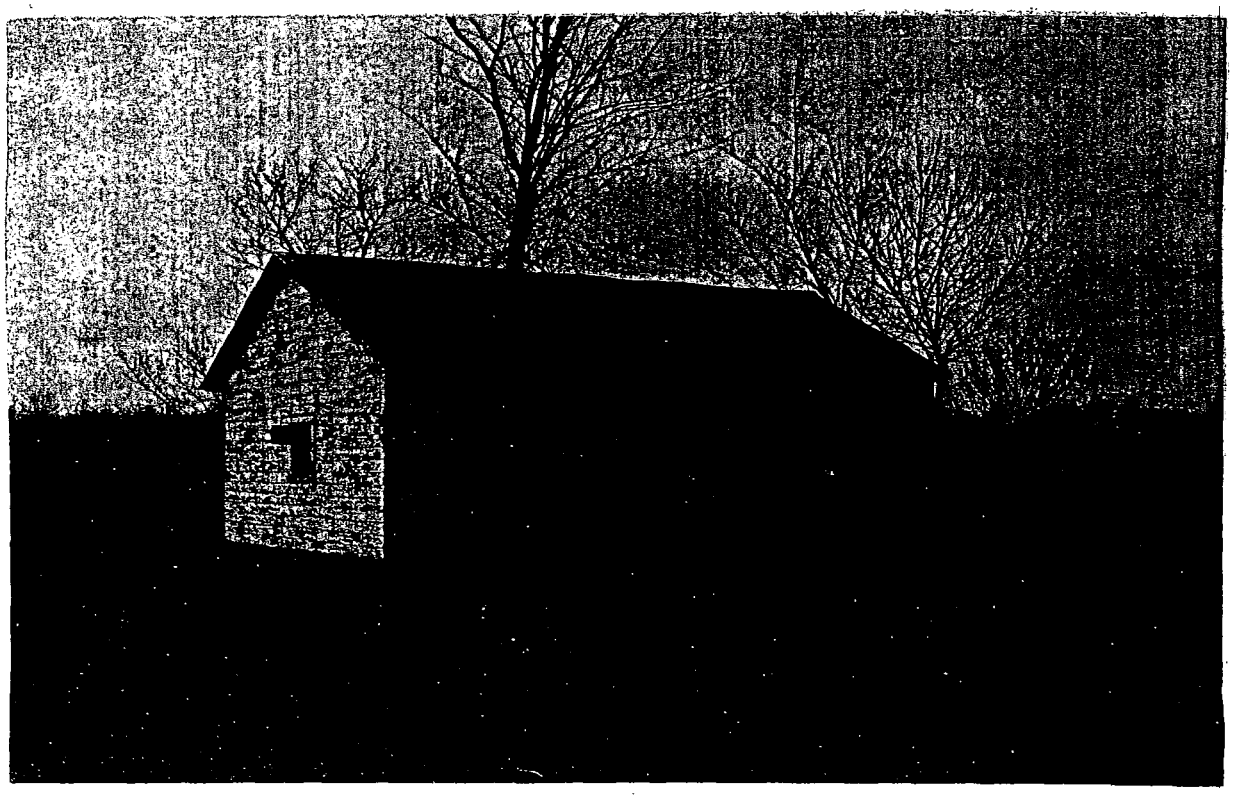
6-43 Outbuilding 4 Front

6-44 Outbuilding 4 Back



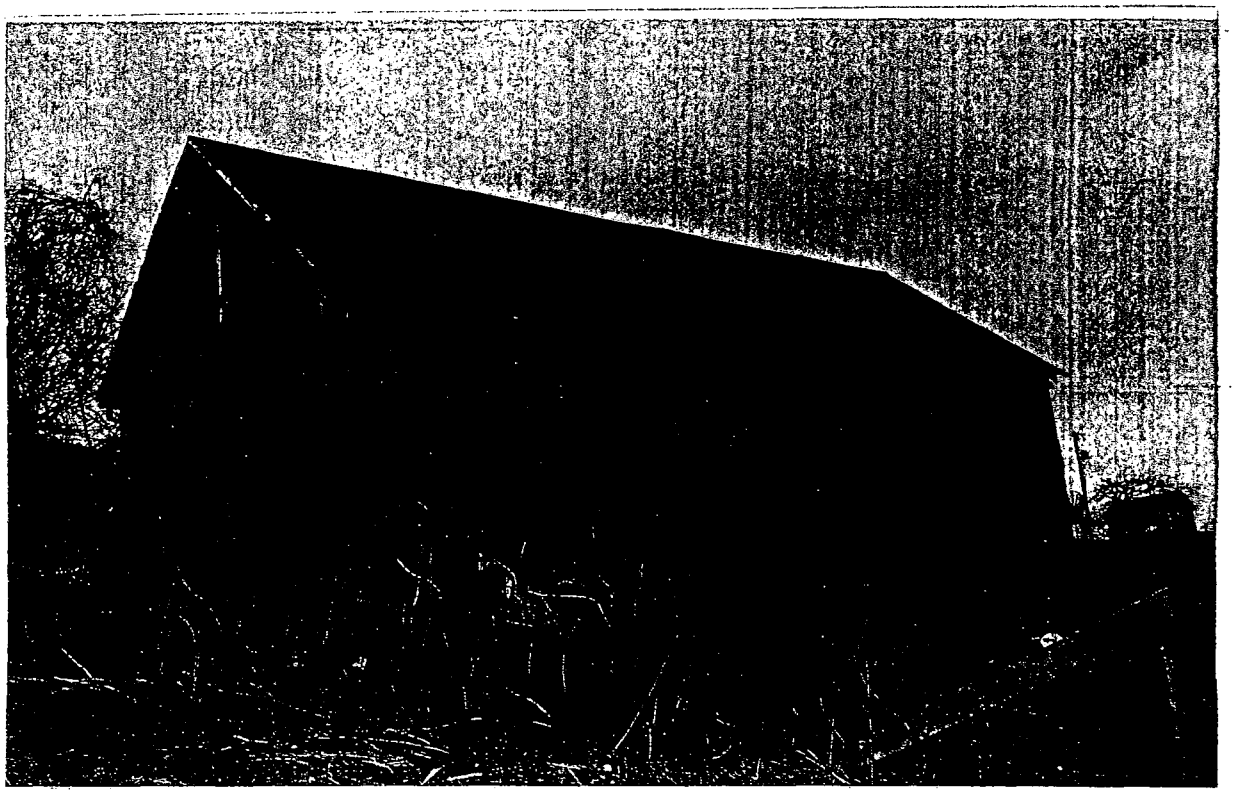
7-45 Garage Front

7-46 Garage Back



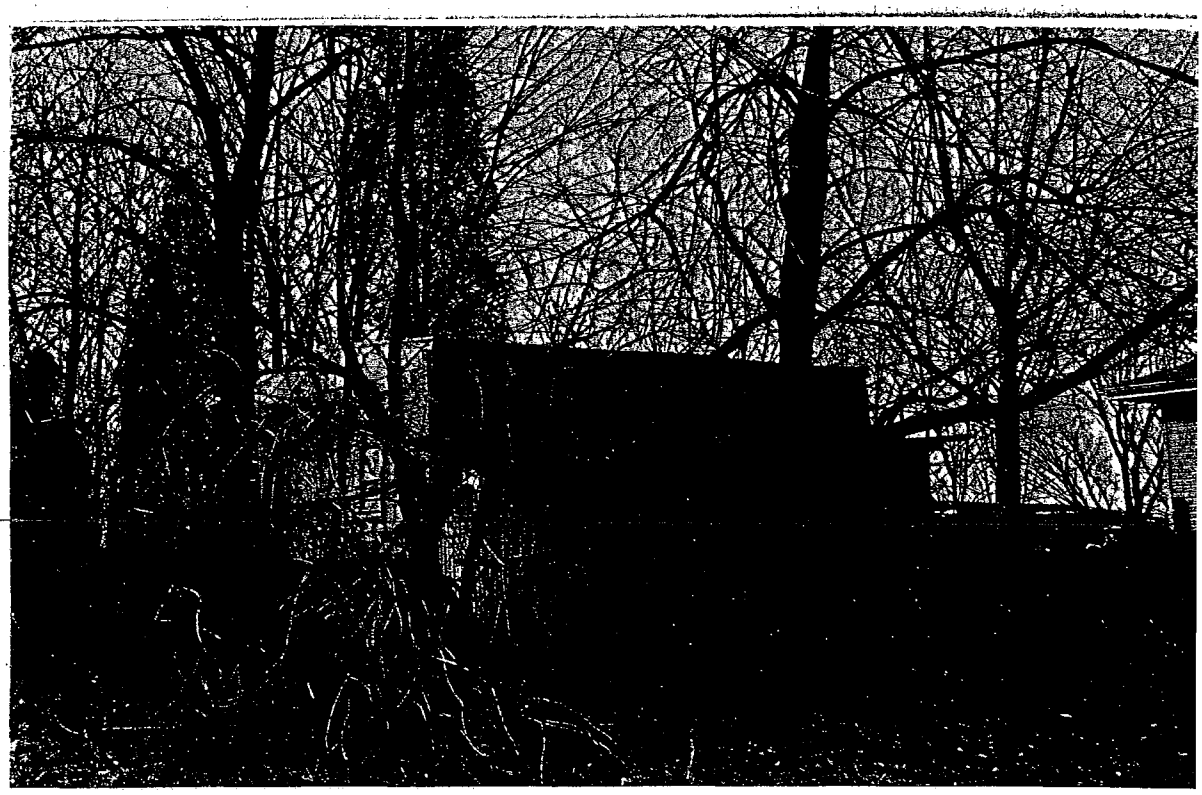
8-47 Barn Front

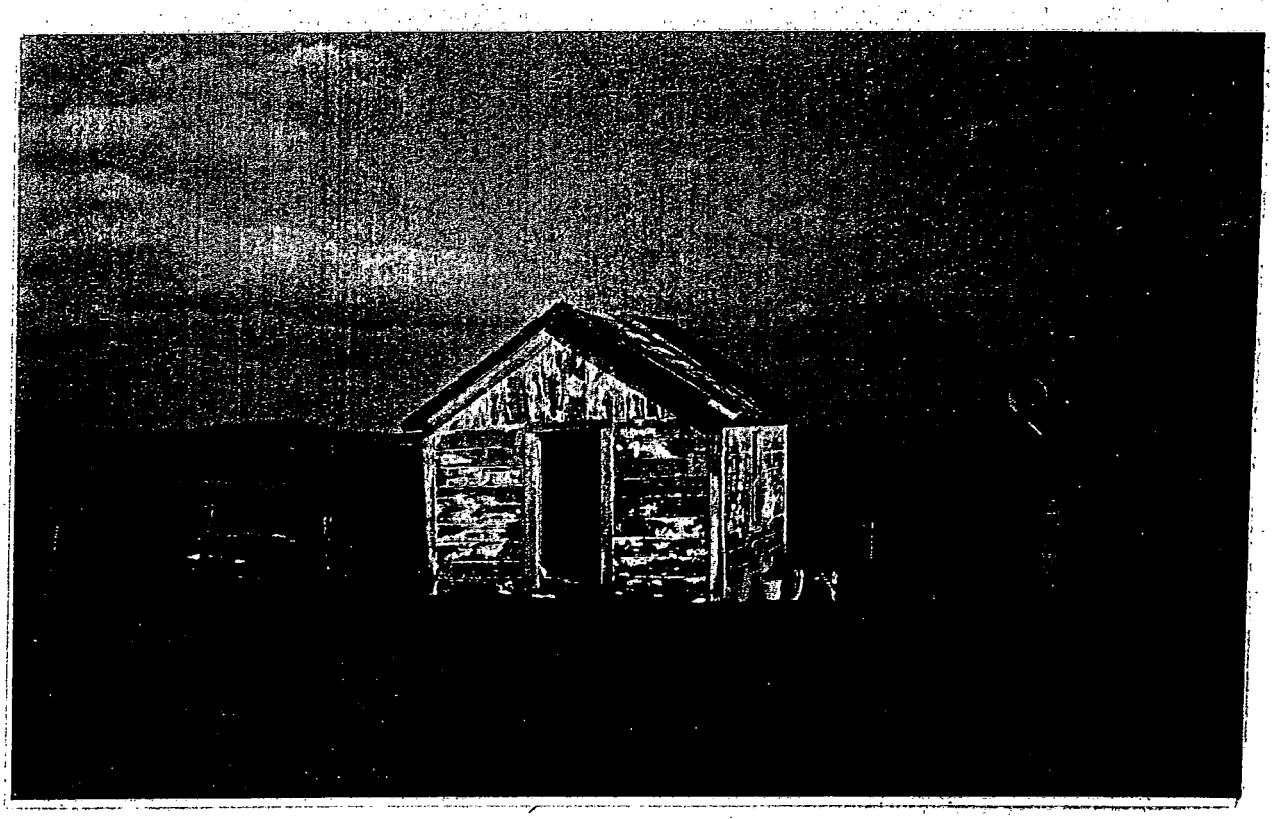
8-48 Barn Back



8-49 Shed 1 Front

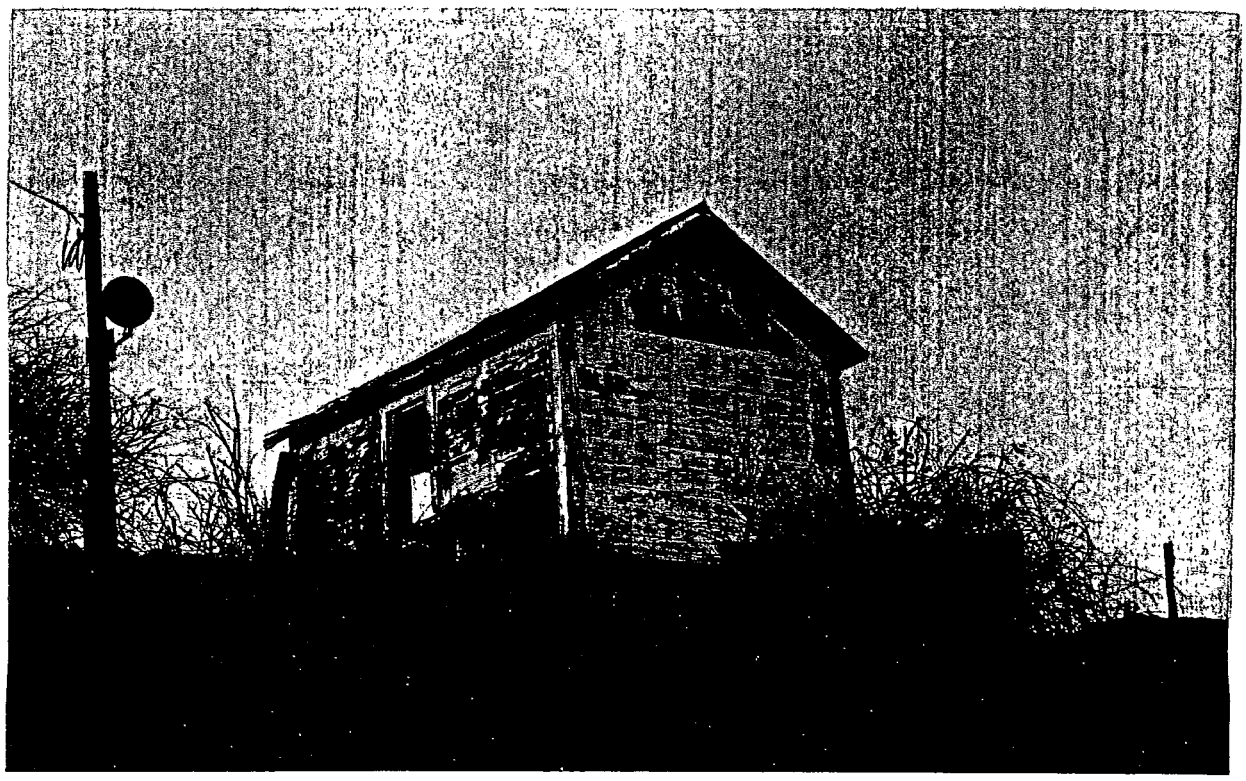
8-50 Shed 1 Back

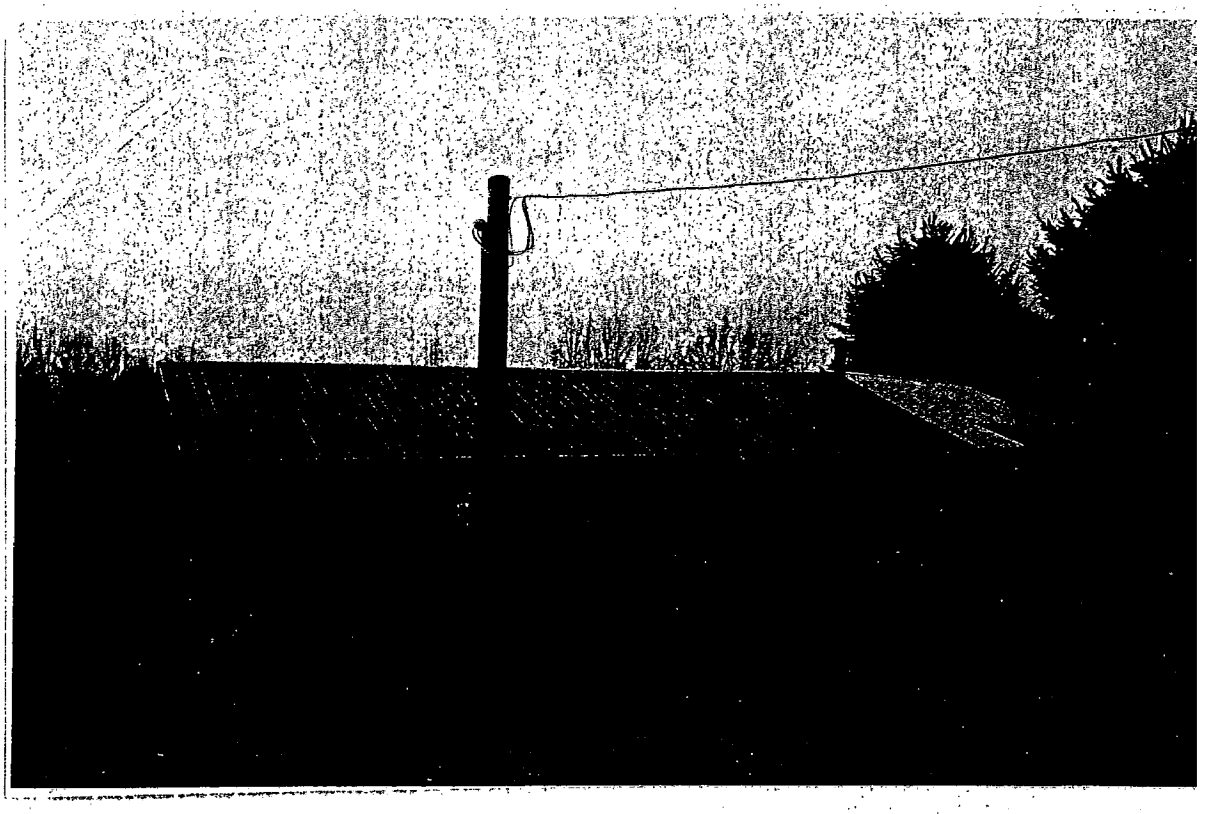




8-51 Shed 2 Front

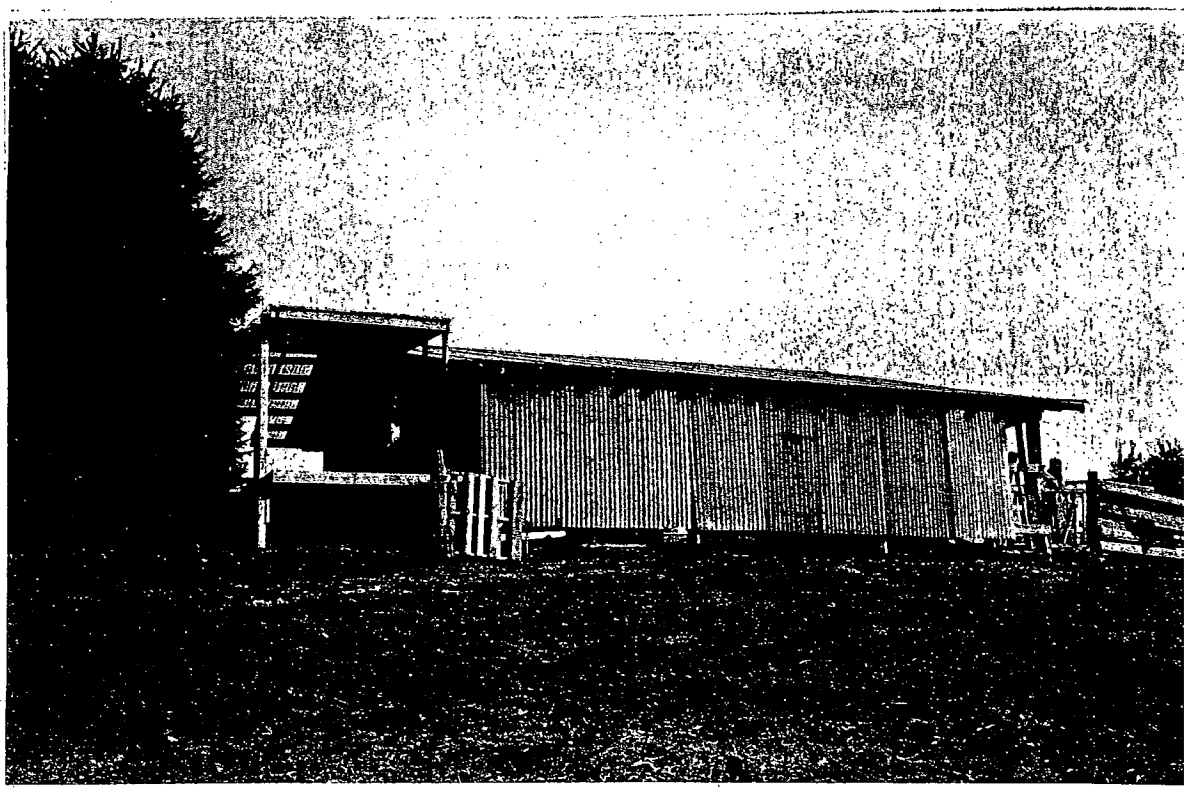
8-52 Shed 2 Back

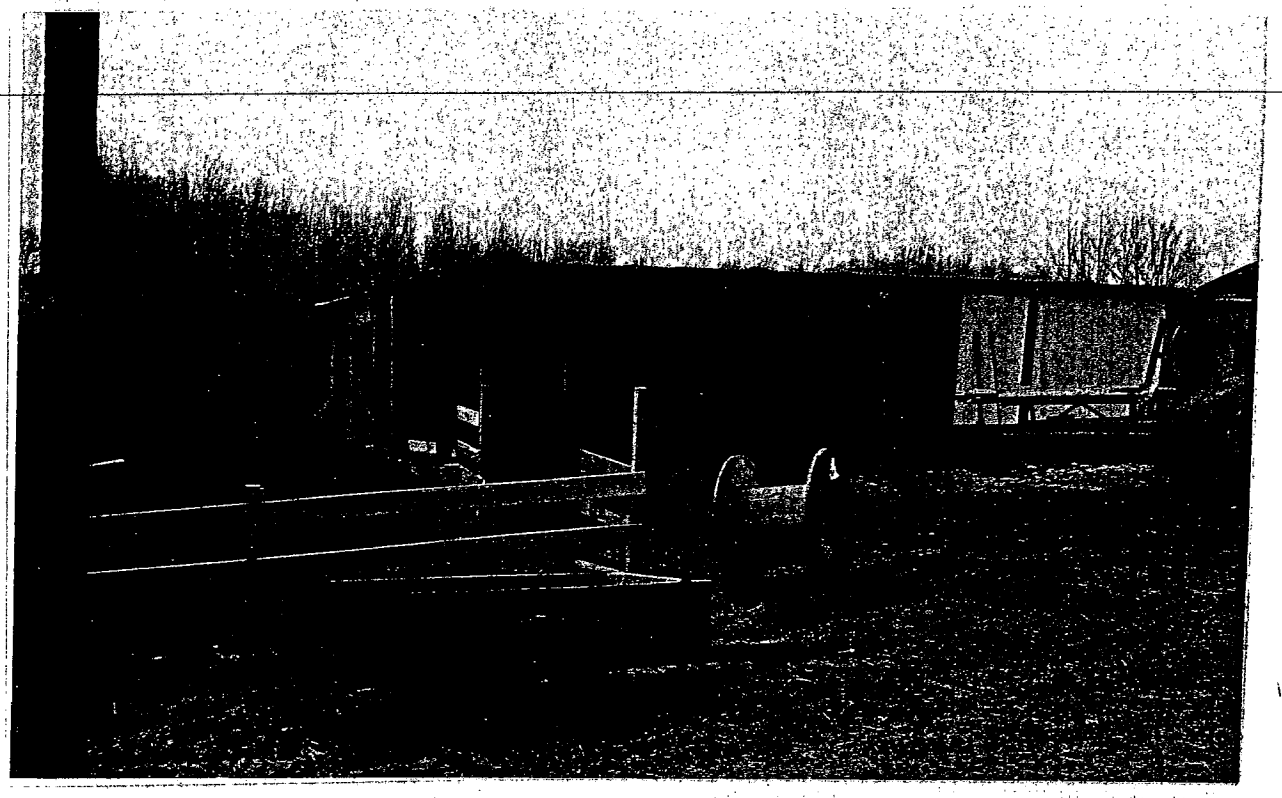




9-53 Outbuilding 1 Front

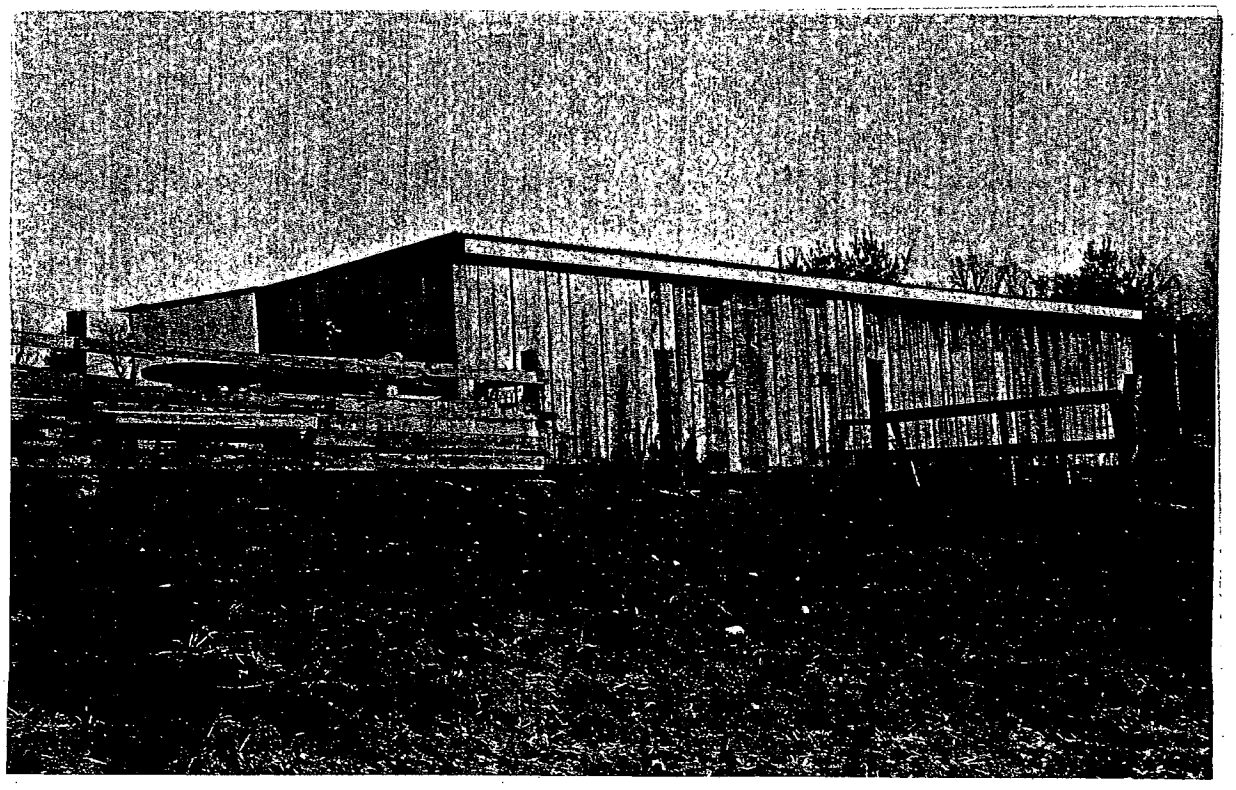
9-54 Outbuilding 1 Back





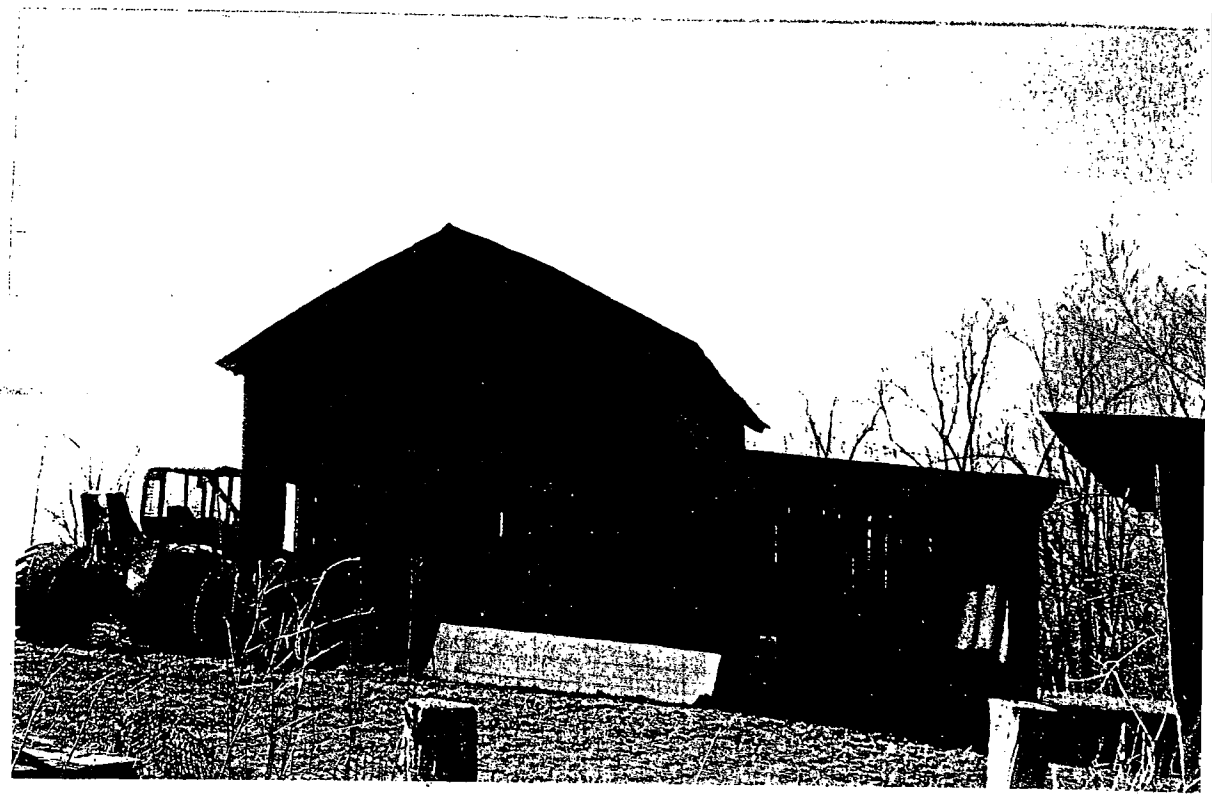
9-55 Outbuilding 2 Front

9-56 Outbuilding 2 Back

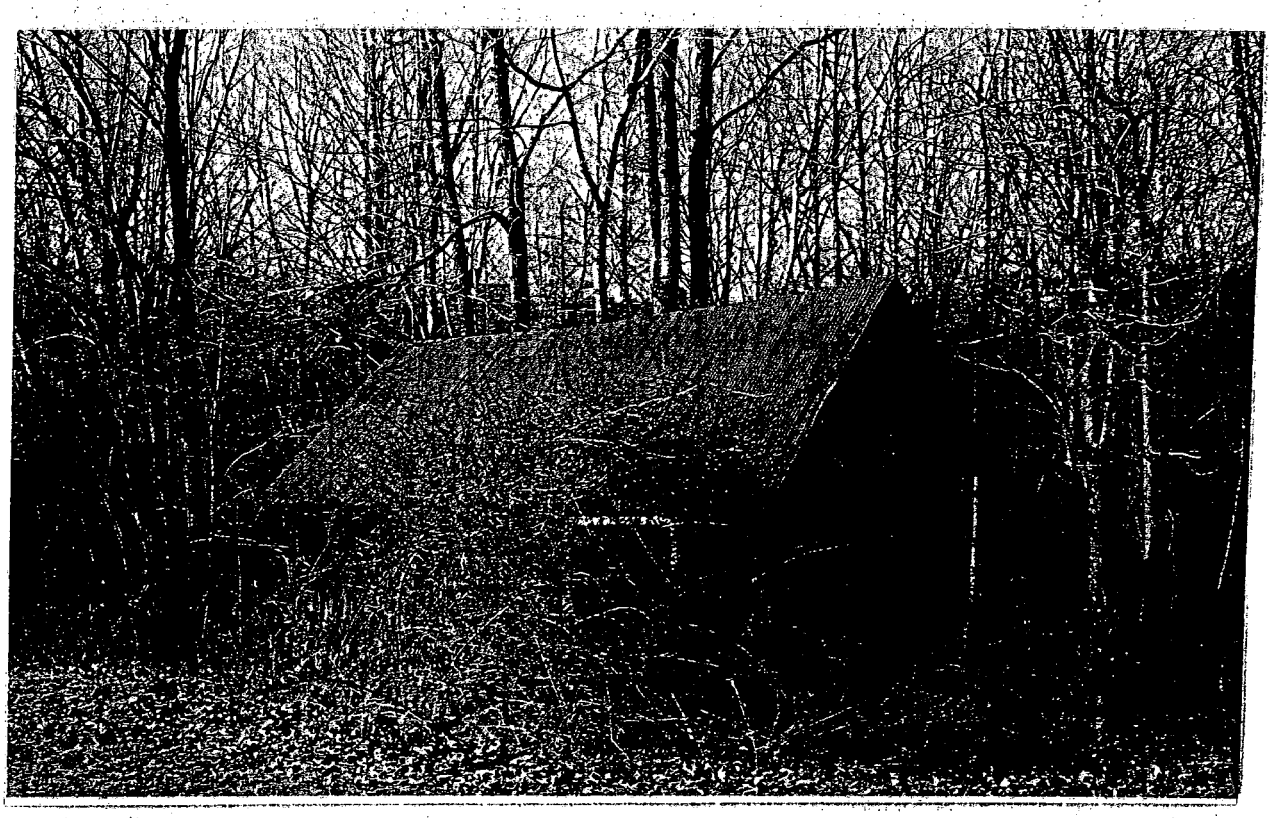


10-57 Barn Front

10-58 Barn Back



AEC 06221

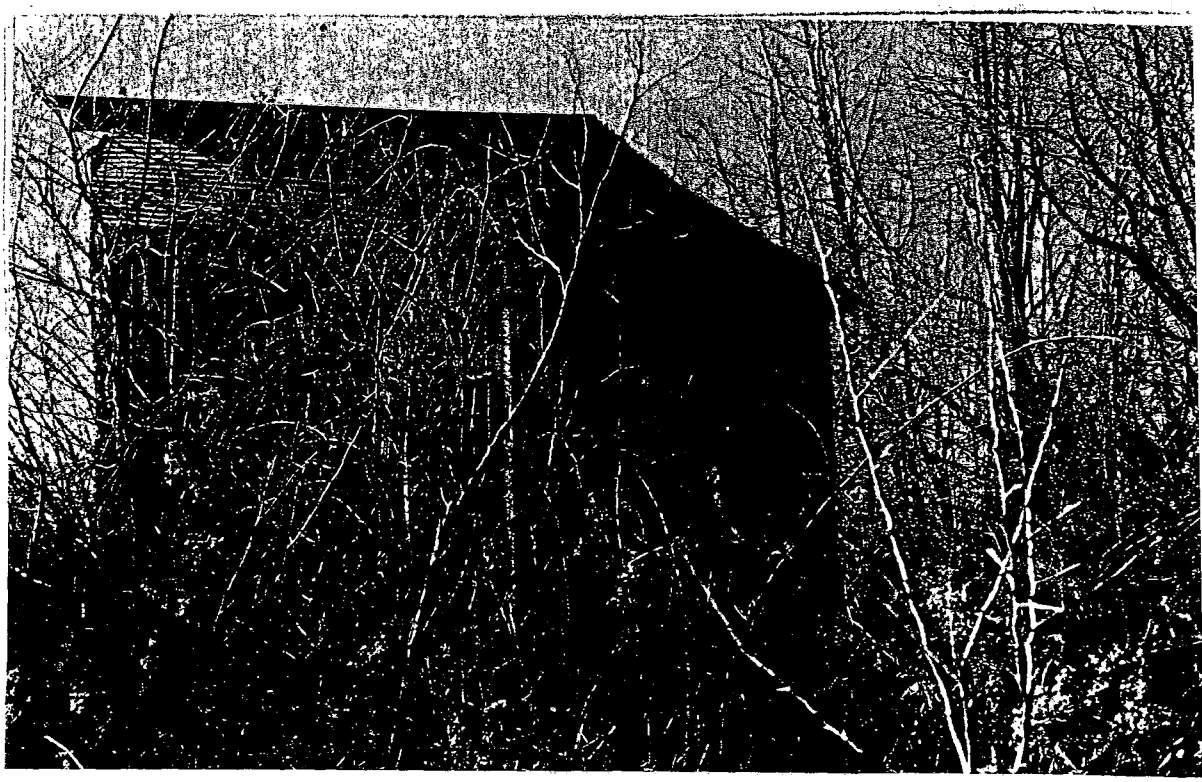


10-59 Outbuilding 1 Front

10-60 Outbuilding 1 Back

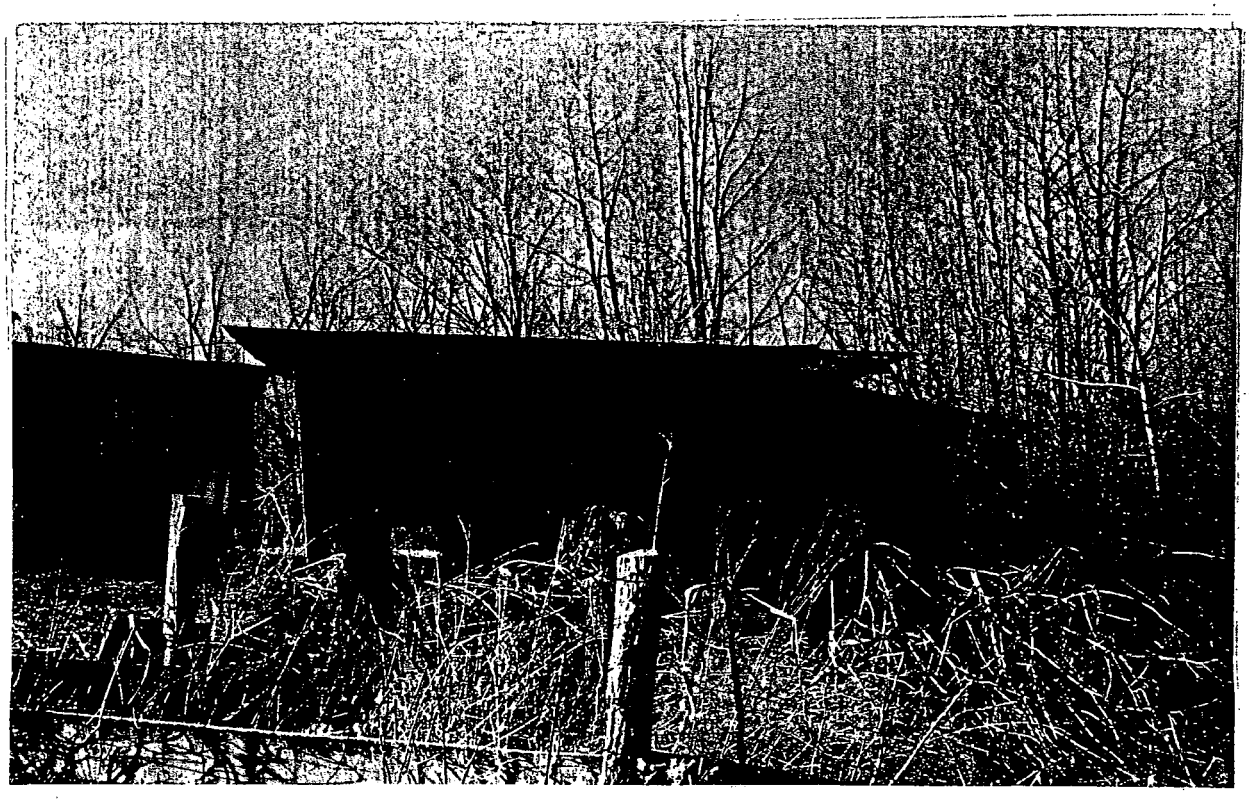
10-61 Outbuilding 2 Front

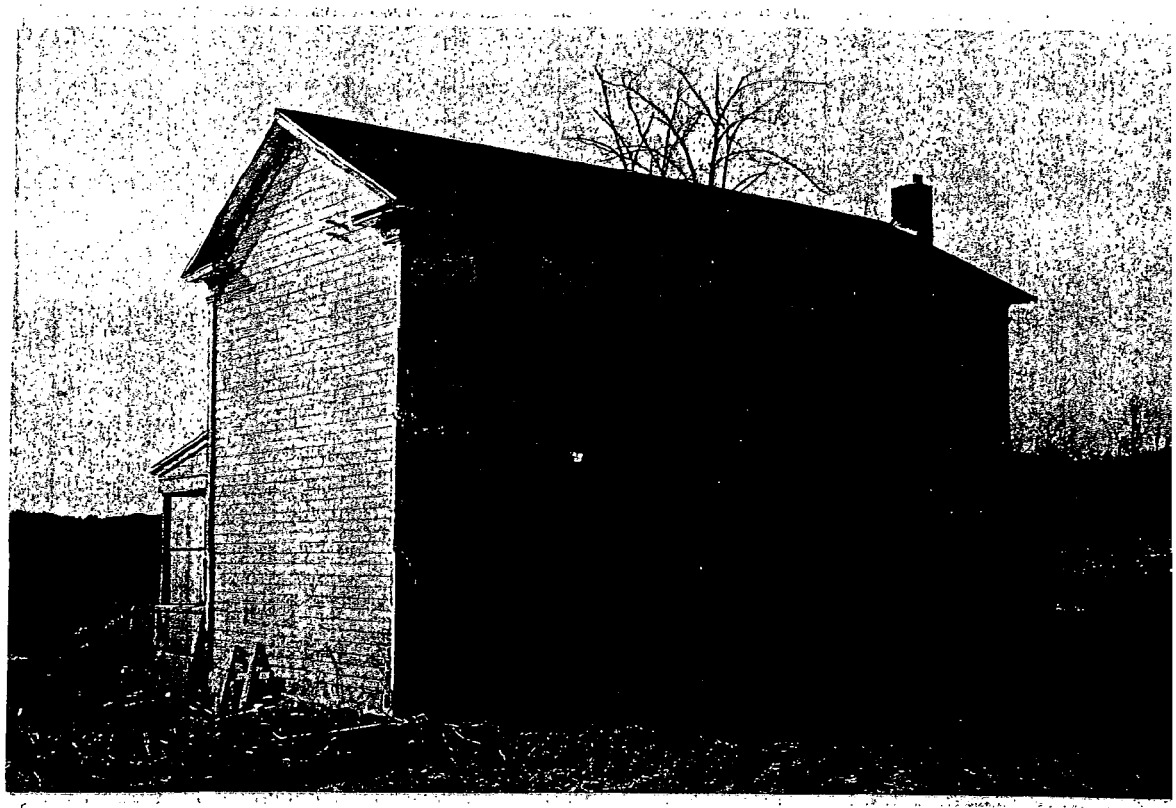
10-62 Outbuilding 2 Back



10-63 Outbuilding 3 Front

10-64 Outbuilding 3 Back



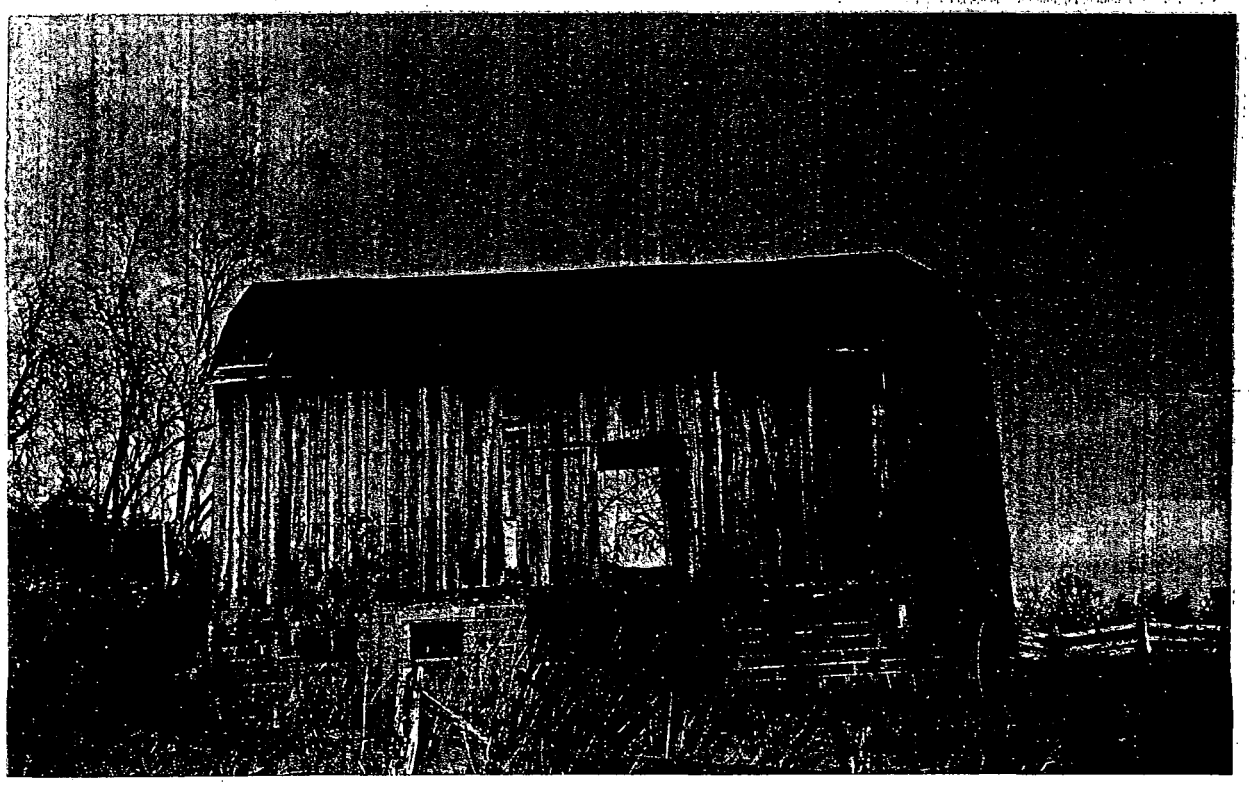


11-65 House Front

11-66 House Back

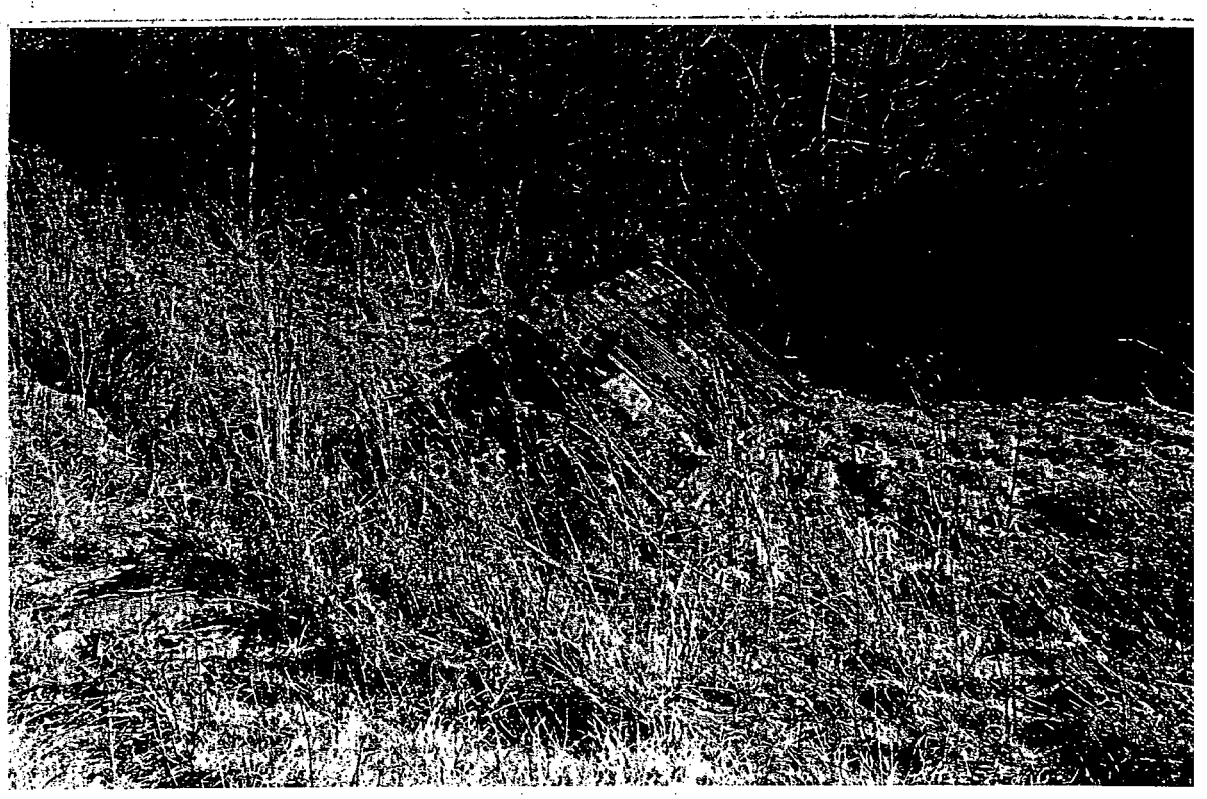
11-67 Barn Front

11-68 Barn Back



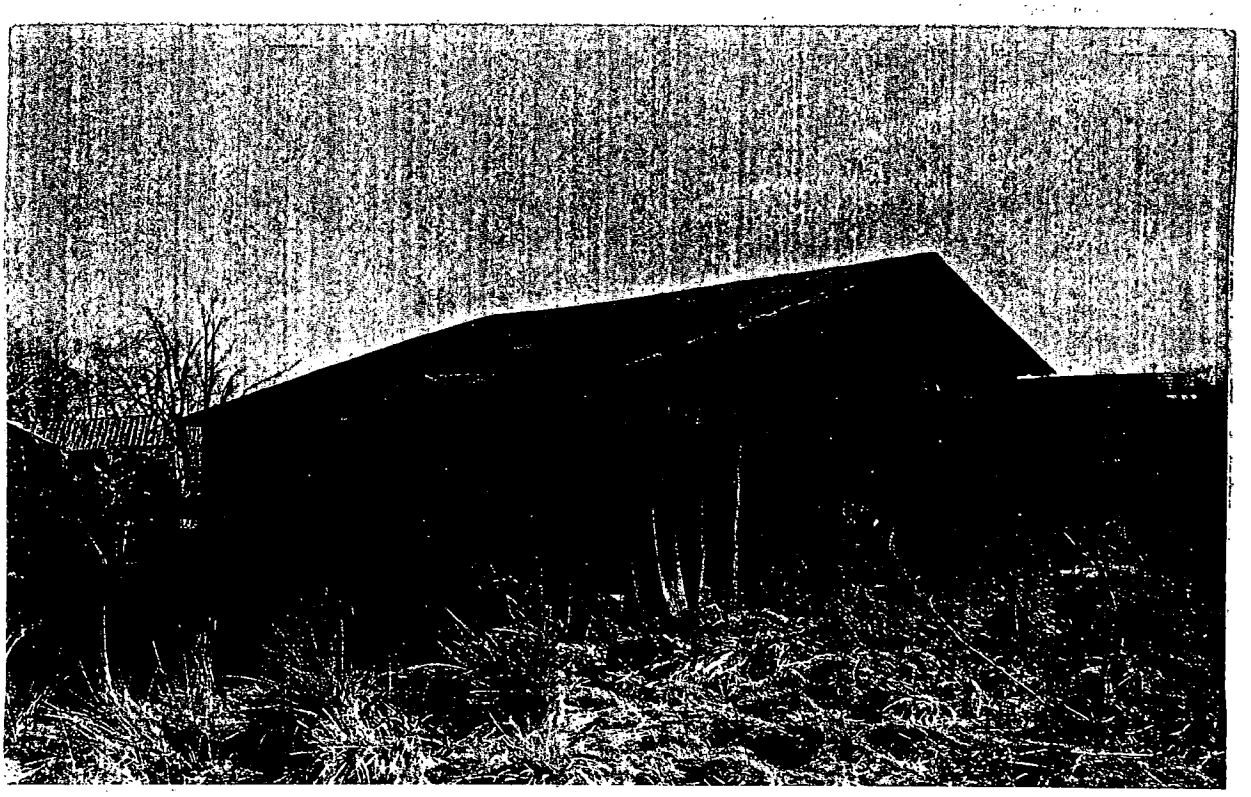
11-69 Spring House Front

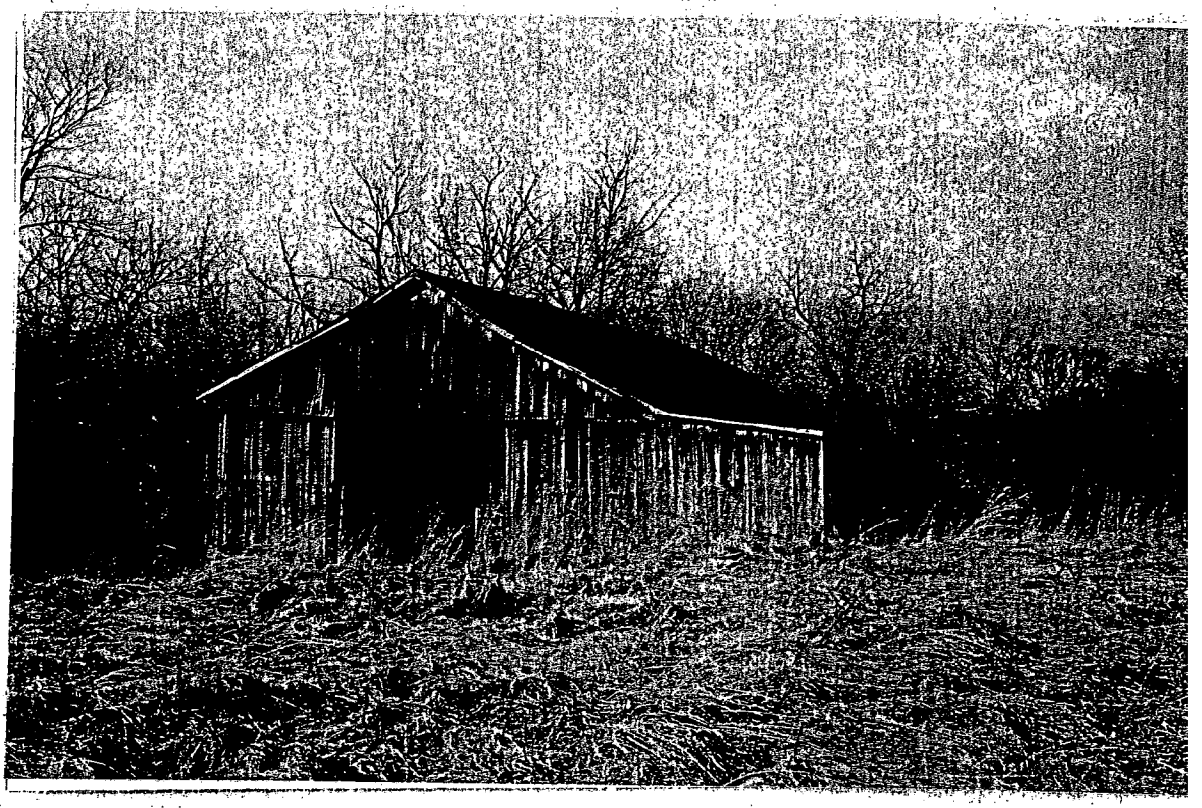
11-70 Spring House Back



11-71 Outbuilding 1 Front

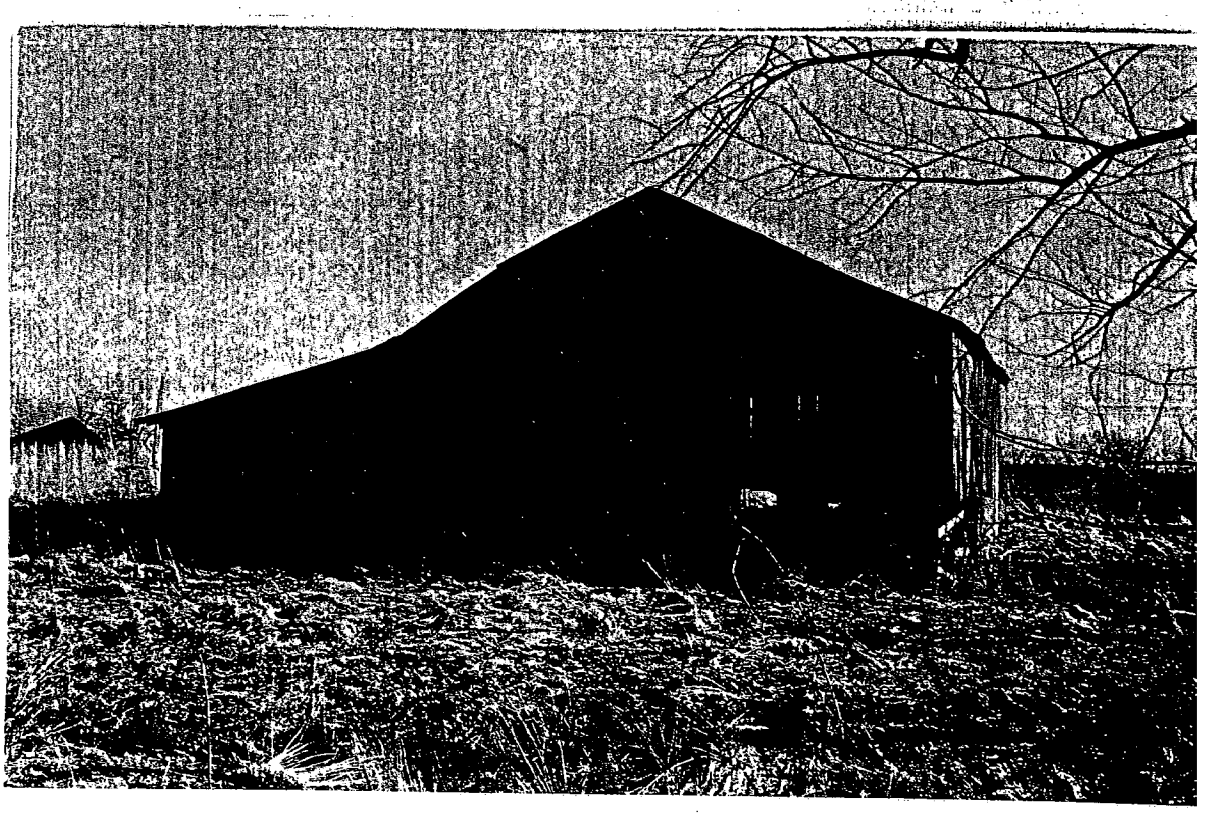
11-72 Outbuilding 1 Back





11-73 Outbuilding 2 Front

11-74 Outbuilding 2 Back

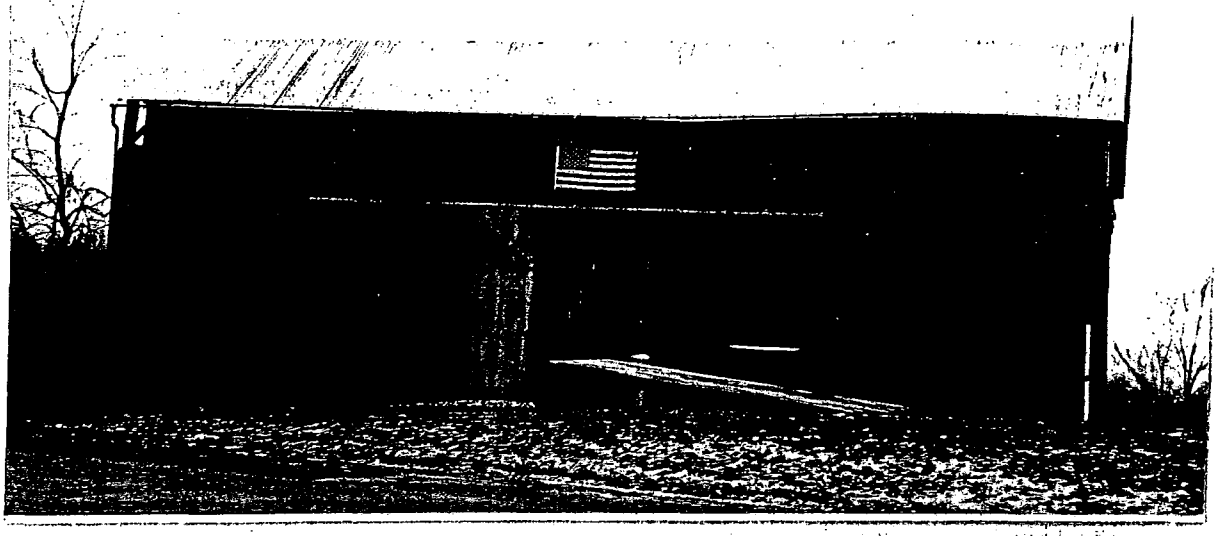


11-75 Outbuilding 3 Front

11-76 Outbuilding 3 Back

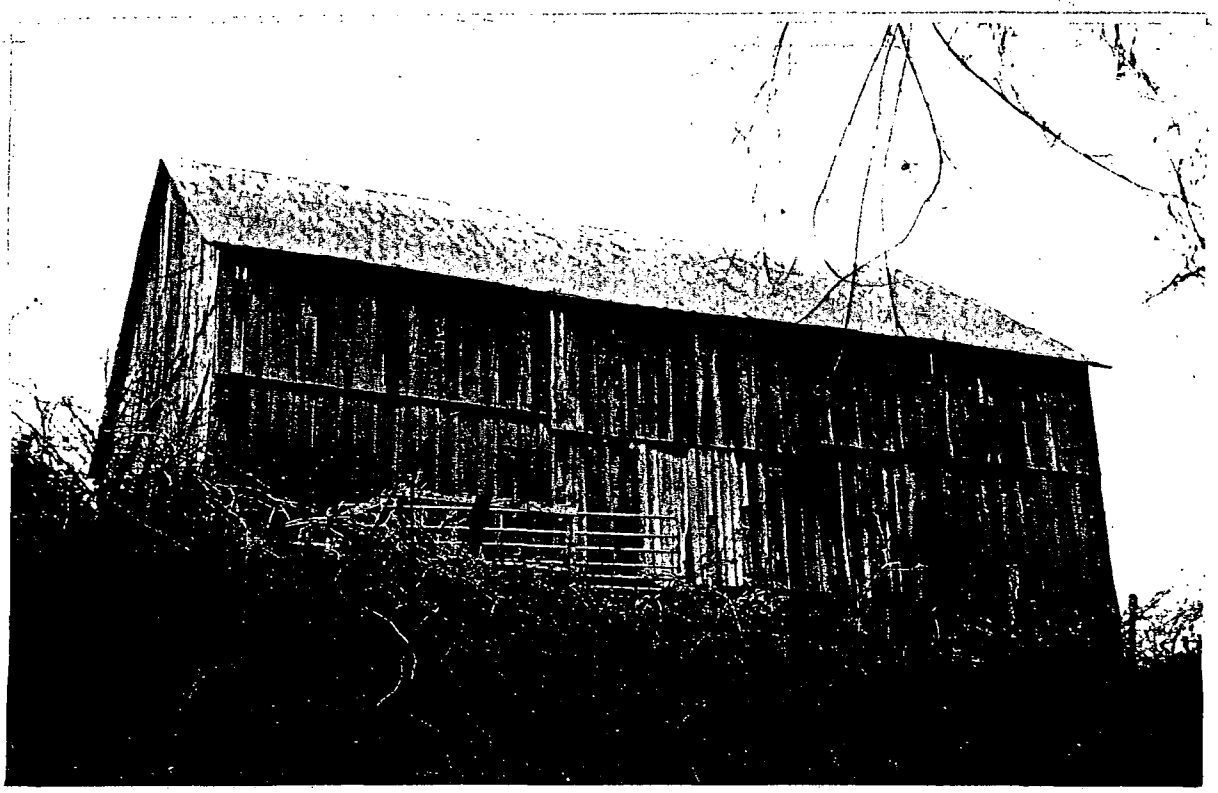
12-77 House Front

12-78 House Back



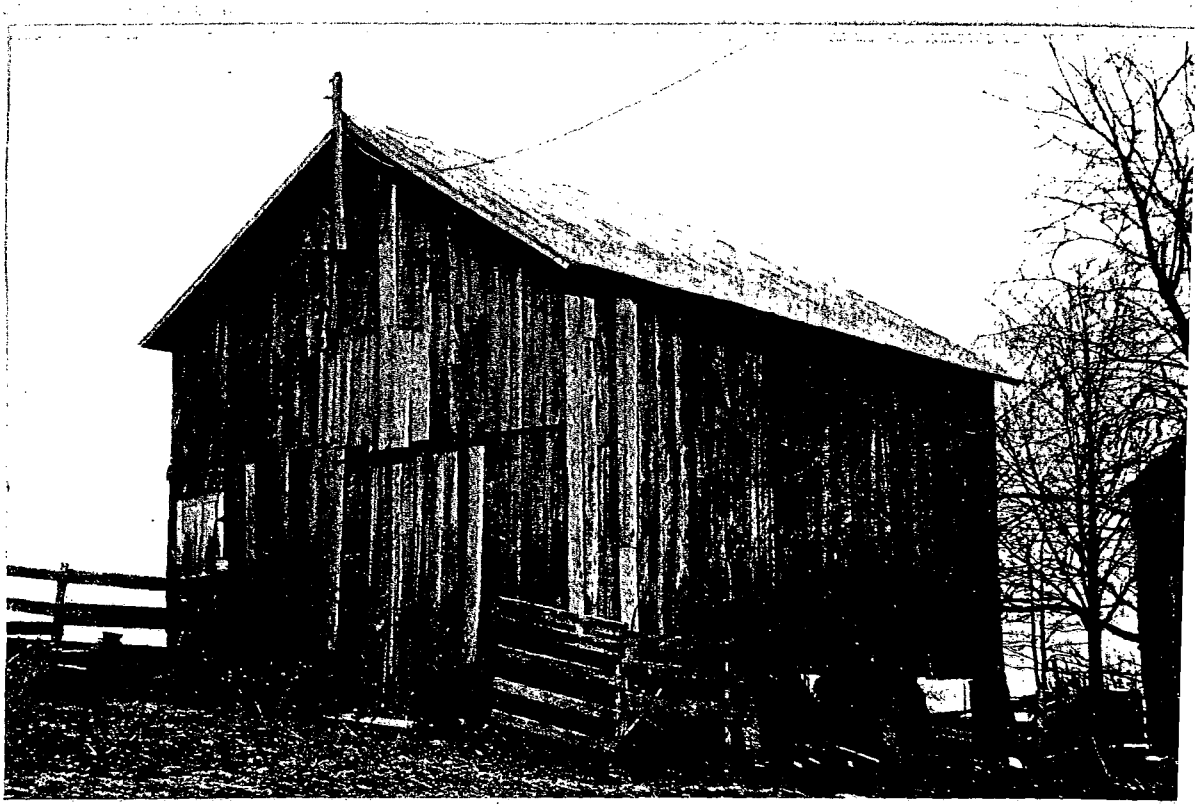
12-79 Barn Front

12-80 Barn Back



12-81 Machine Shed Front

12-82 Machine Shed Back



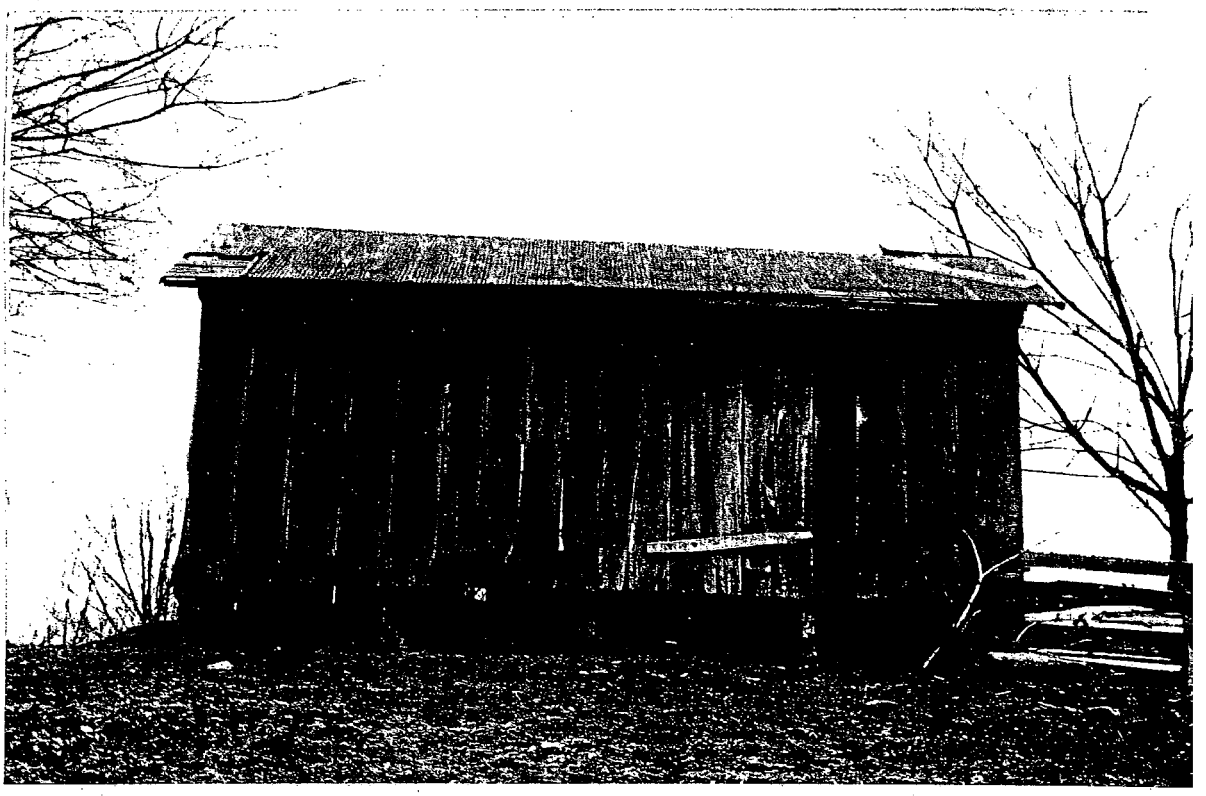
AEC 06233

12-83 Chicken Coupe Front

12-84 Chicken Coupe Back

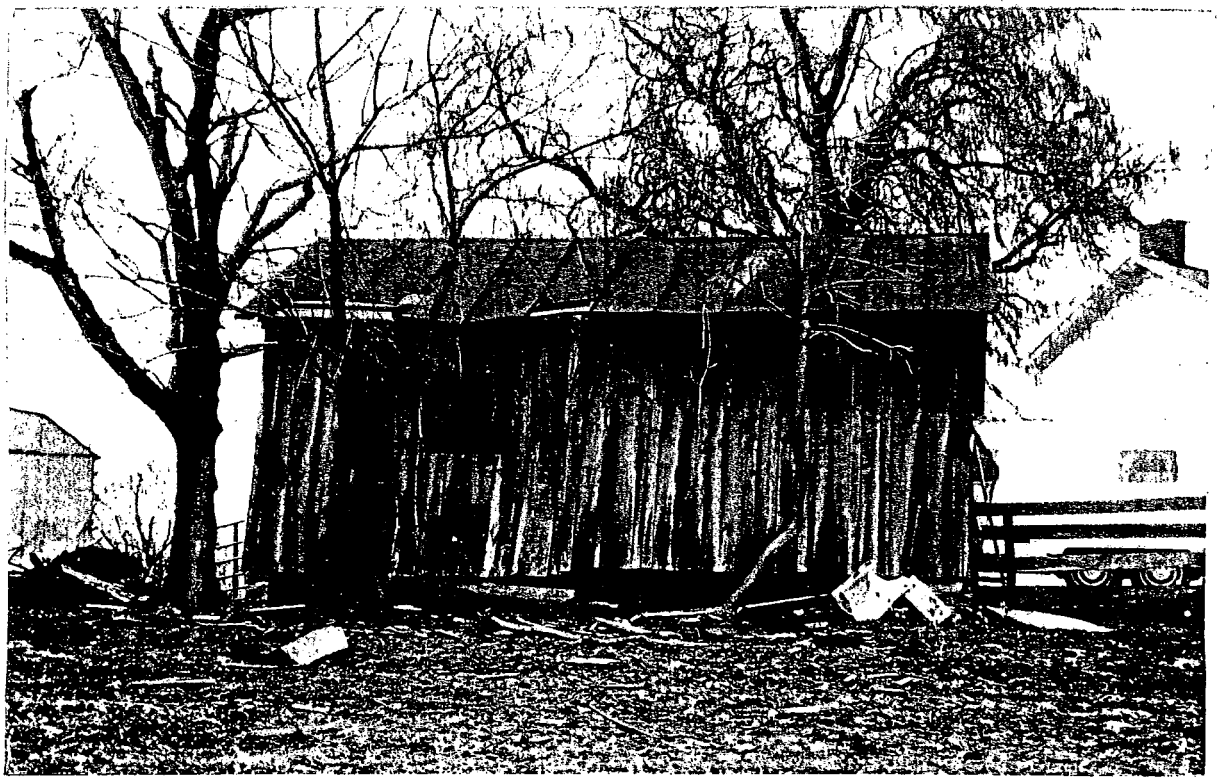
12-85 Hog Shed Front

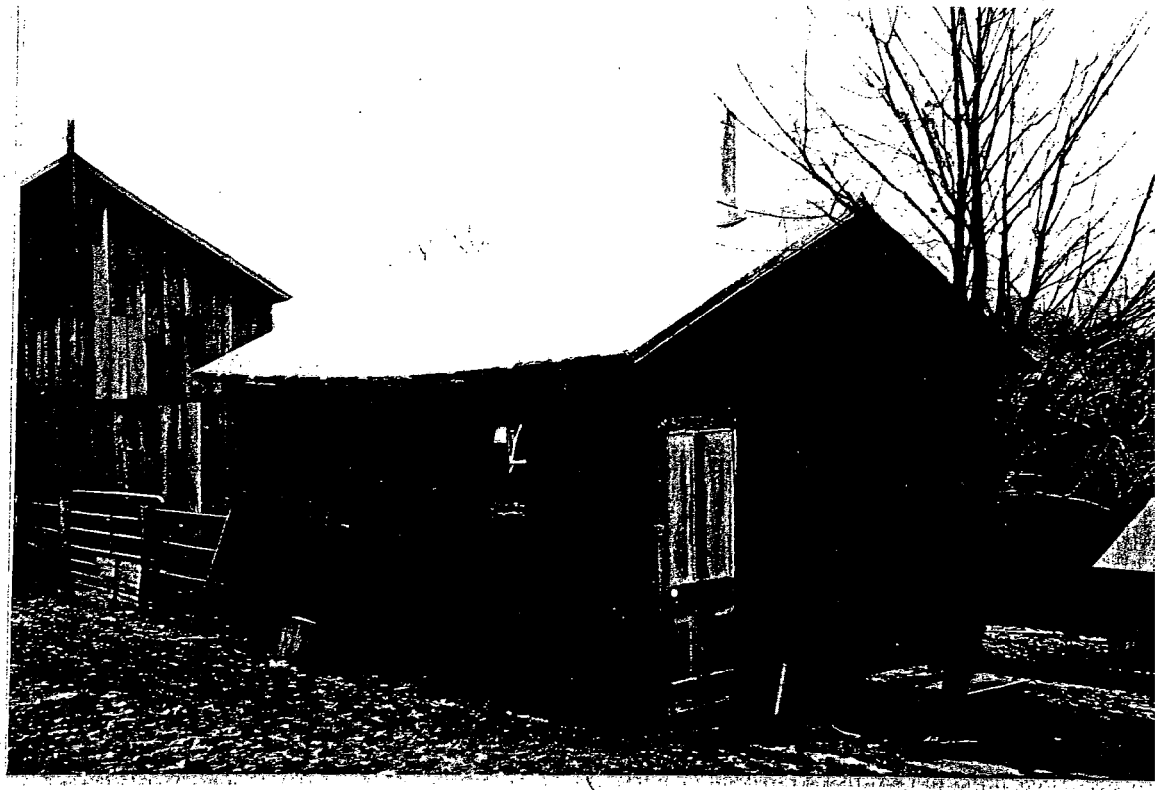
12-86 Hog Shed Back



12-87 Shed 1 Front

12-88 Shed 1 Back





12-89 Shed 2 Front

12-90 Shed 2 Back

12-91 Outbuilding 1 Front

12-92 Outbuilding 1 Back

12-93 Garage Front

12-94 Garage Back

12-95 Machine Shop Front

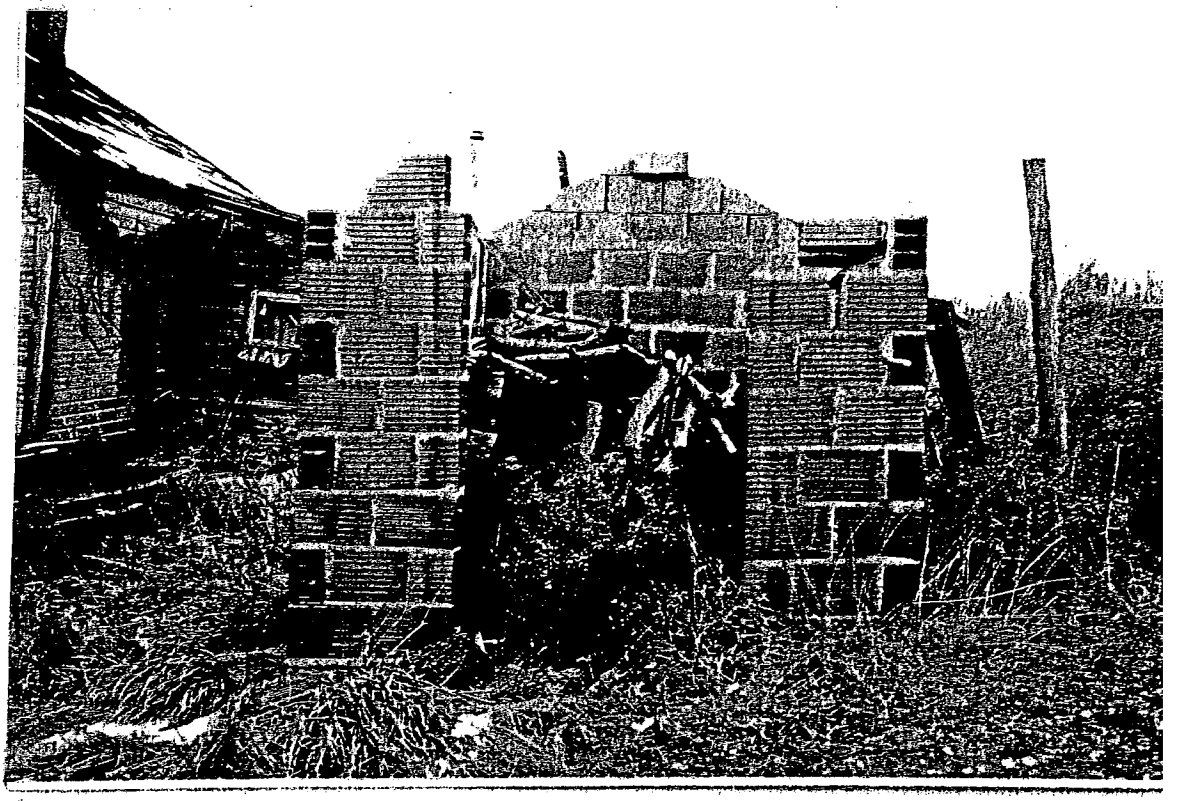
12-96 Machine Shop Back

12-97 Outbuilding 2 Front

12-98 Outbuilding 2 Back

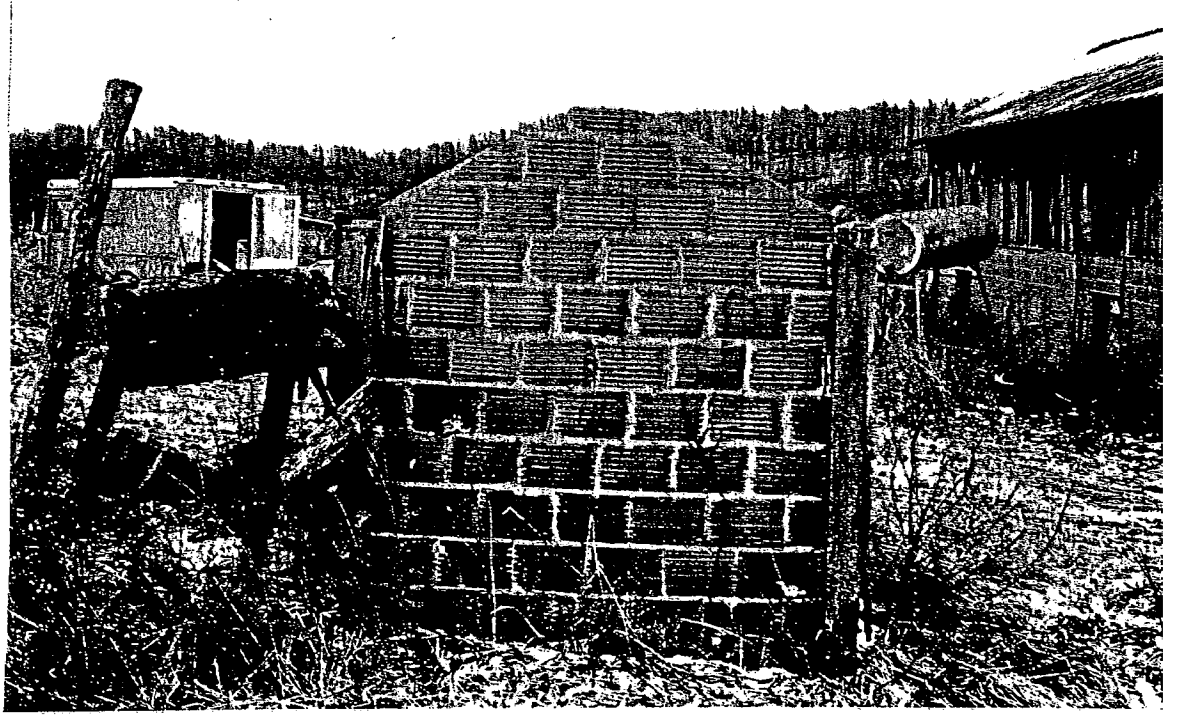
13-99 House Front

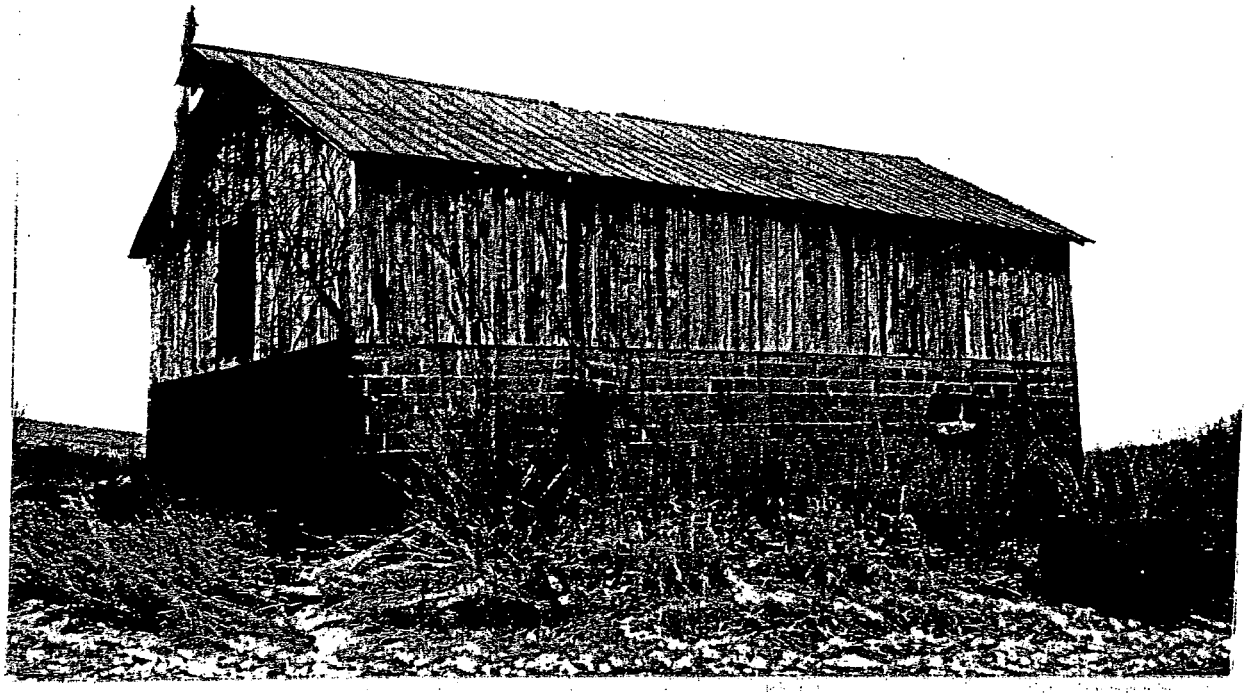
13-100 House Back



13-101 Coal Reservoir Front

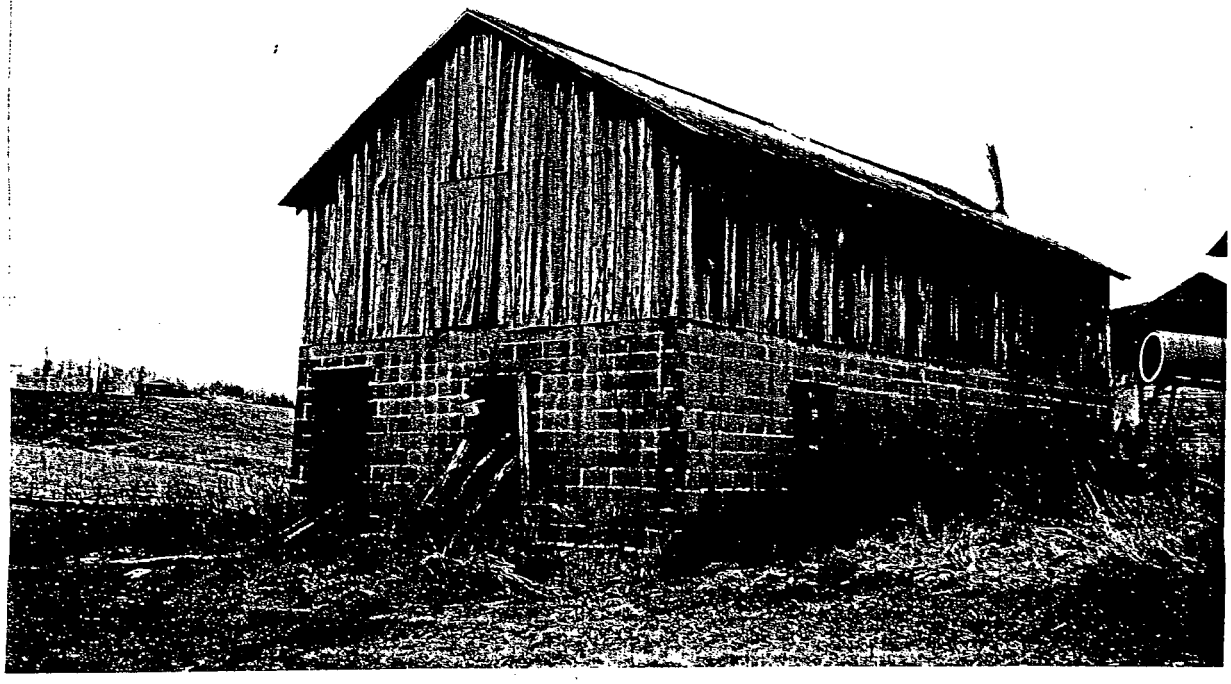
13-102 Coal Reservoir Back





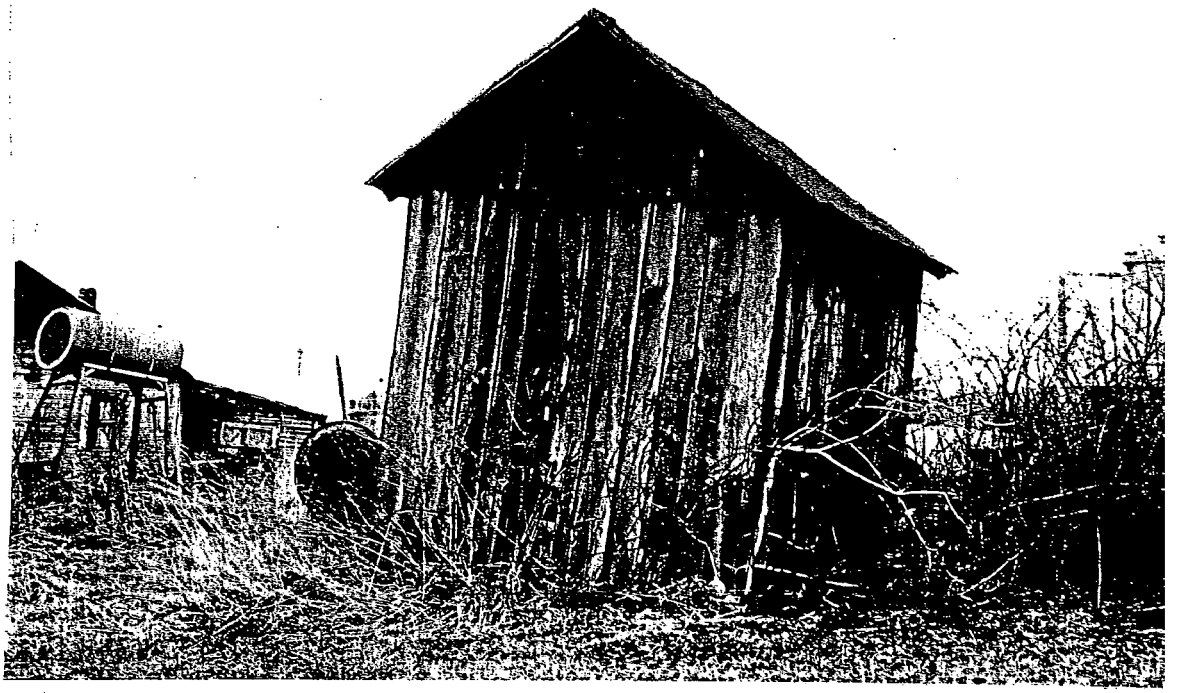
13-103 Barn 1 Front

13-104 Barn 1 Back



13-105 Shed Front

13-106 Shed Back



13-107 Privy Front

13-108 Privy Back

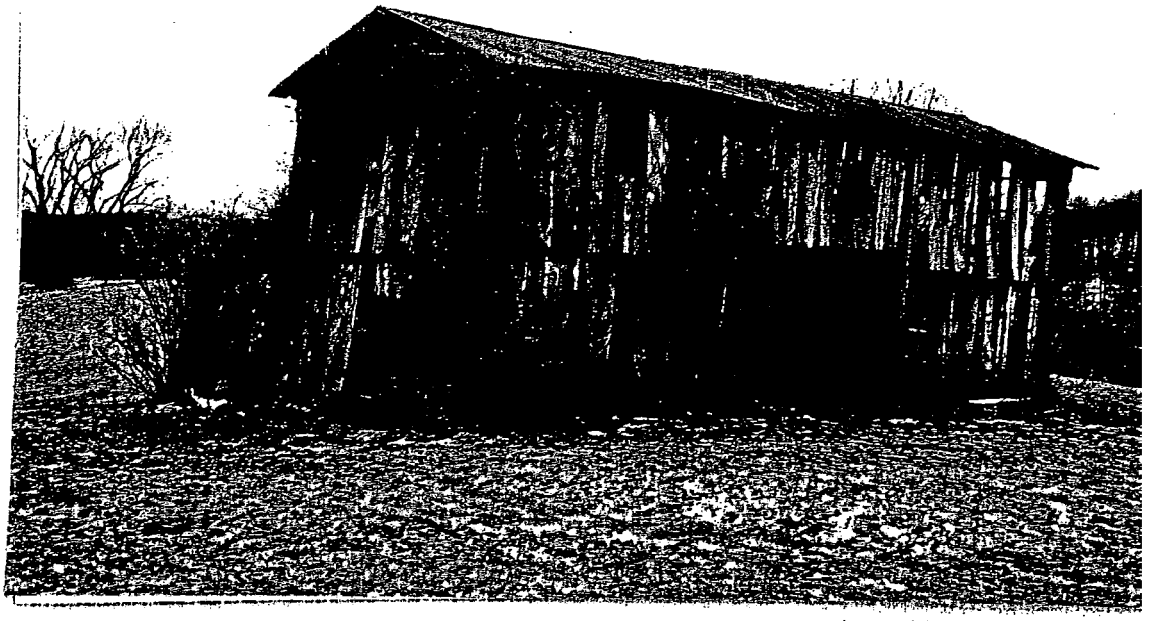
13-109 Ruins

Blank

Blank

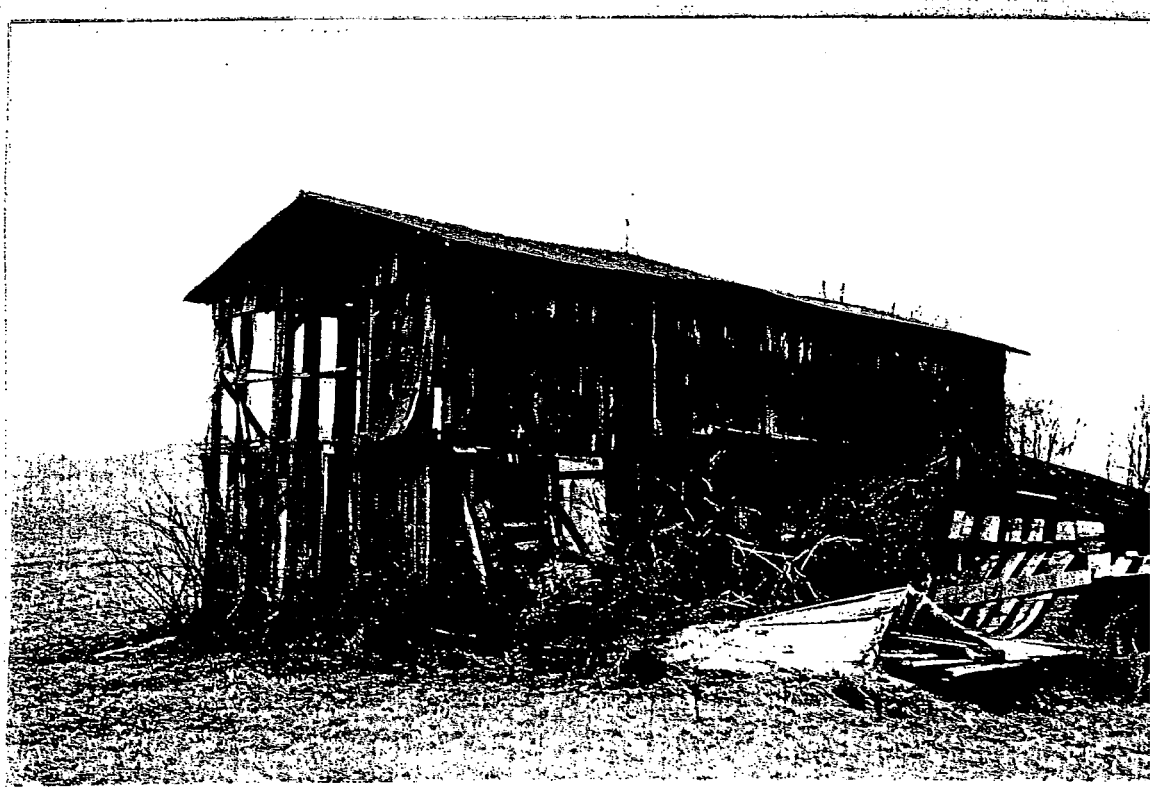
13-110 House Front

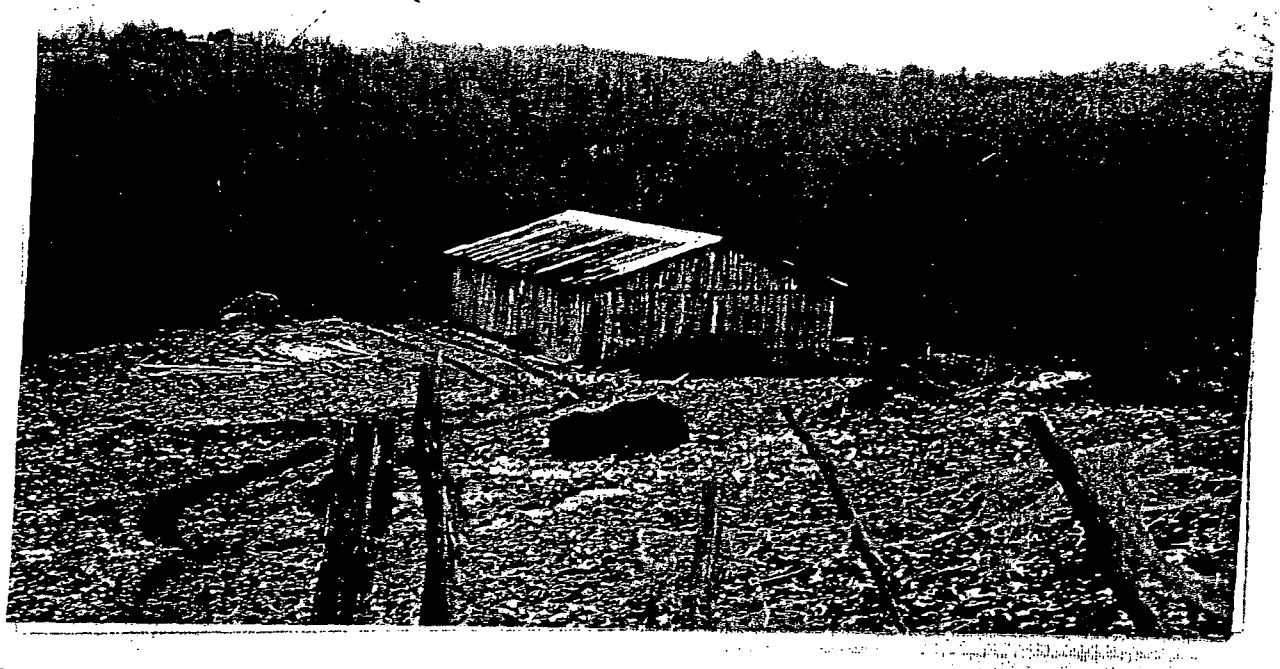
13-111 House Back



13-112 Barn 2 Front

13-113 Barn 2 Back





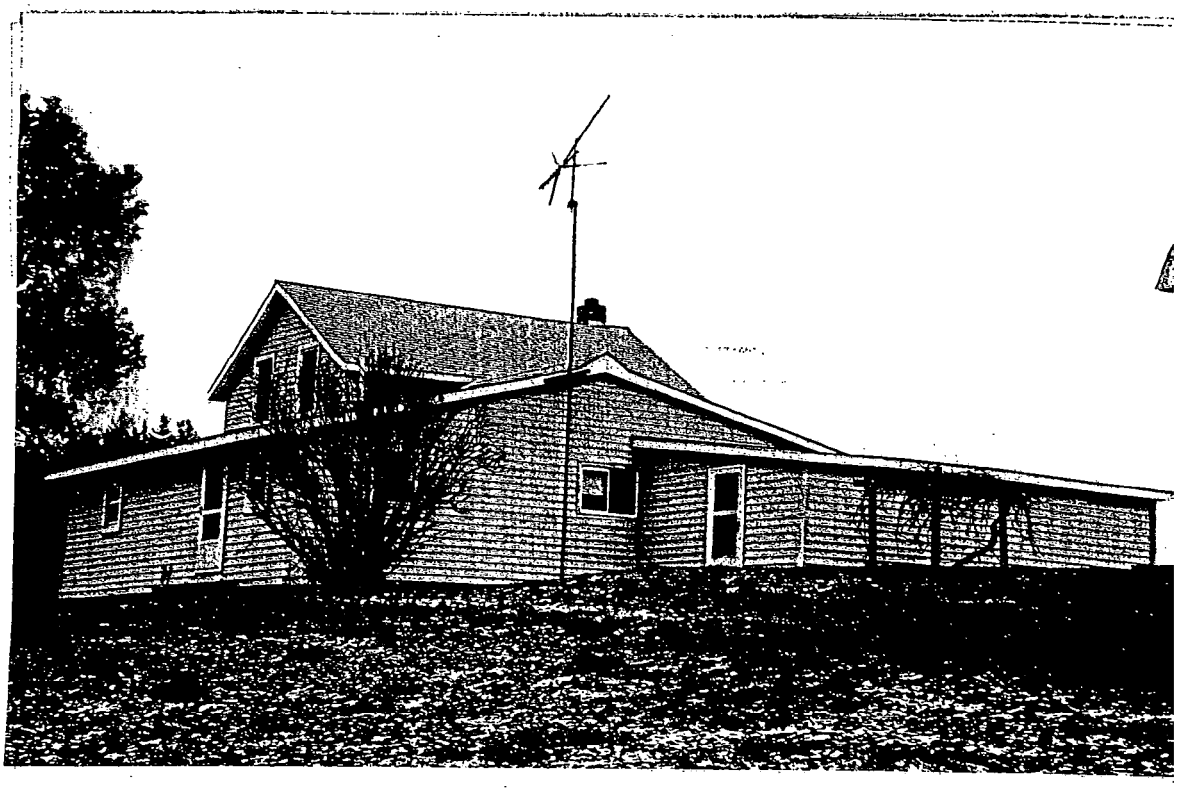
13-114 Cow Barn Front

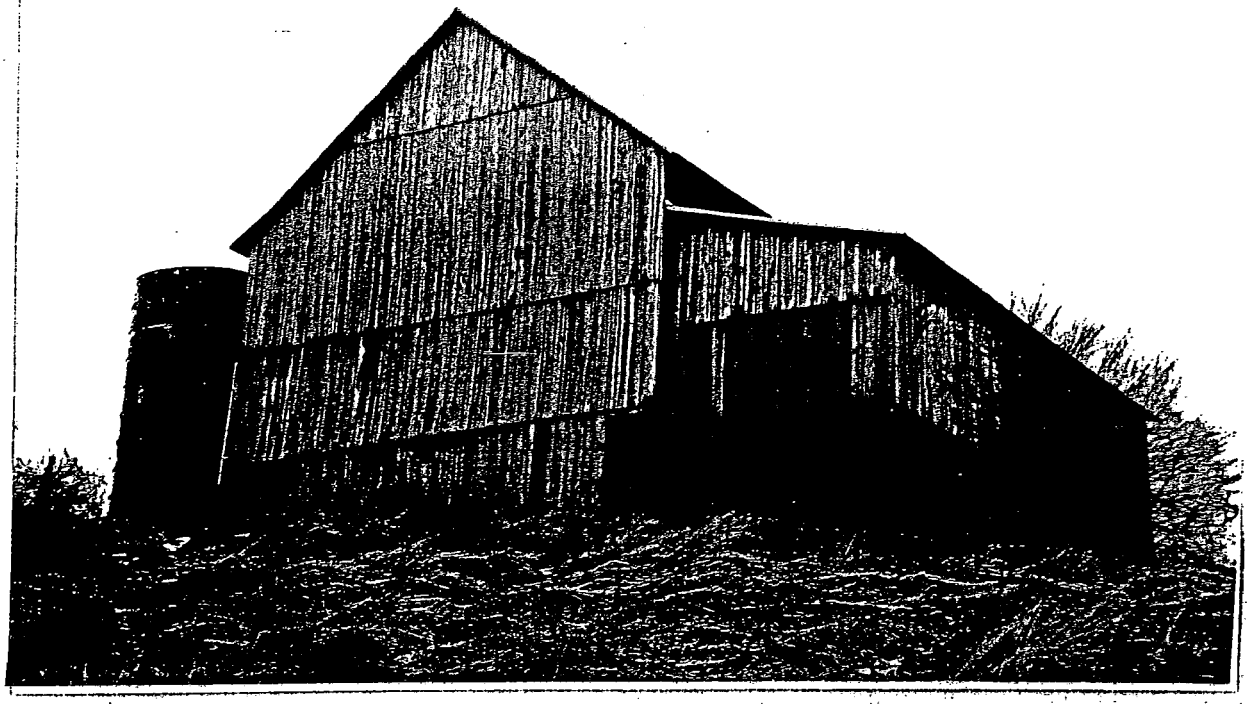
13-115 Cow Barn Back

AEC 06250

14116 House 1 Front

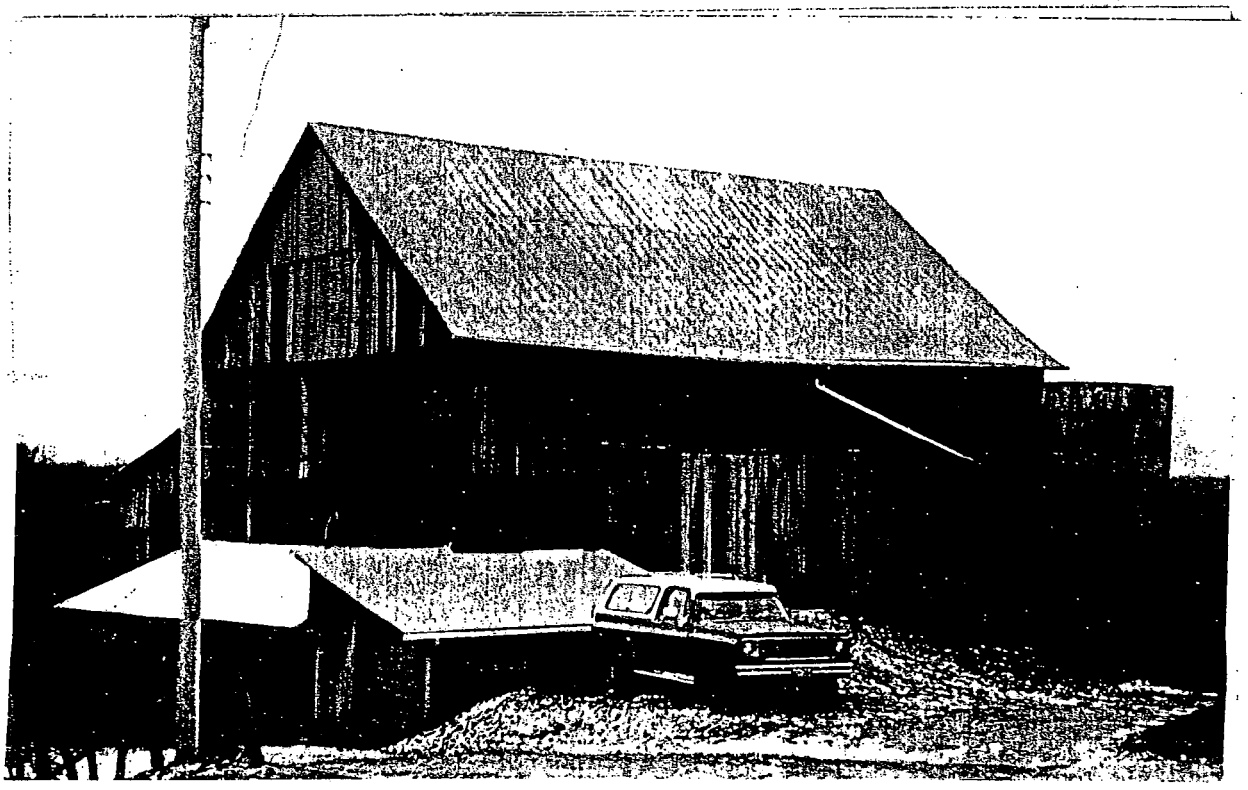
14-117 House 1 Back

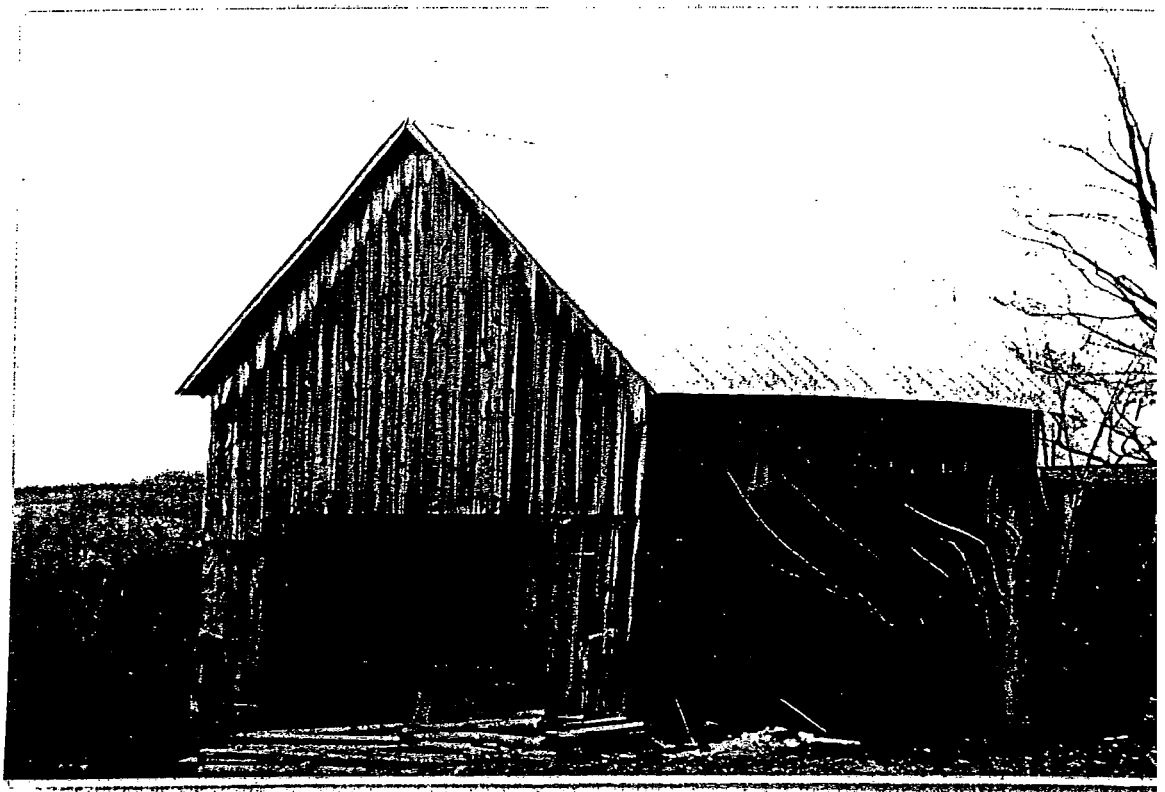




14-118 Barn & Silo Front

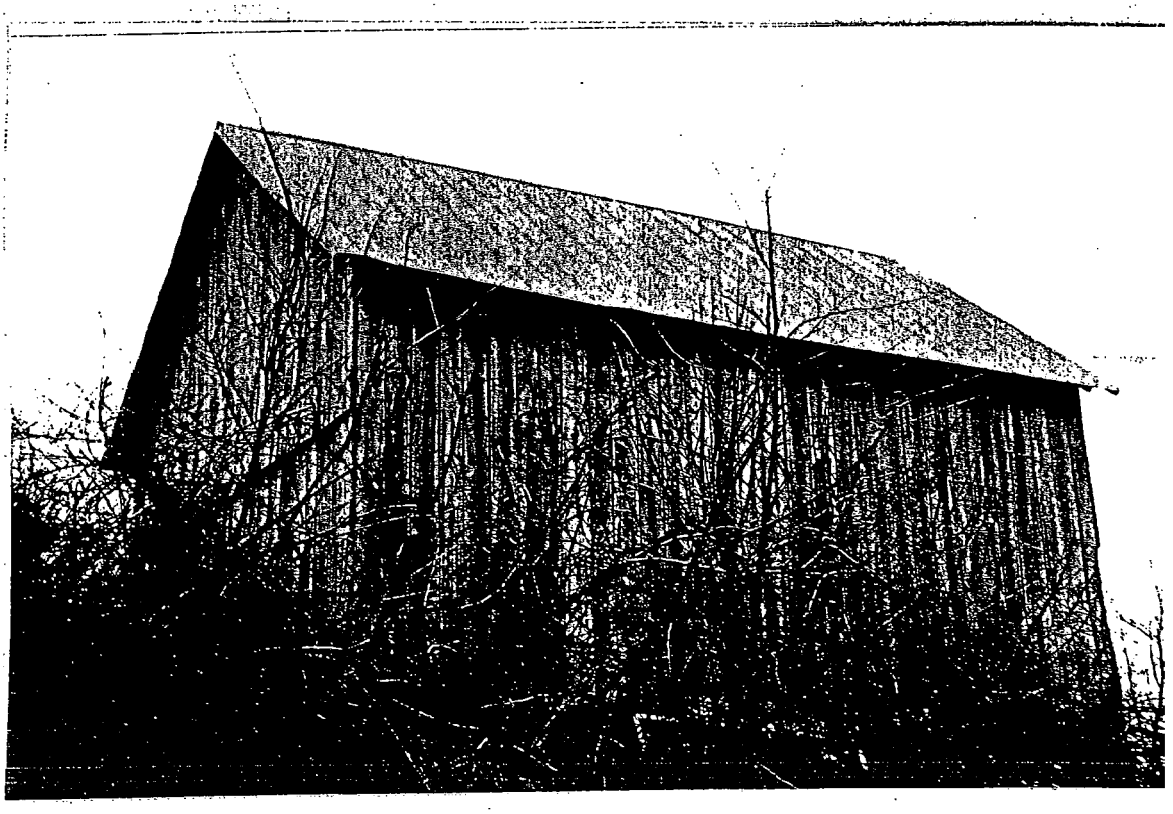
14-119 Barn & Silo Back





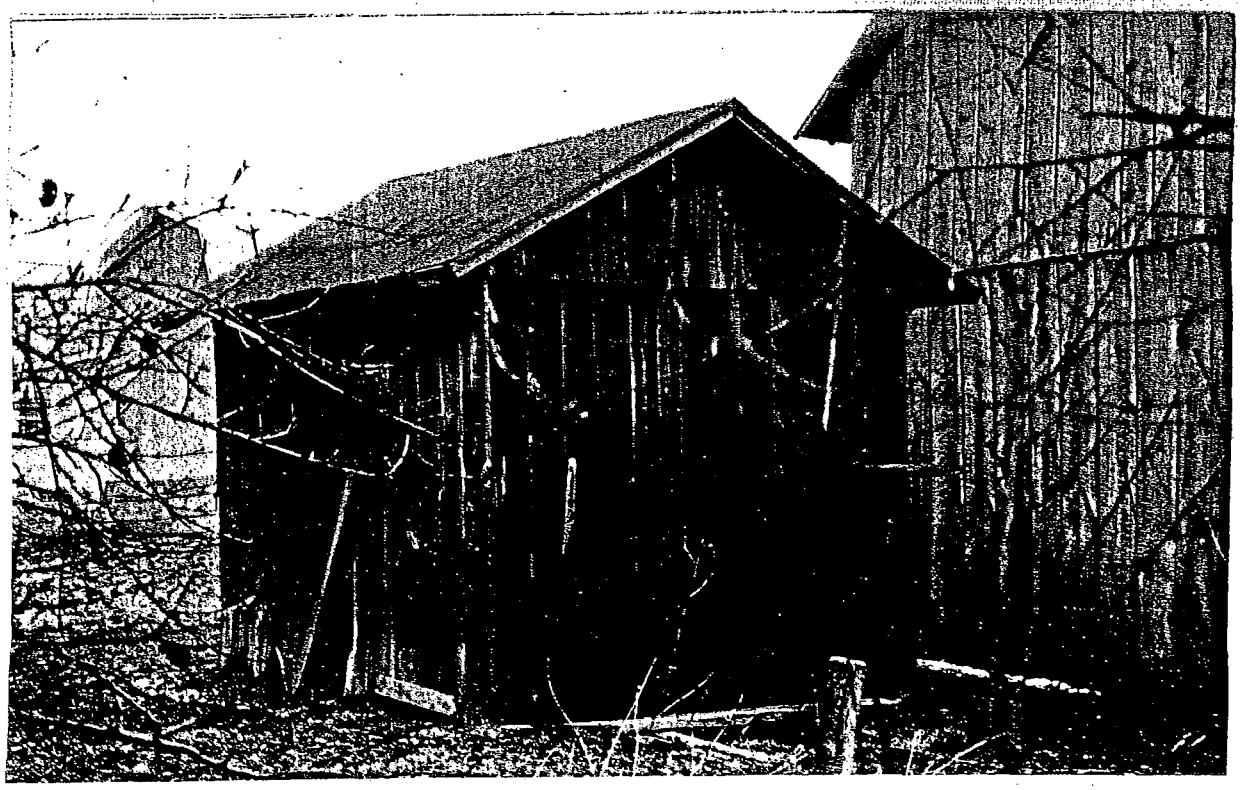
14-120 Machine Shed Front

14-121 Machine Shed Back



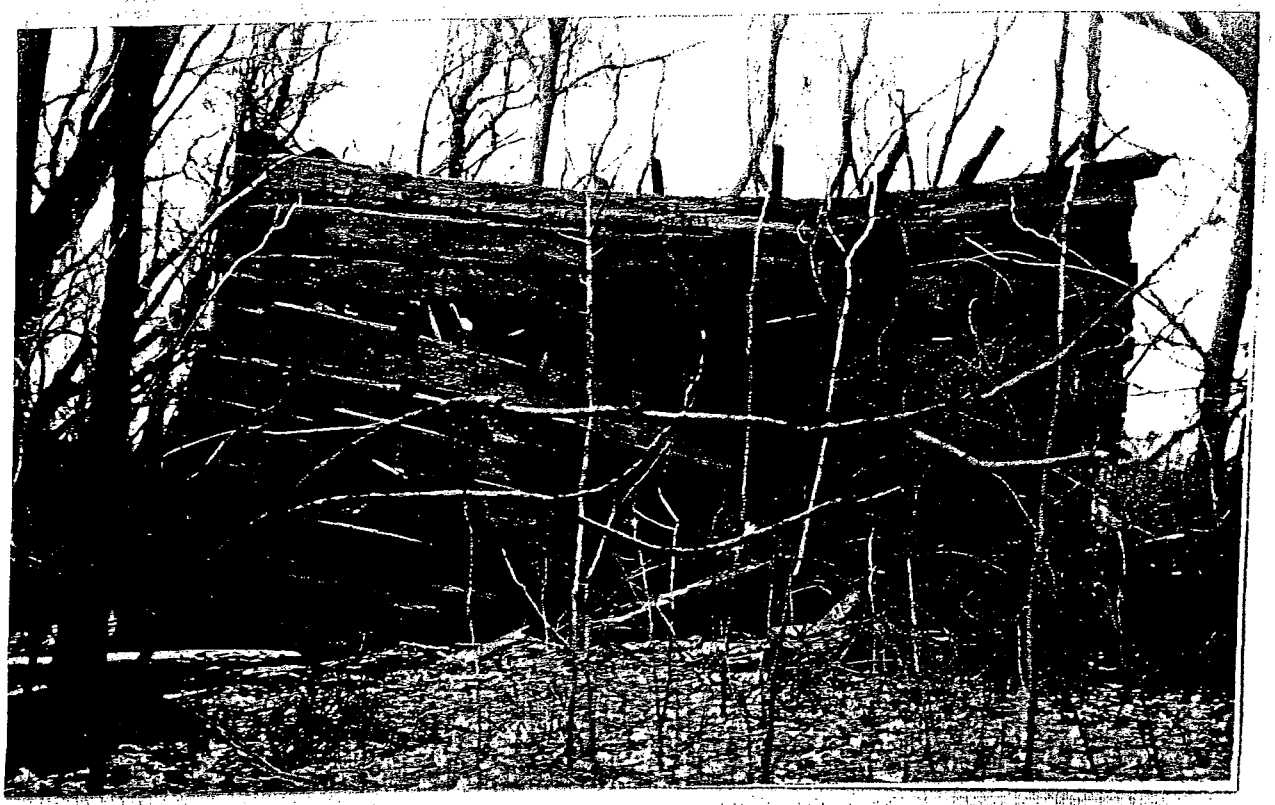
14-122 Shed 1 Front

14-123 Shed 1 Back



14-124 House 2 Front

14-125 House 2 Back

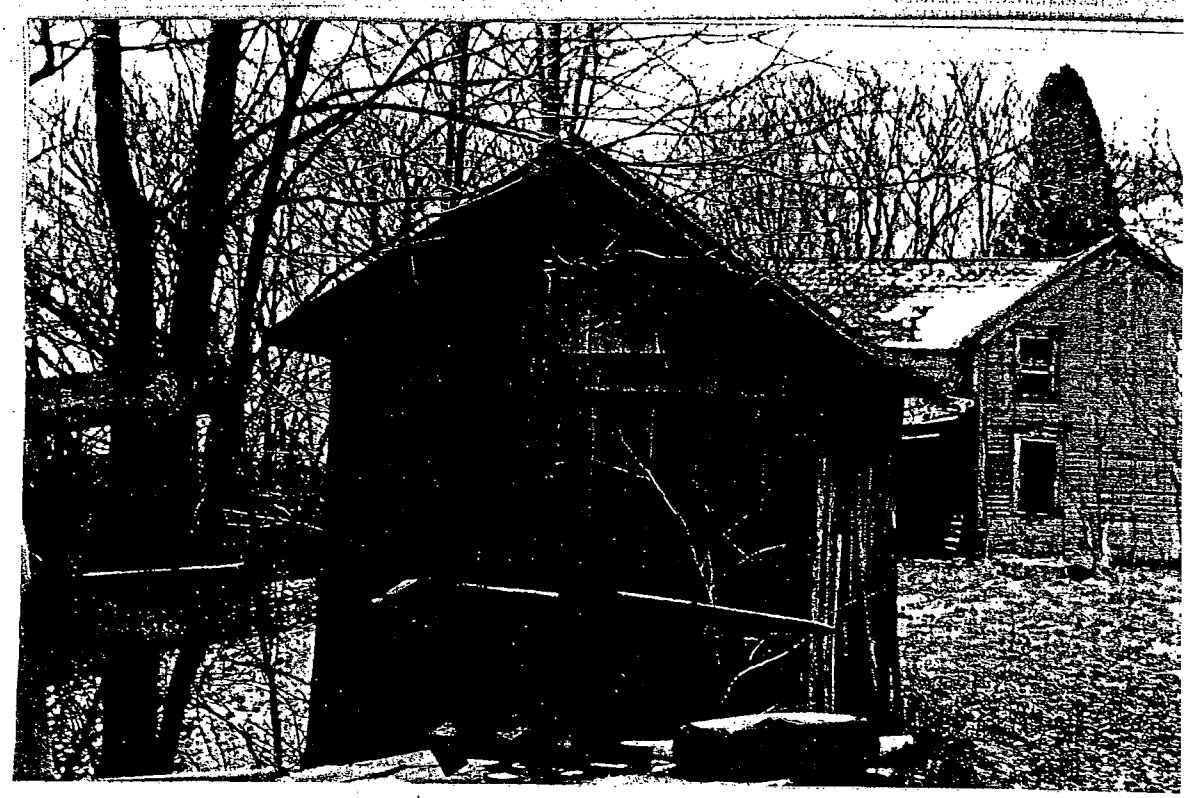


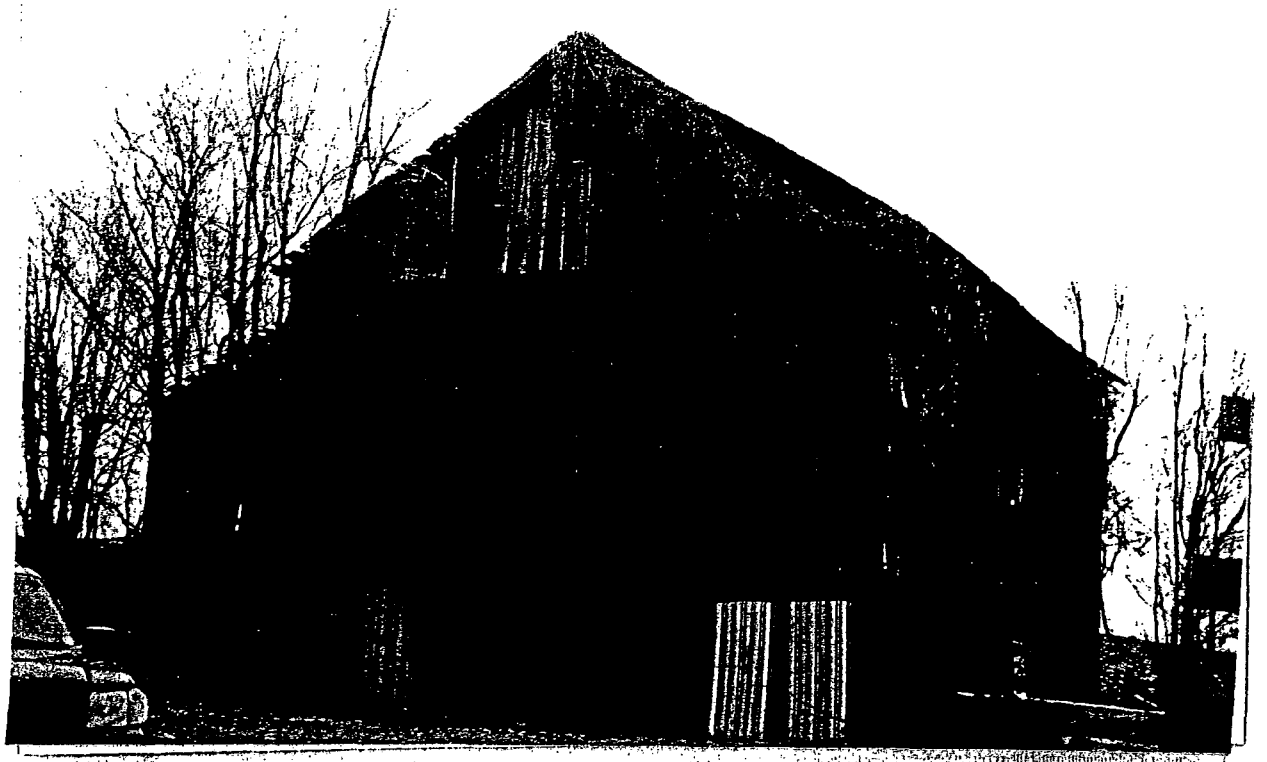
14-126 Log House Front

14-127 Log House Back

14-128 Shed 2 Front

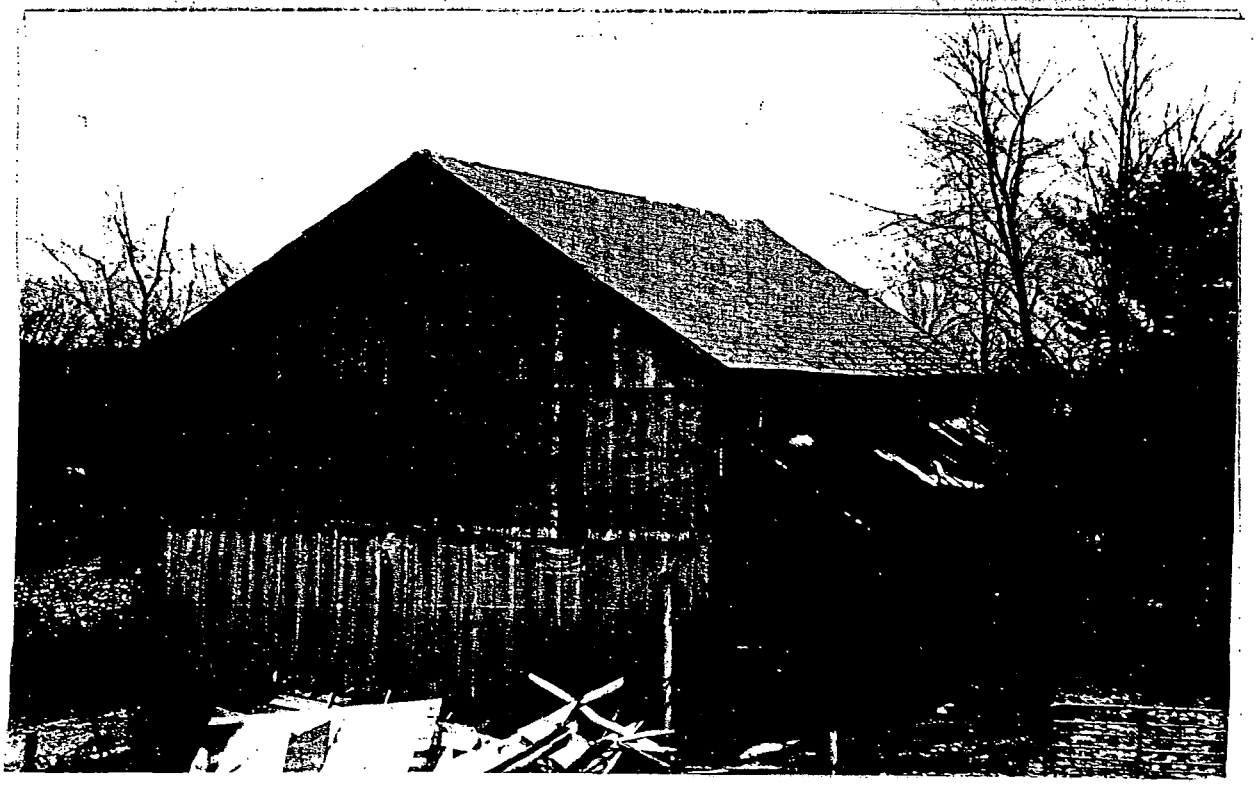
14-129 Shed 2 Back

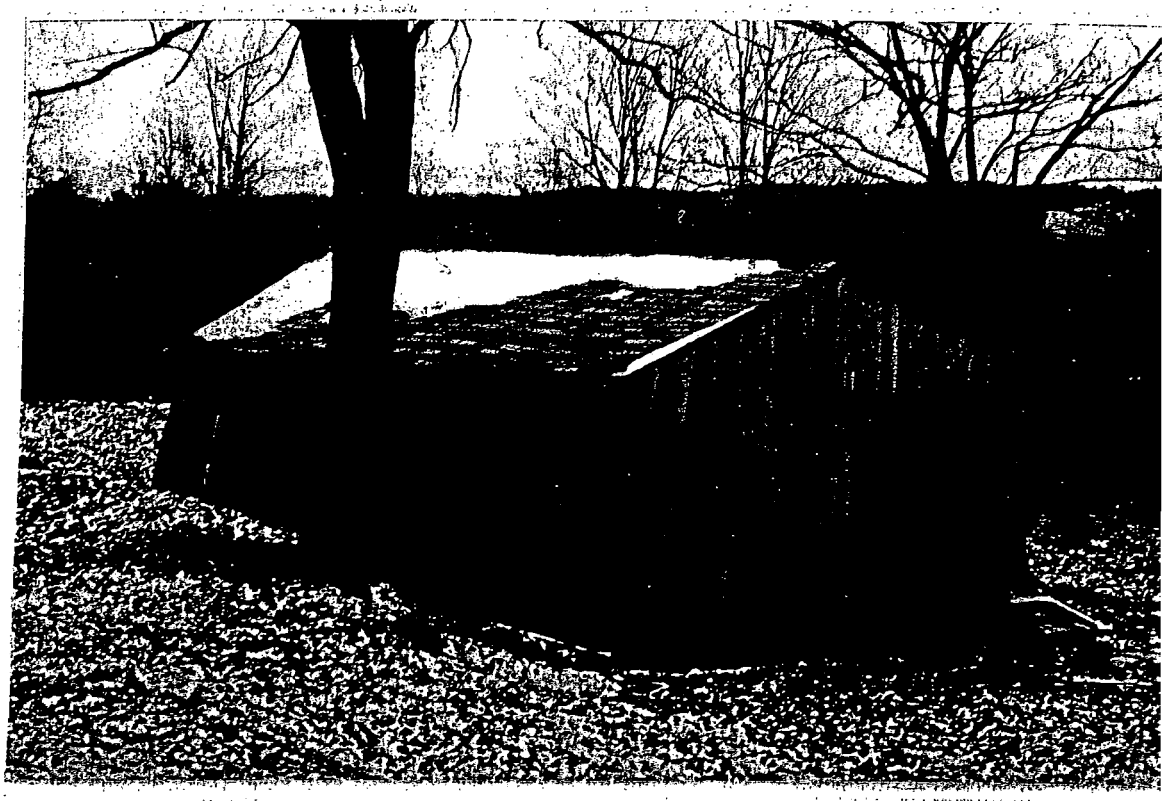




14-130 Barn Front

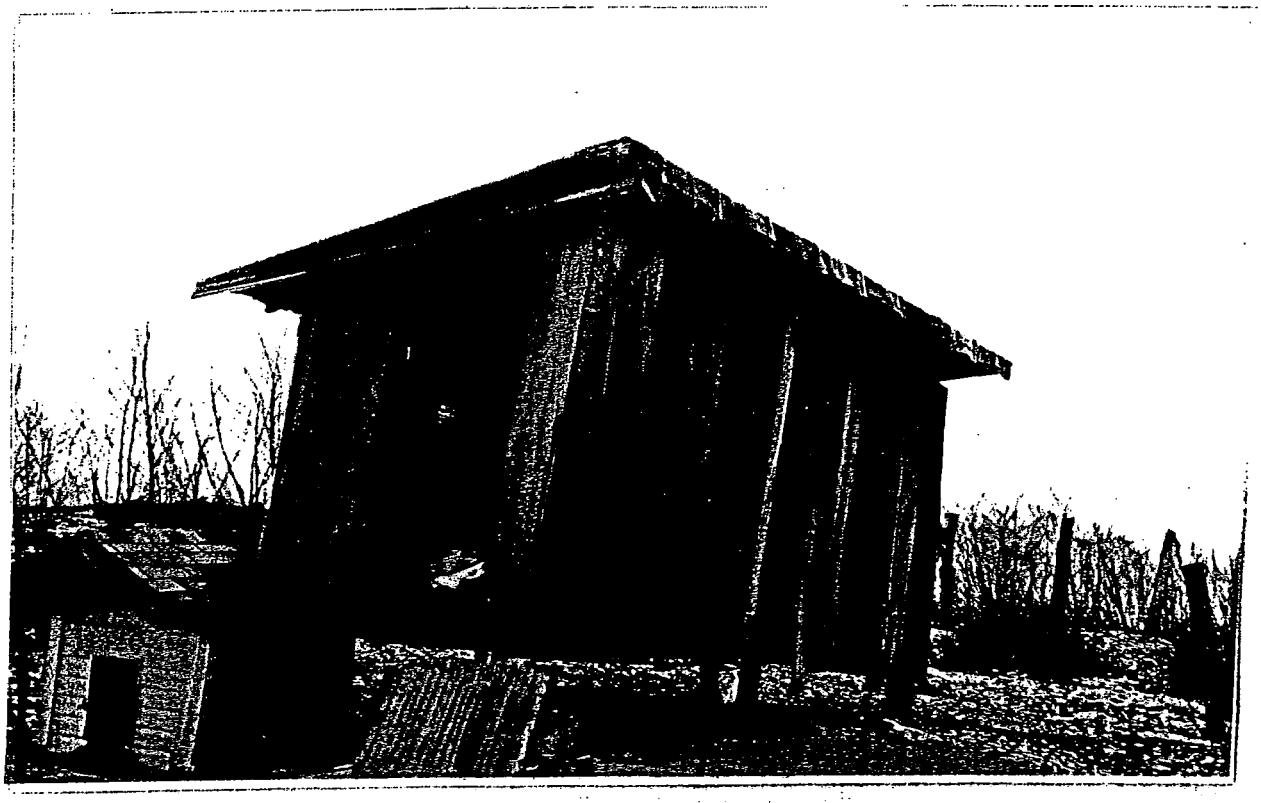
14-131 Barn Back





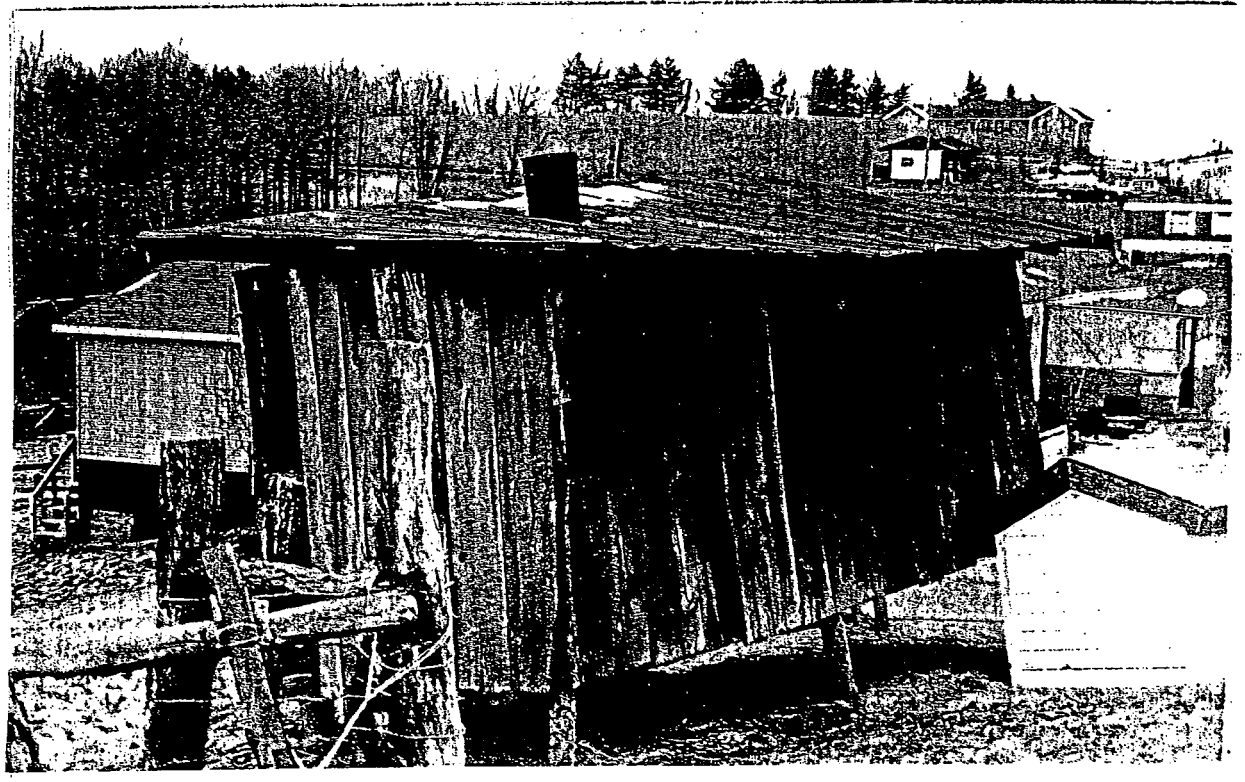
15-132 Outbuilding Front

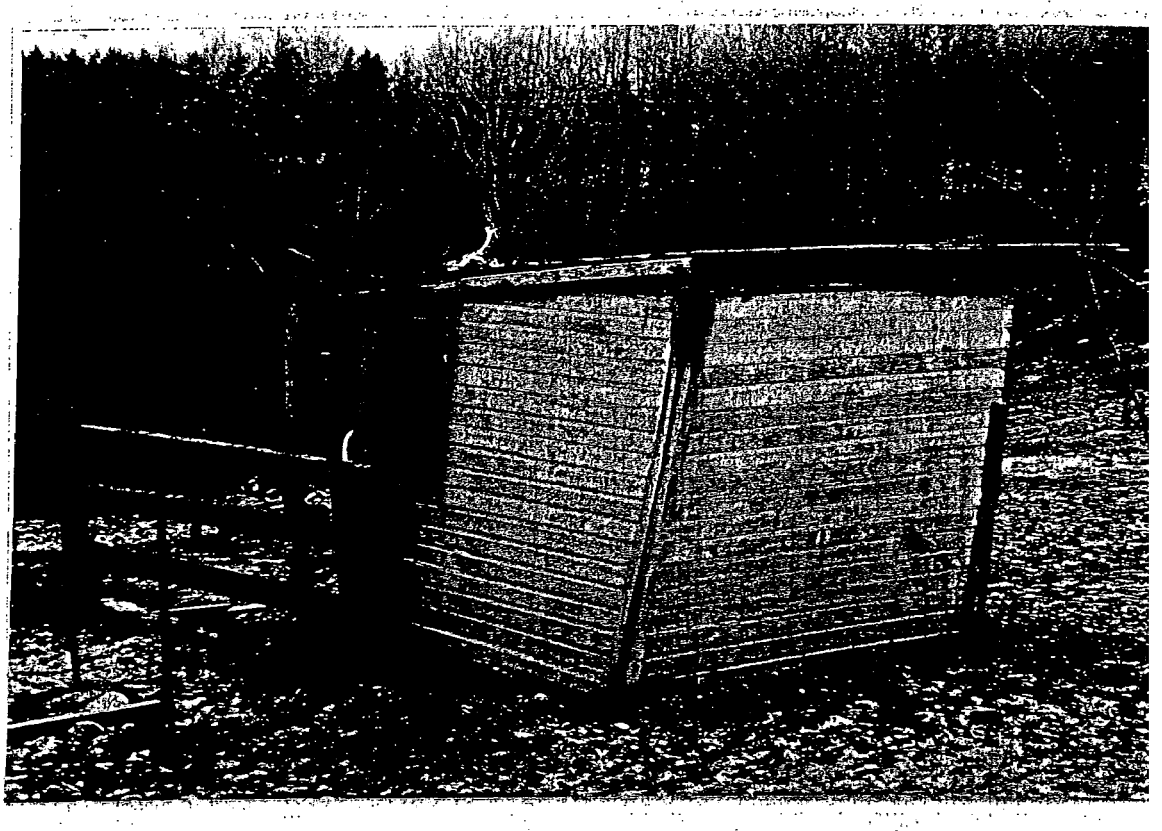
15-133 Outbuilding Back



15-134 Corn Crib Front

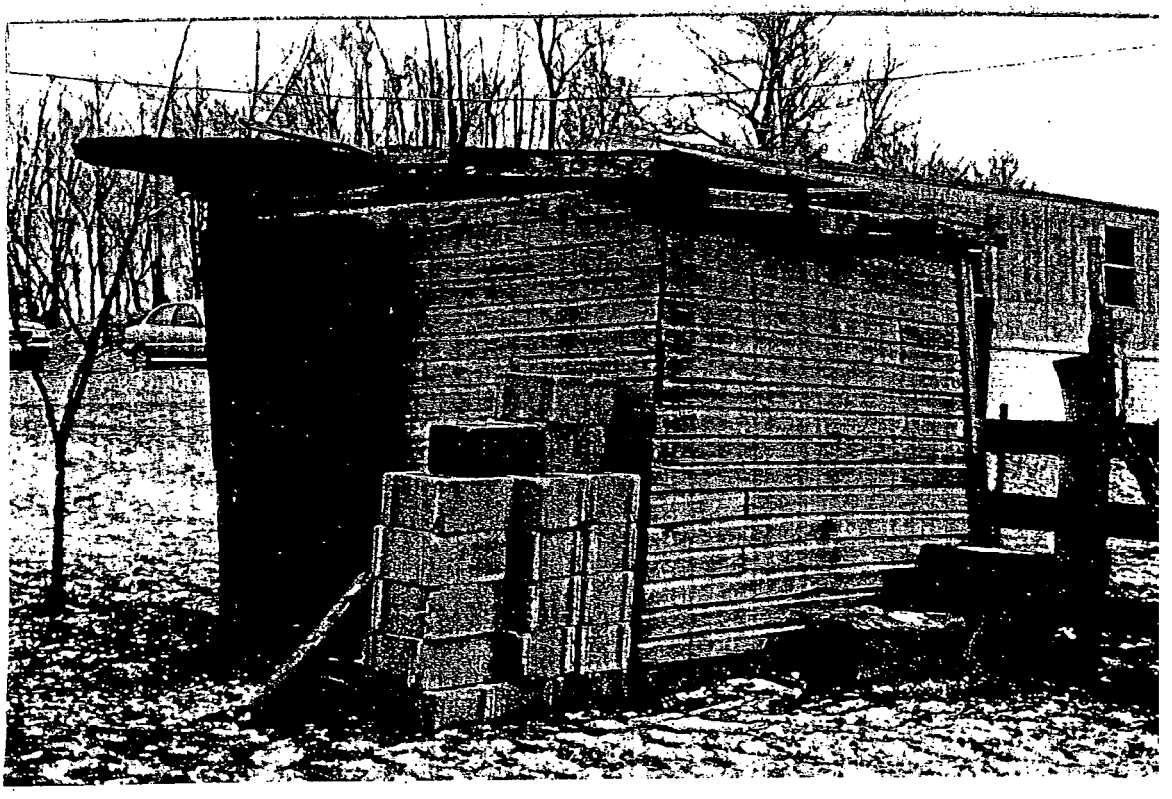
15-135 Corn Crib Back

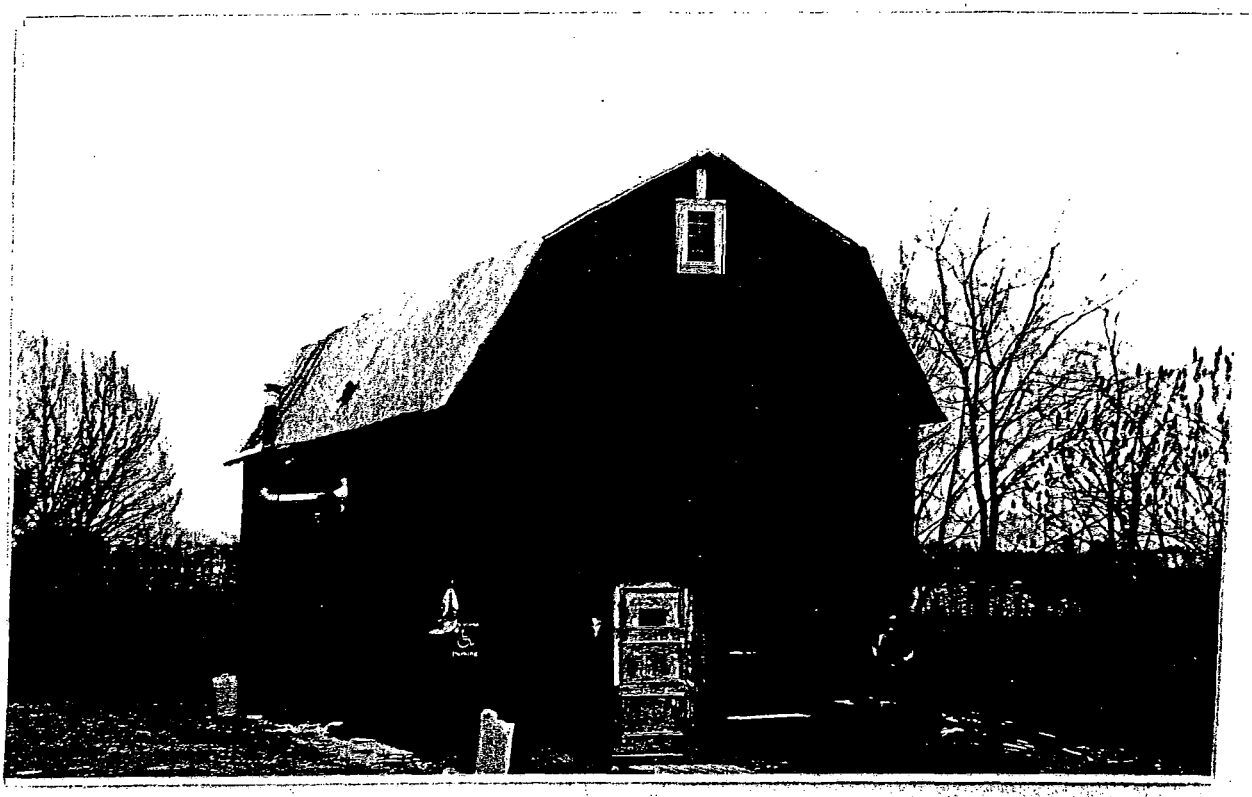




15-136 Well House Front

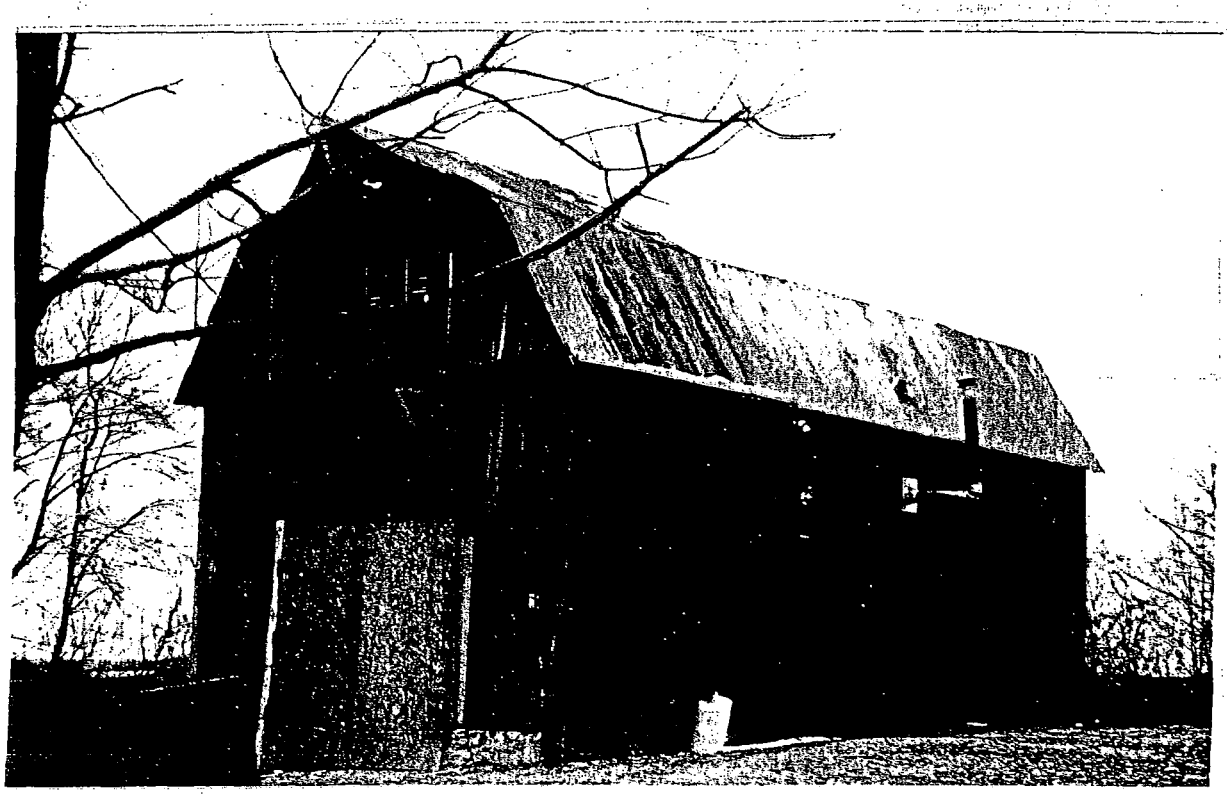
15-137 Well House Back





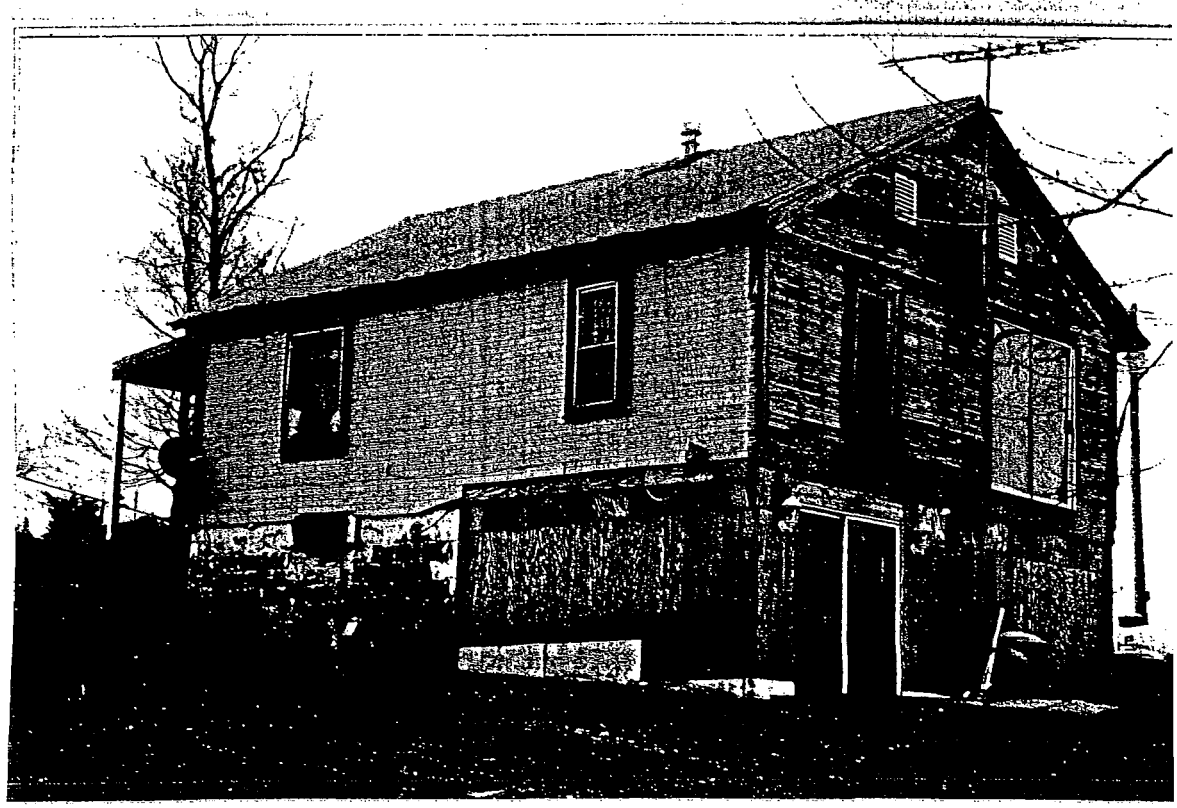
16-138 Barn Front

16 139 Barn Back



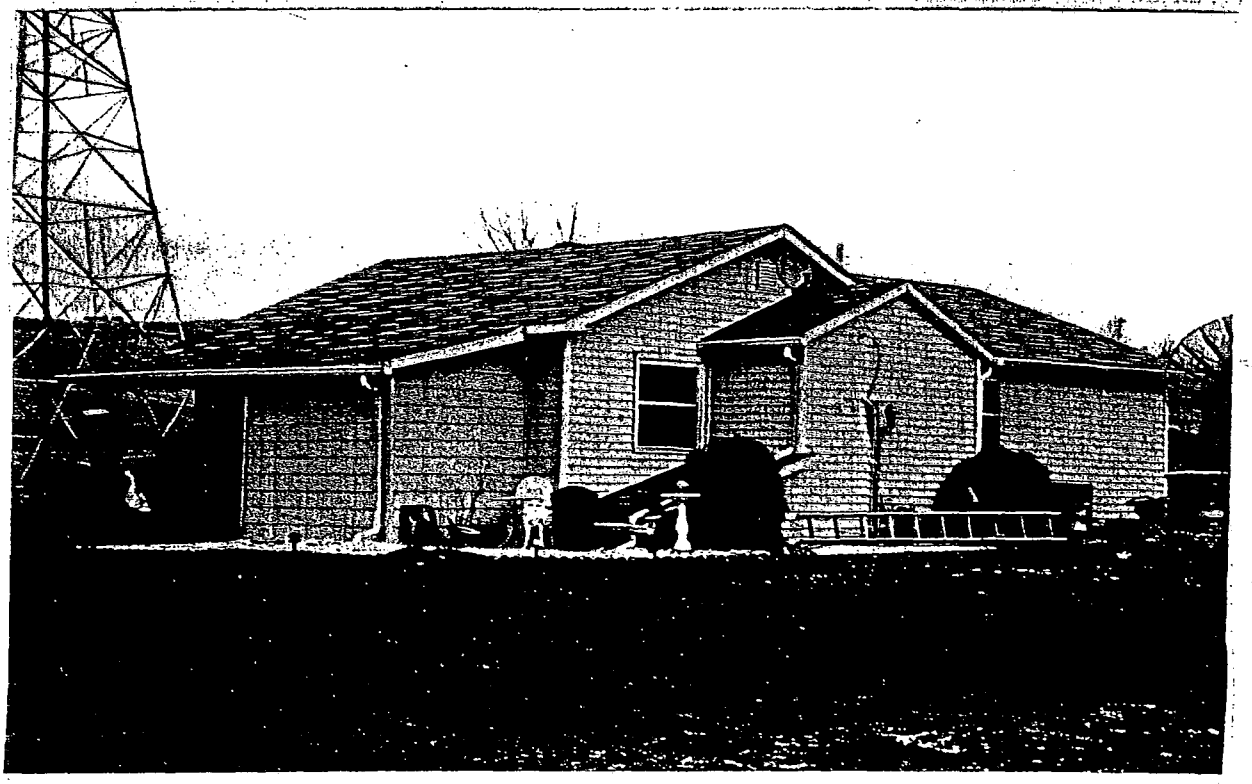
17-140 House Front

17-141 House Back



18-142 House Front

18-143 House Back



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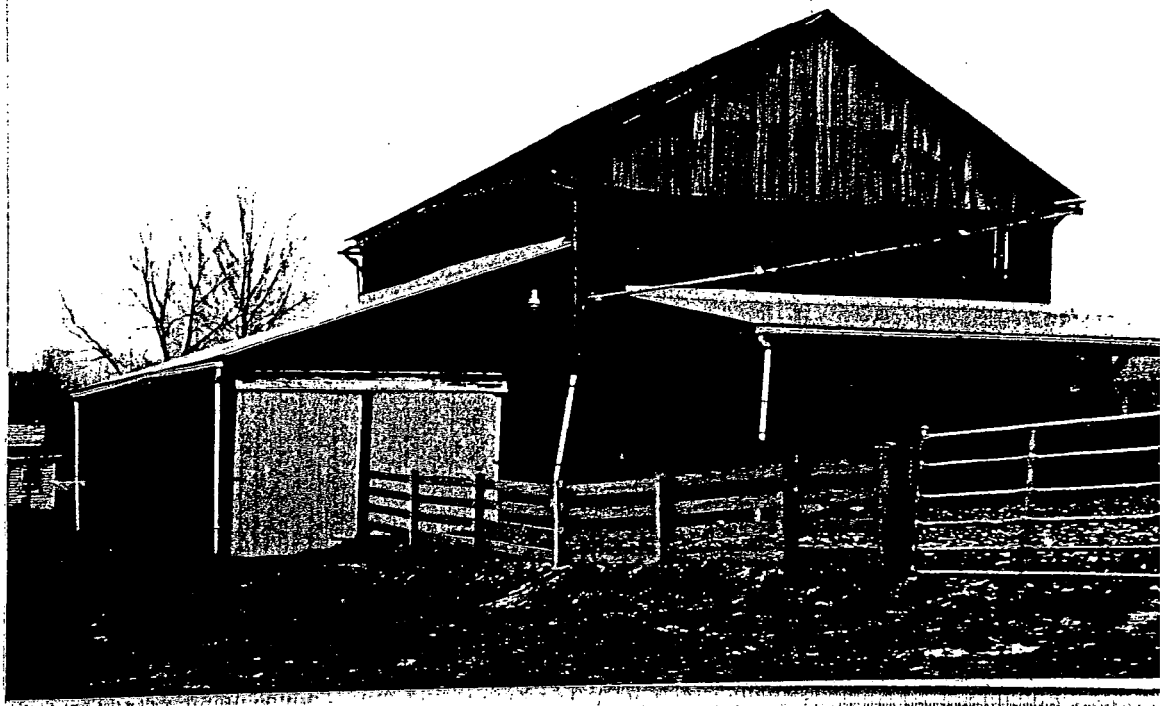
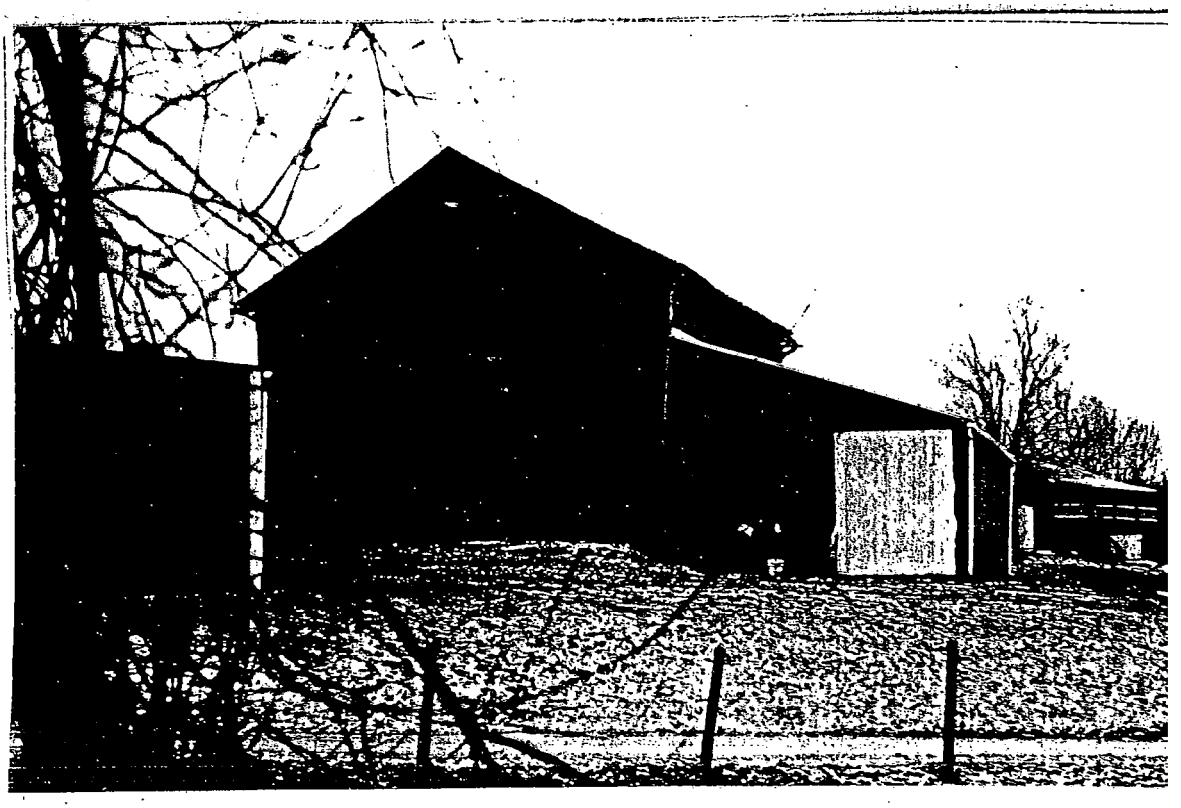
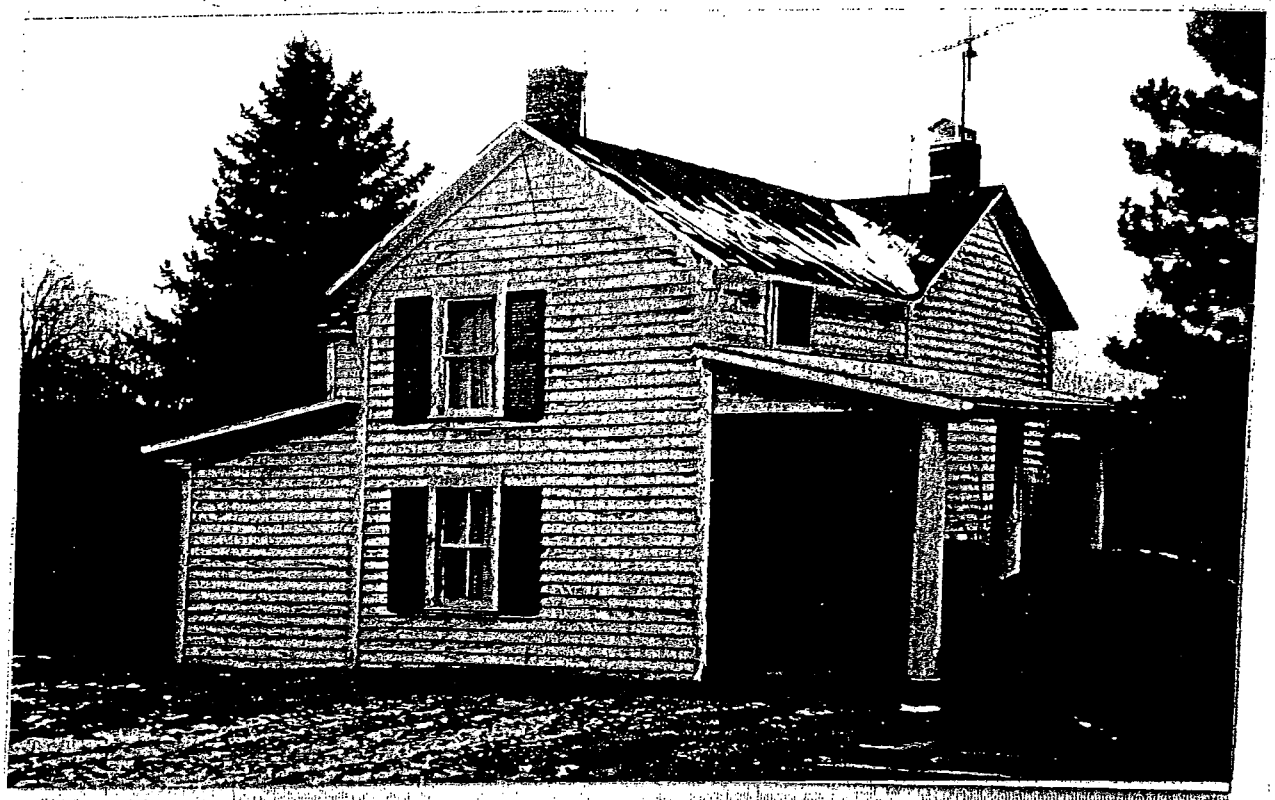


19-144 Barn Front

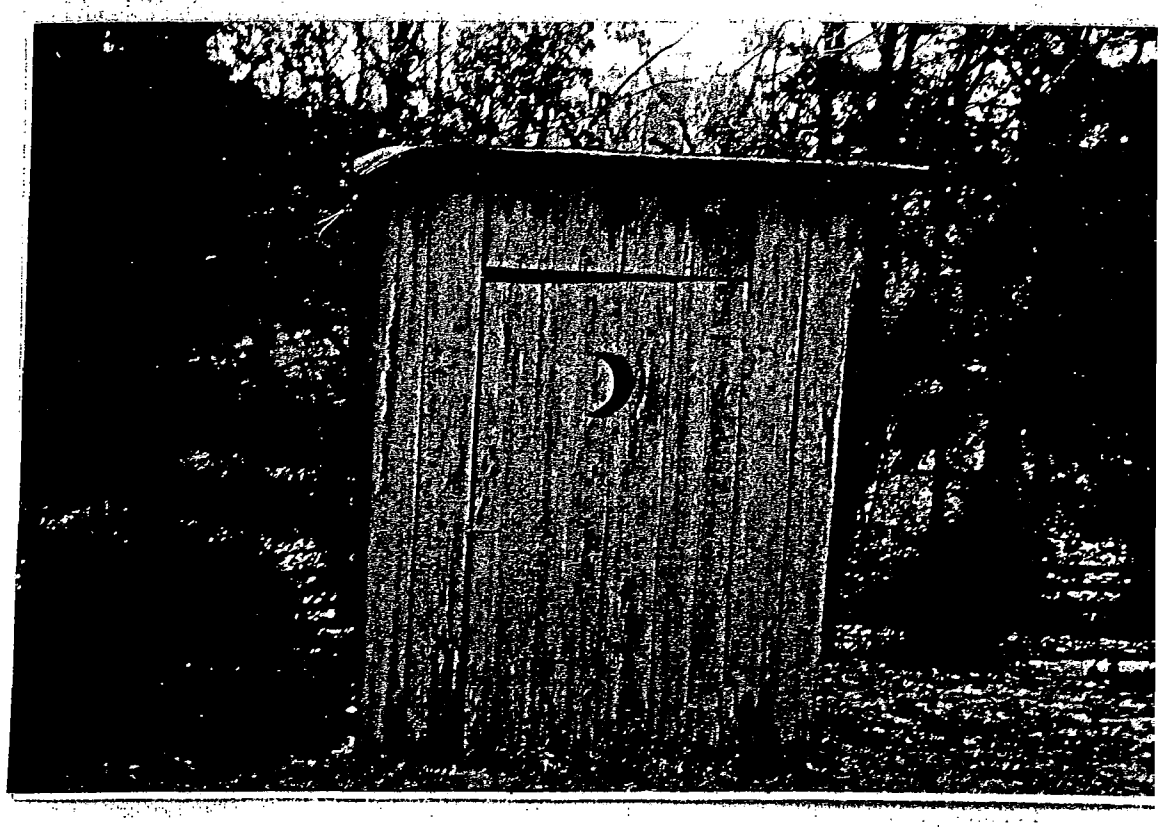
19-145 Barn Back





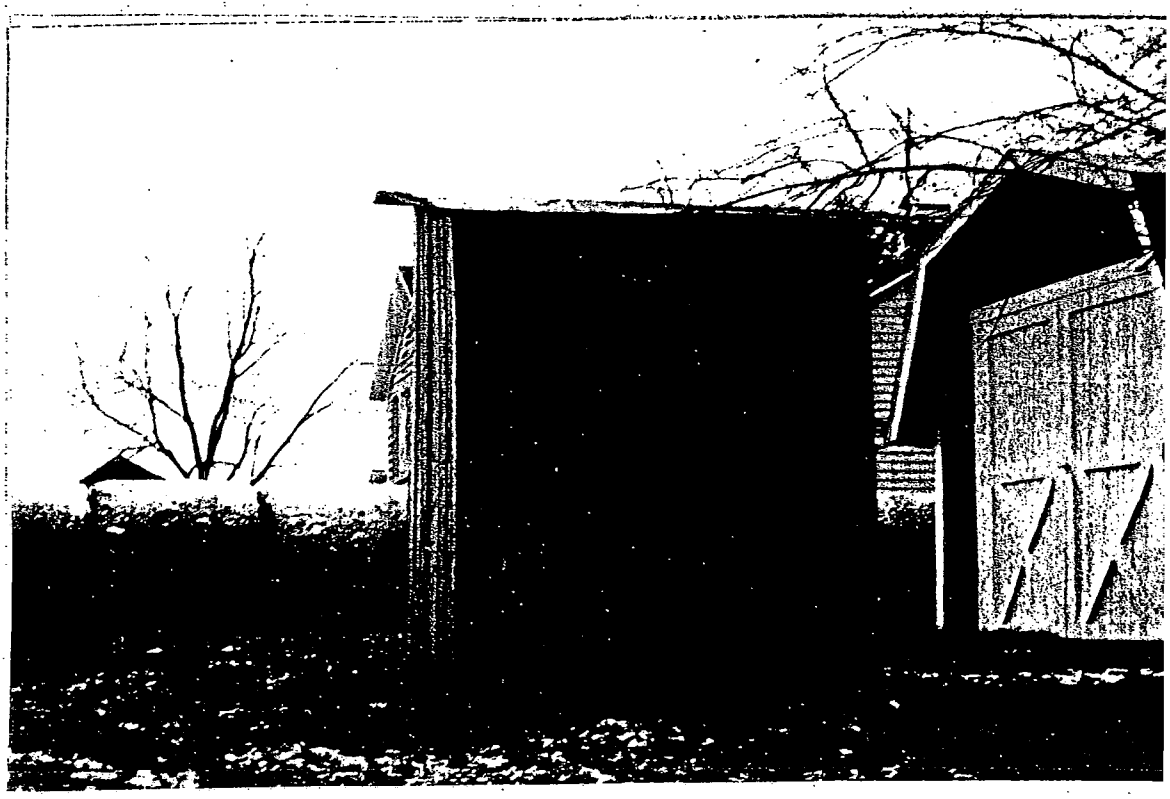
19-146 House Front

19-147 House Back



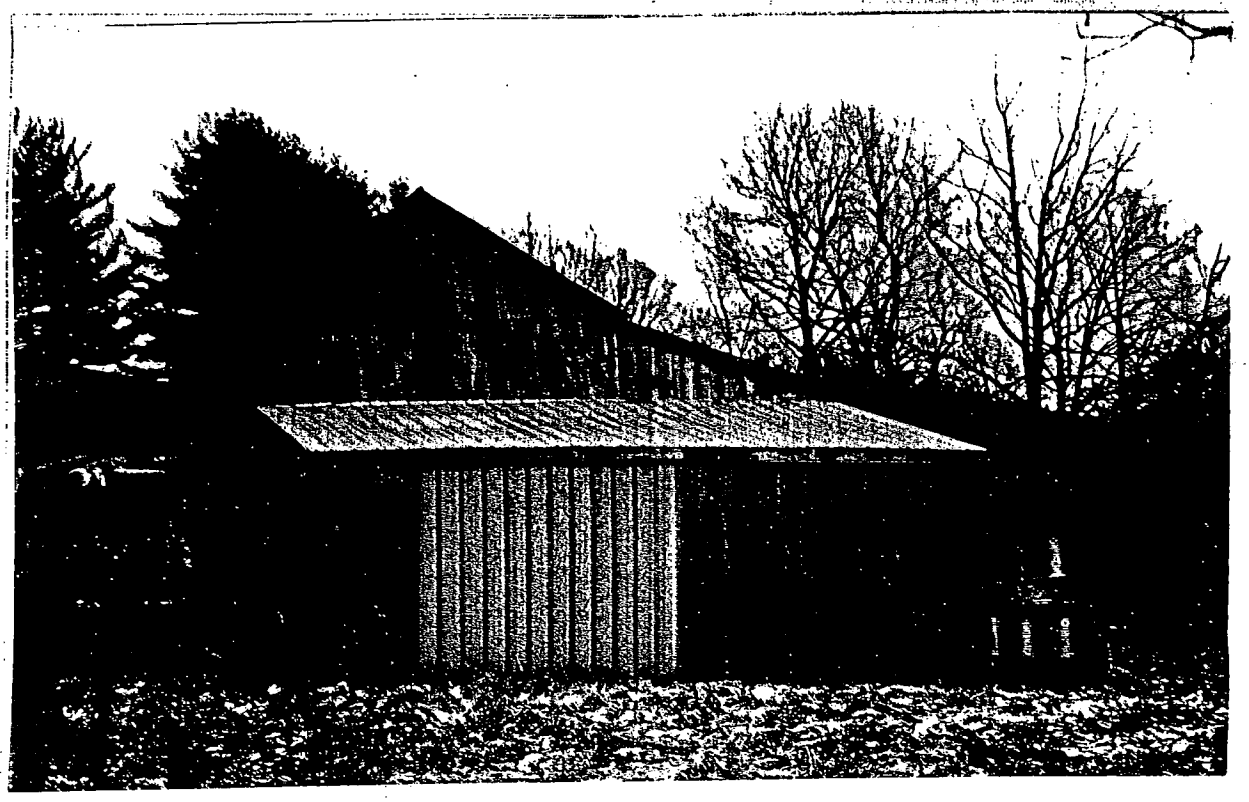
19-148 Privy Front

19-149 Privy Back



20-150 Cow Barn Front

20-51 Cow Barn Back

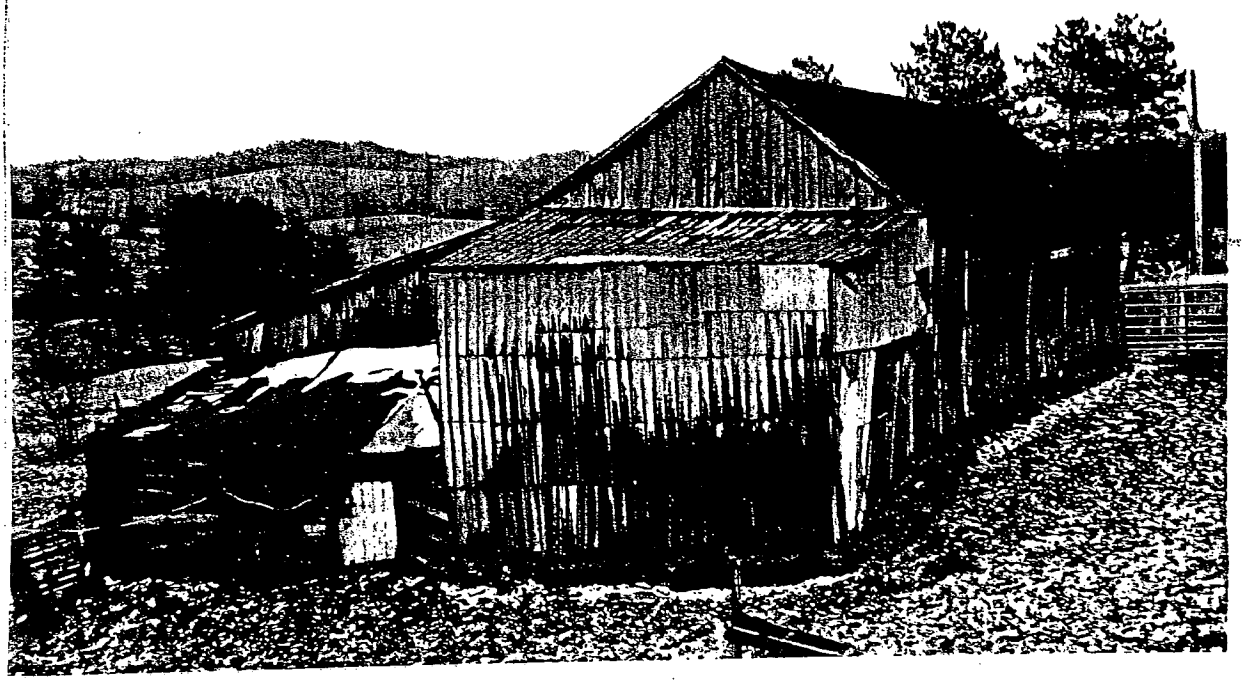


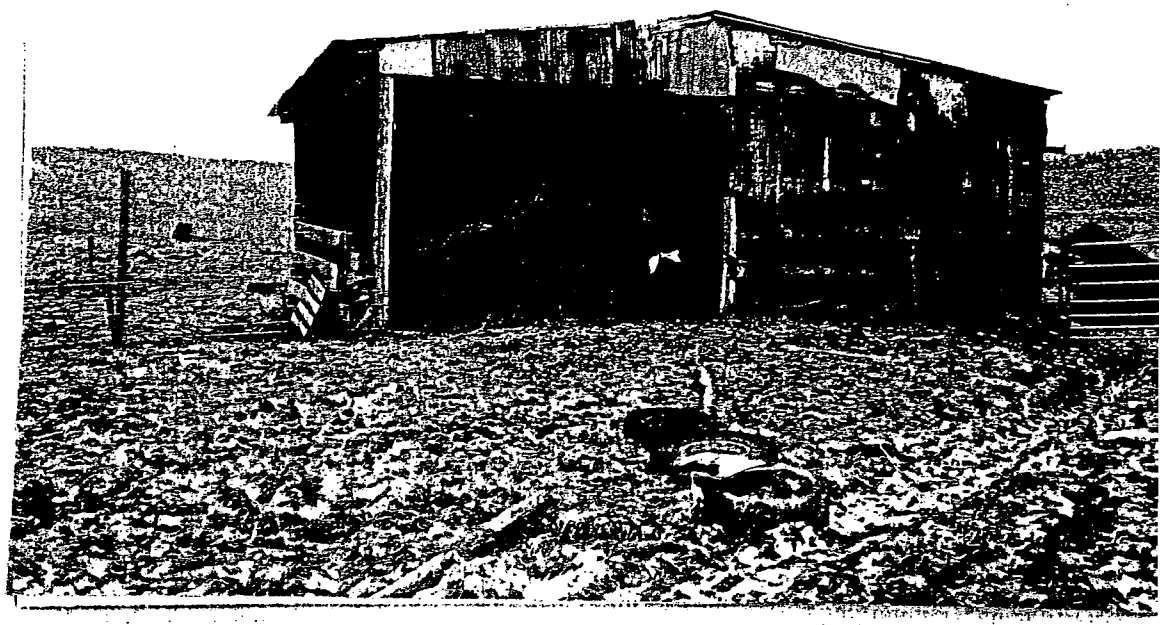
20-152 House Front

20-153 House Back

20-154 Barn Front

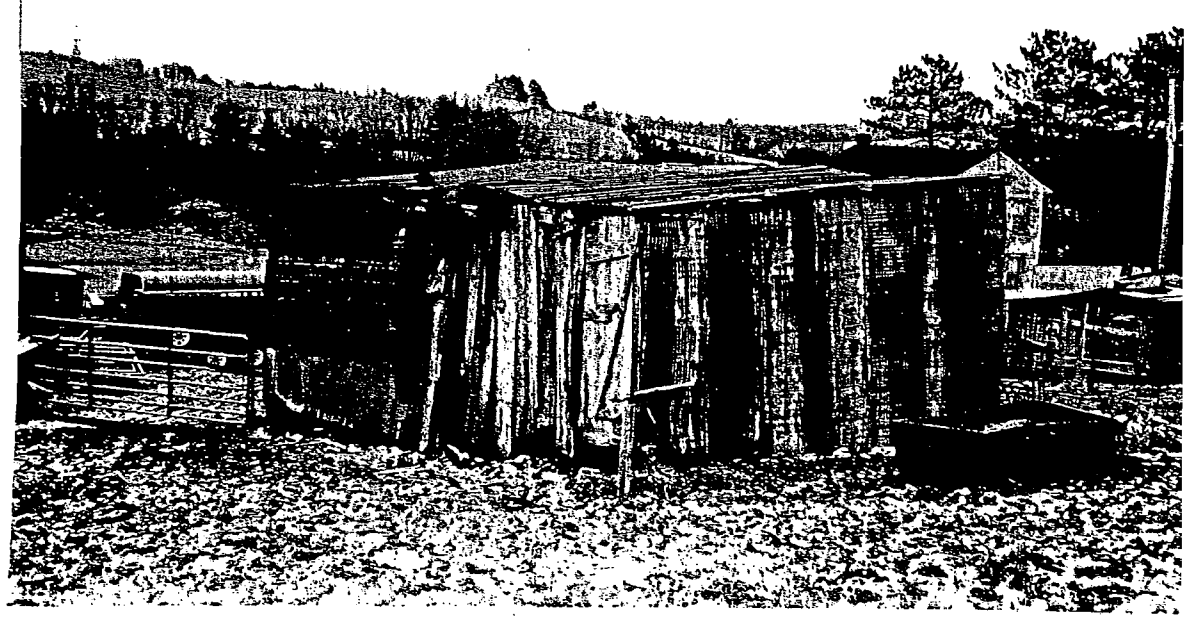
20-155 Barn Back





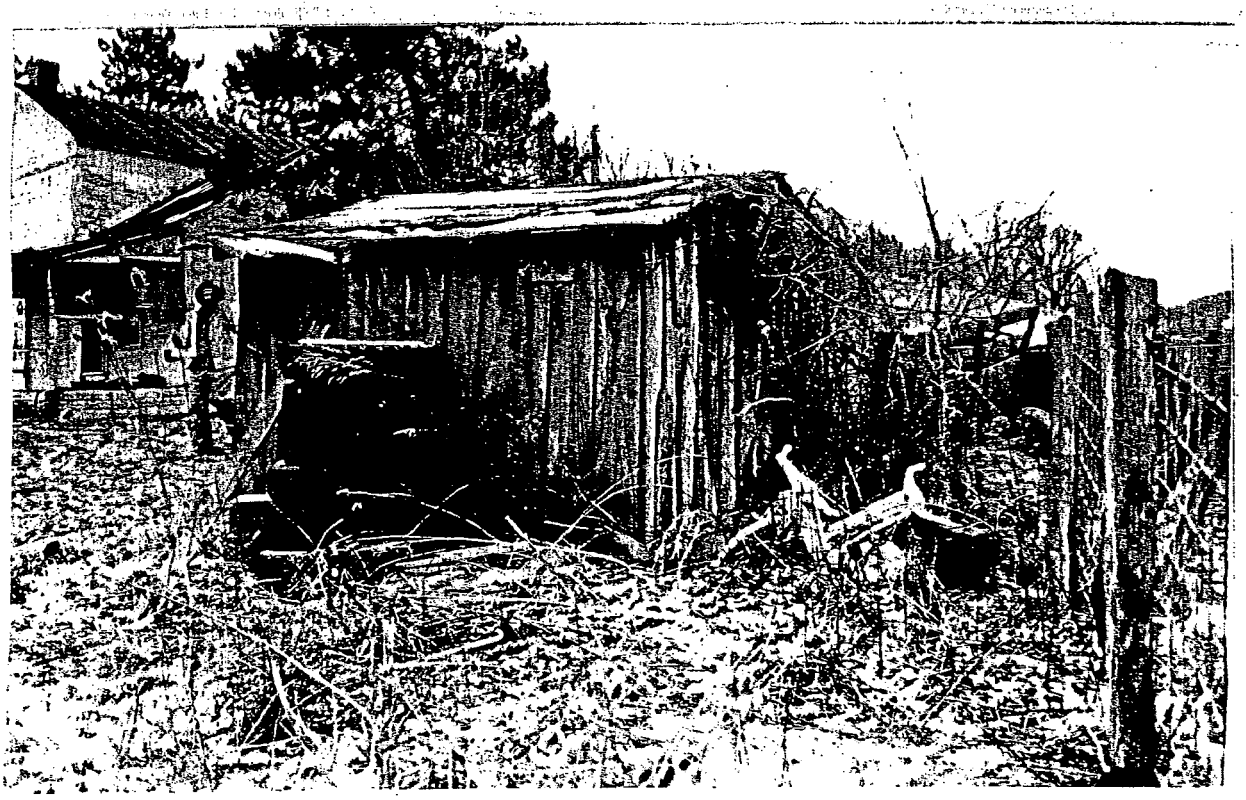
20-156 Hay Barn Front

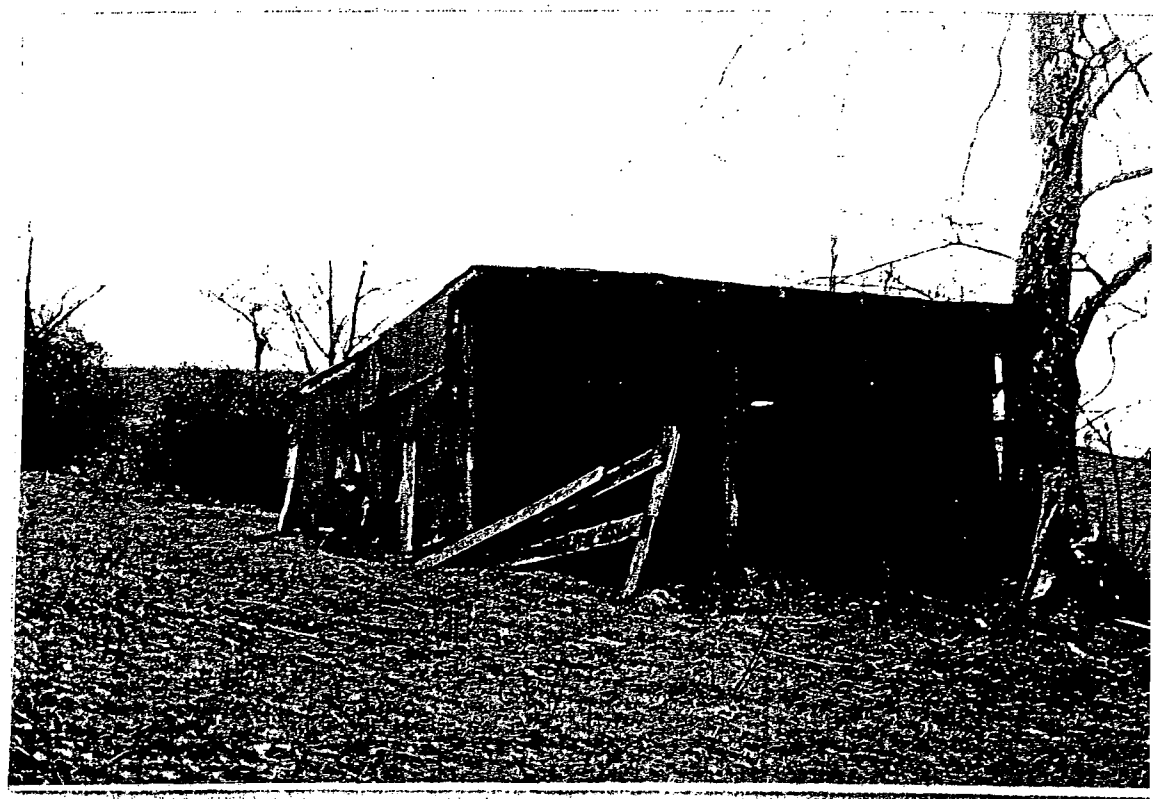
20-157 Hay Barn Back



20-158 Shed Front

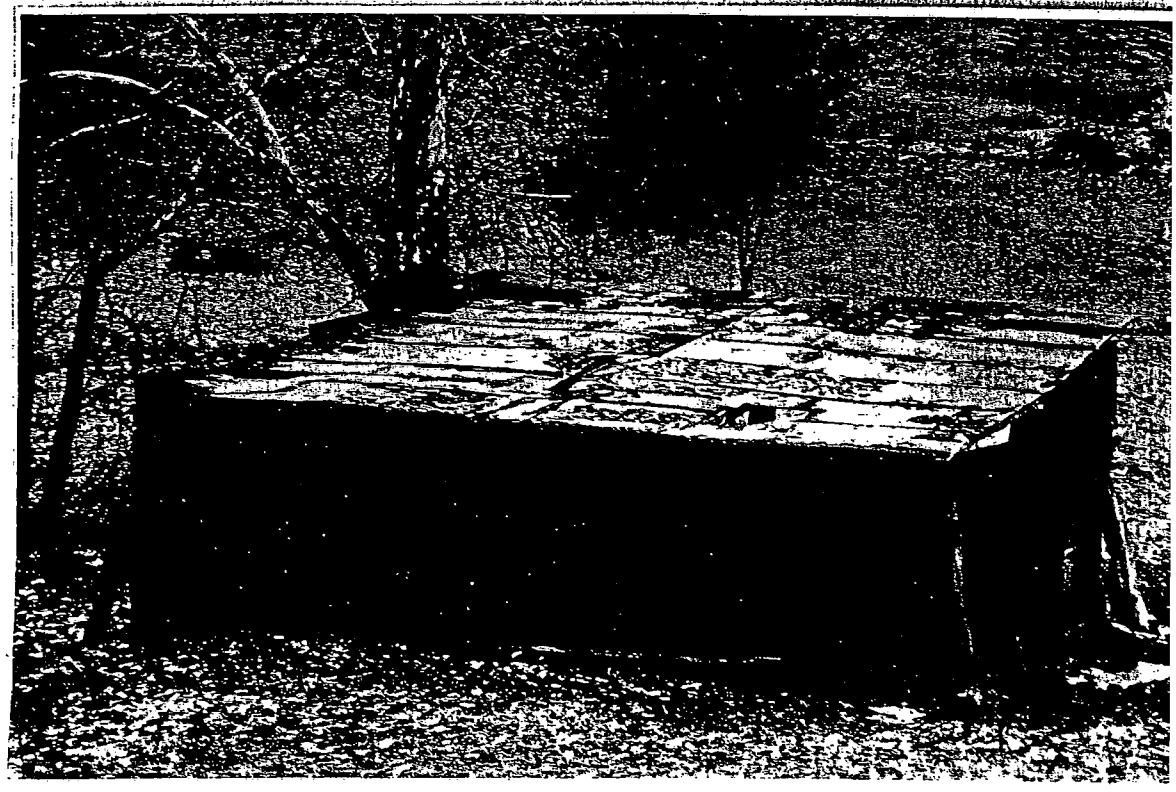
20-159 Shed Back

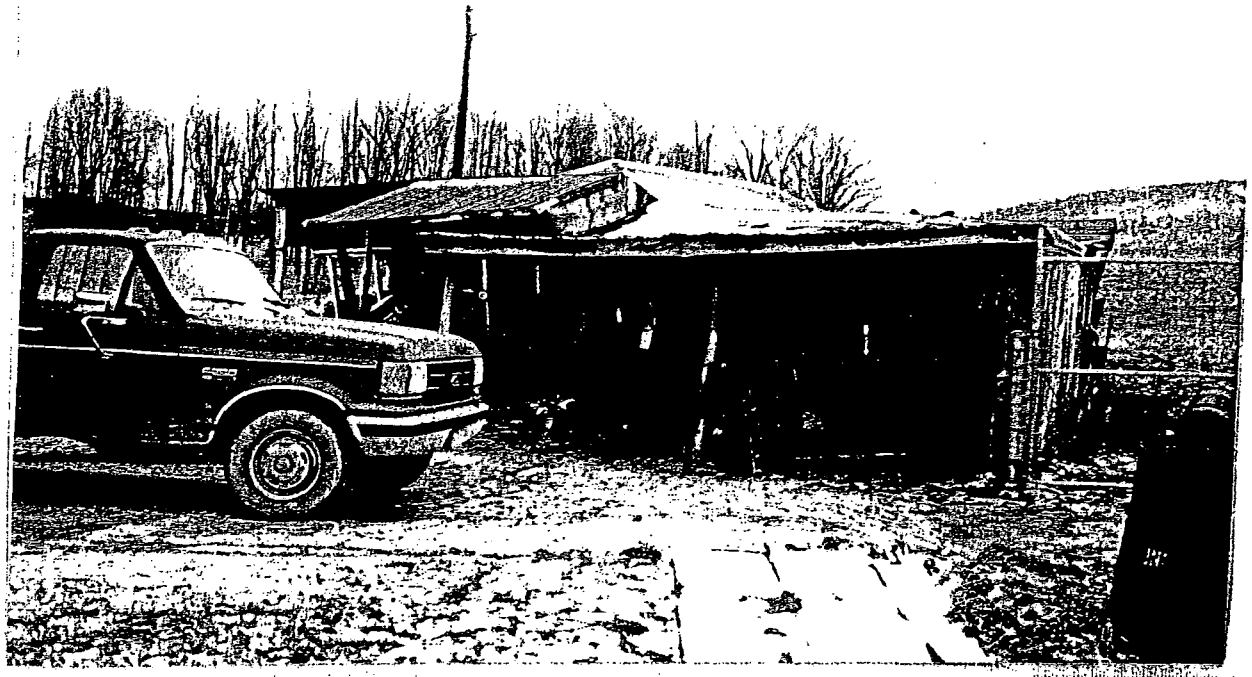




20-160 Outbuilding Front

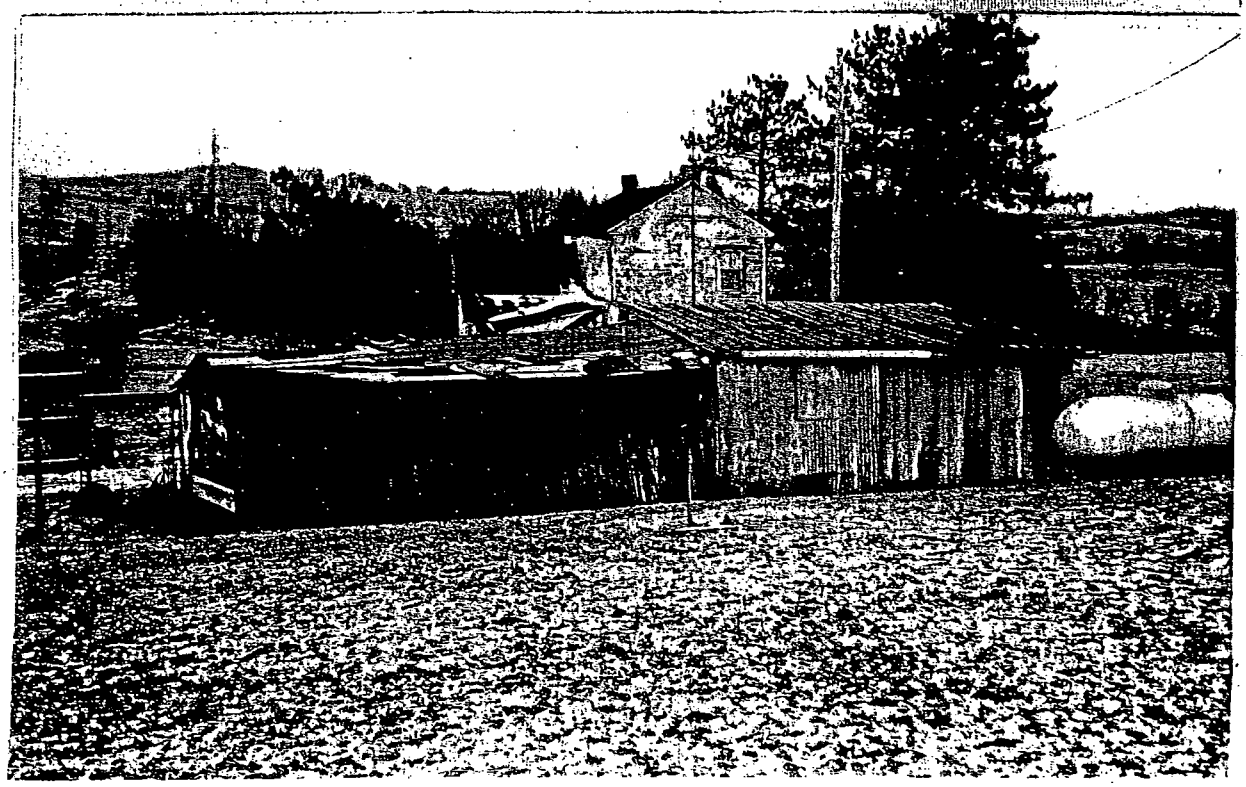
20-161 Outbuilding Back





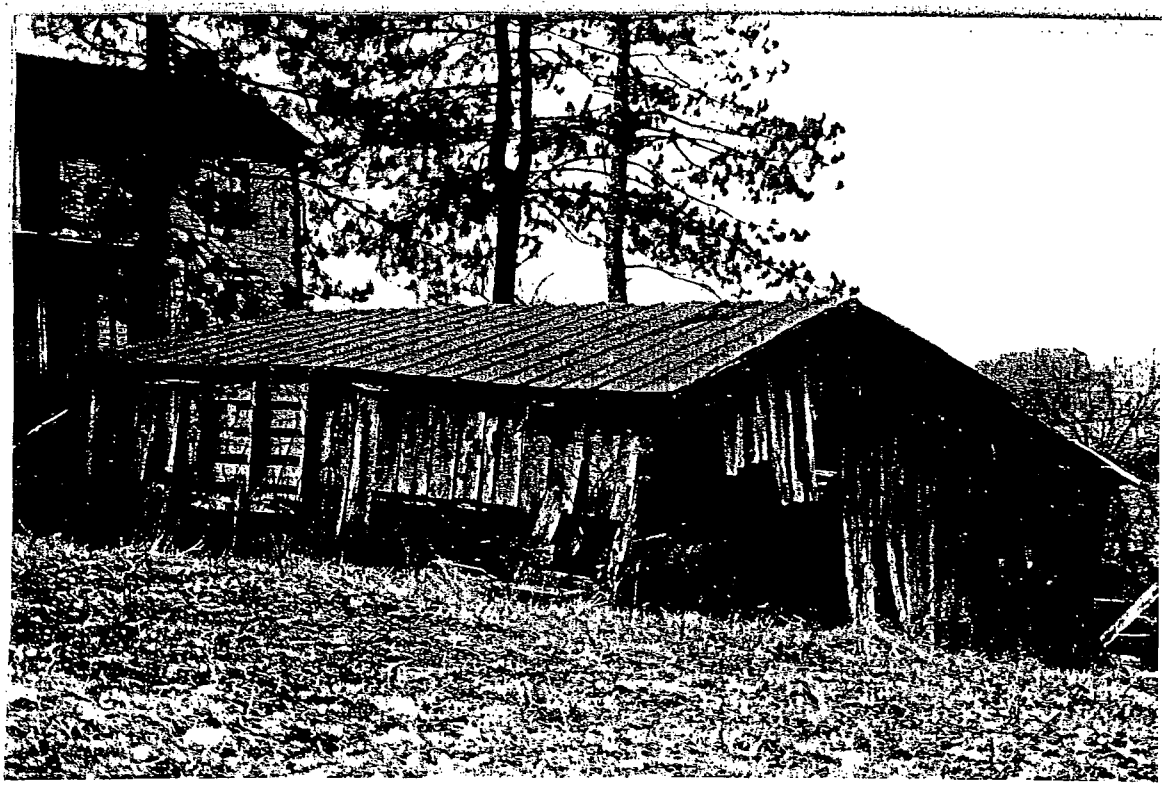
20-162 Machine Shed 1 Front

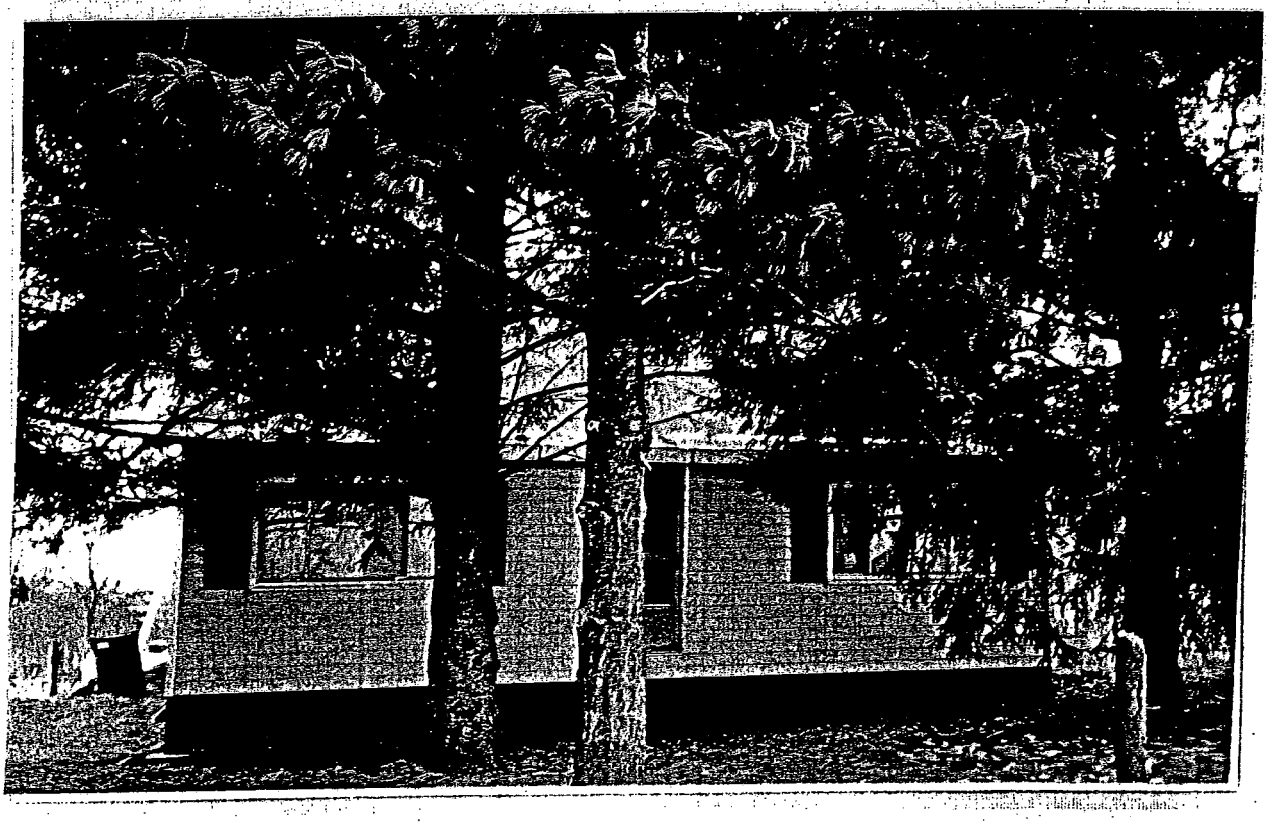
20-163 Machine Shed 1 Back



20-164 Machine Shed 2 Front

20-165 Machine Shed 2 Back



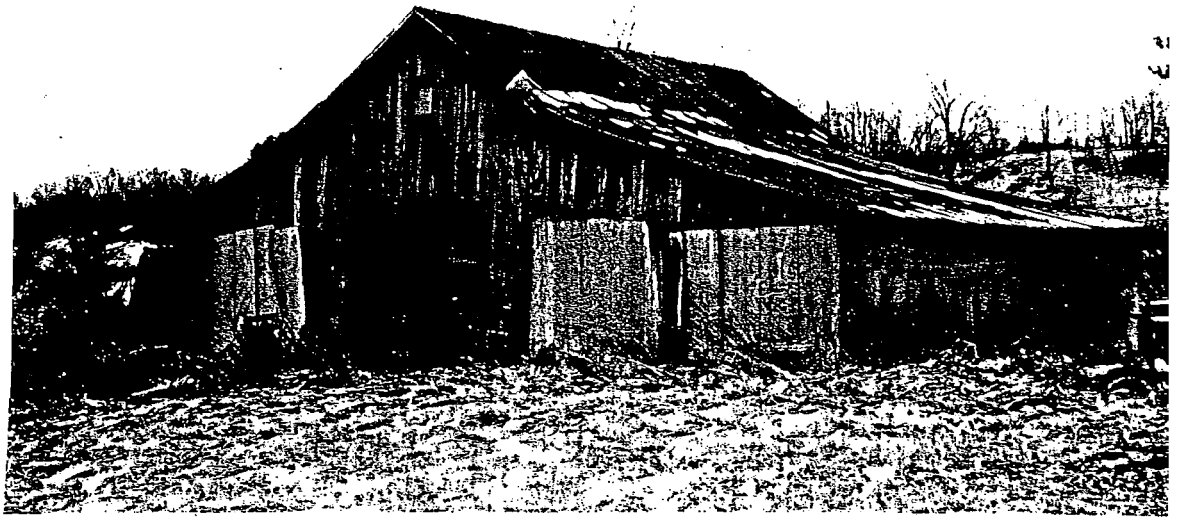


21-166 House Front

21-167 House Back

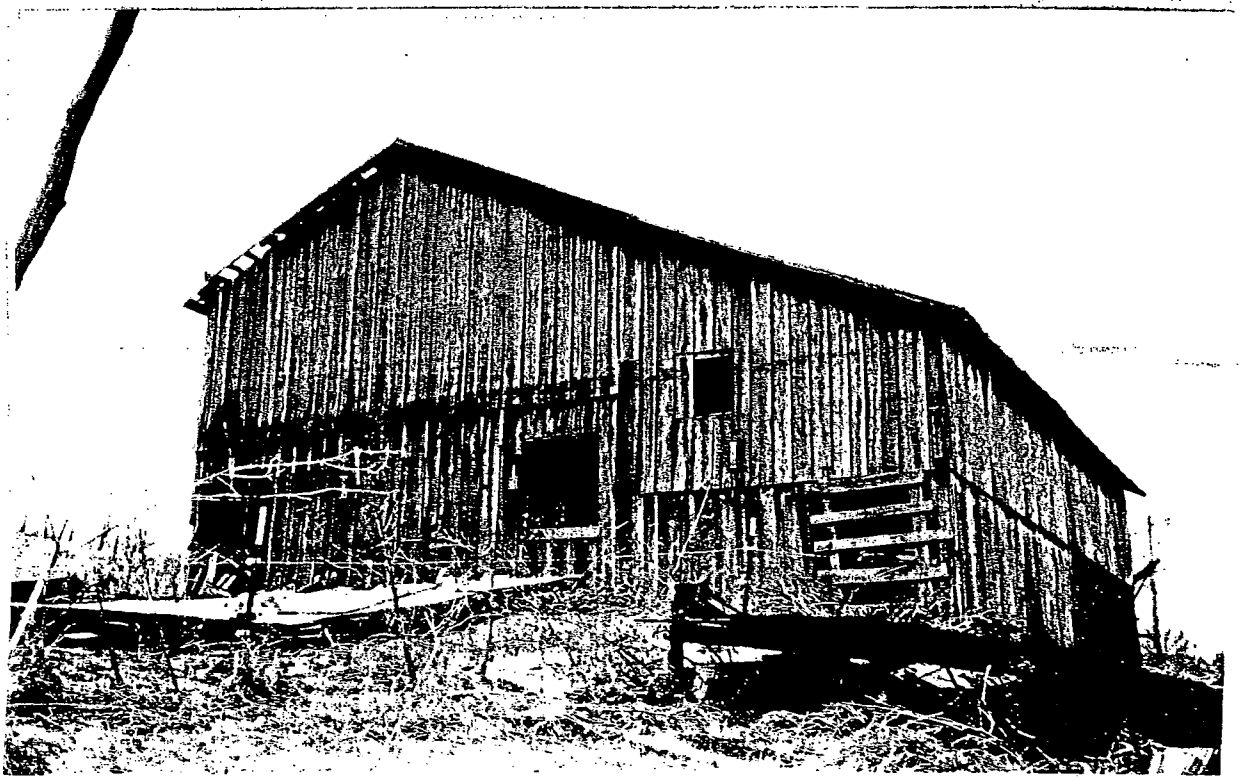
21-168 Machine Shed Front

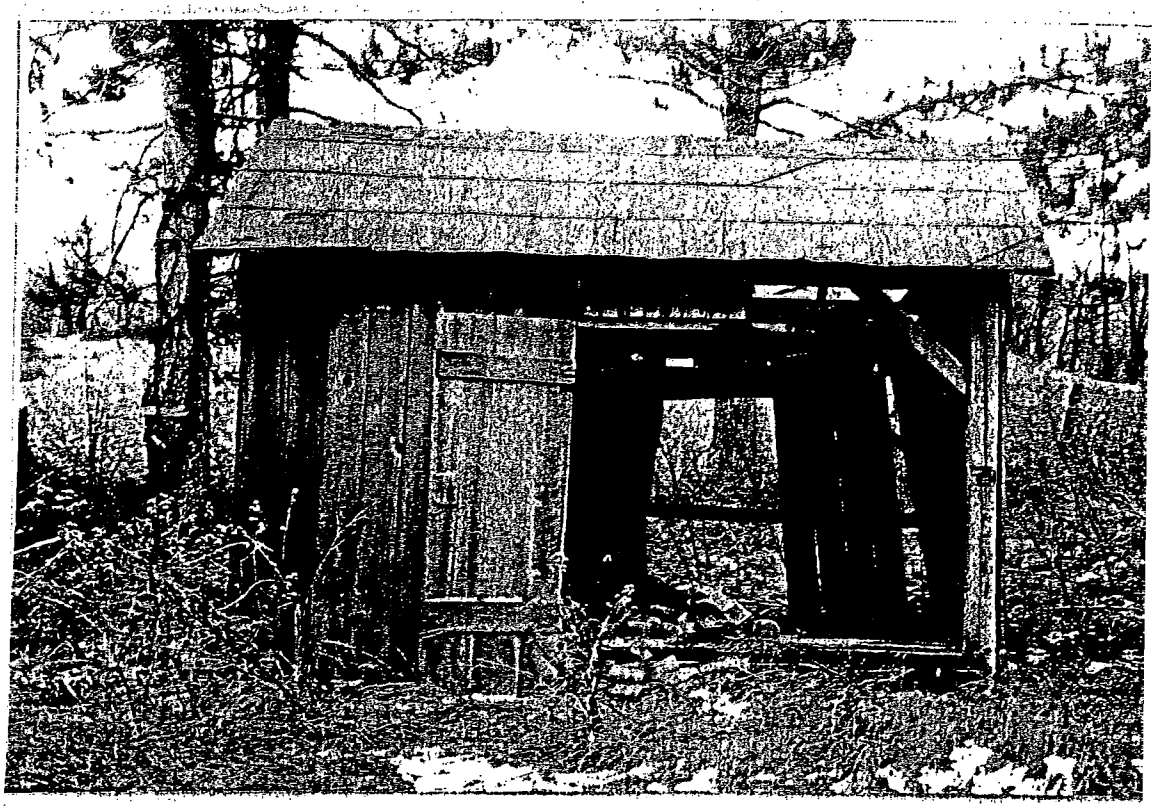
21-169 Machine Shed Back



21-170Barn Front

21-171 Barn Back





21-172 Shed Front

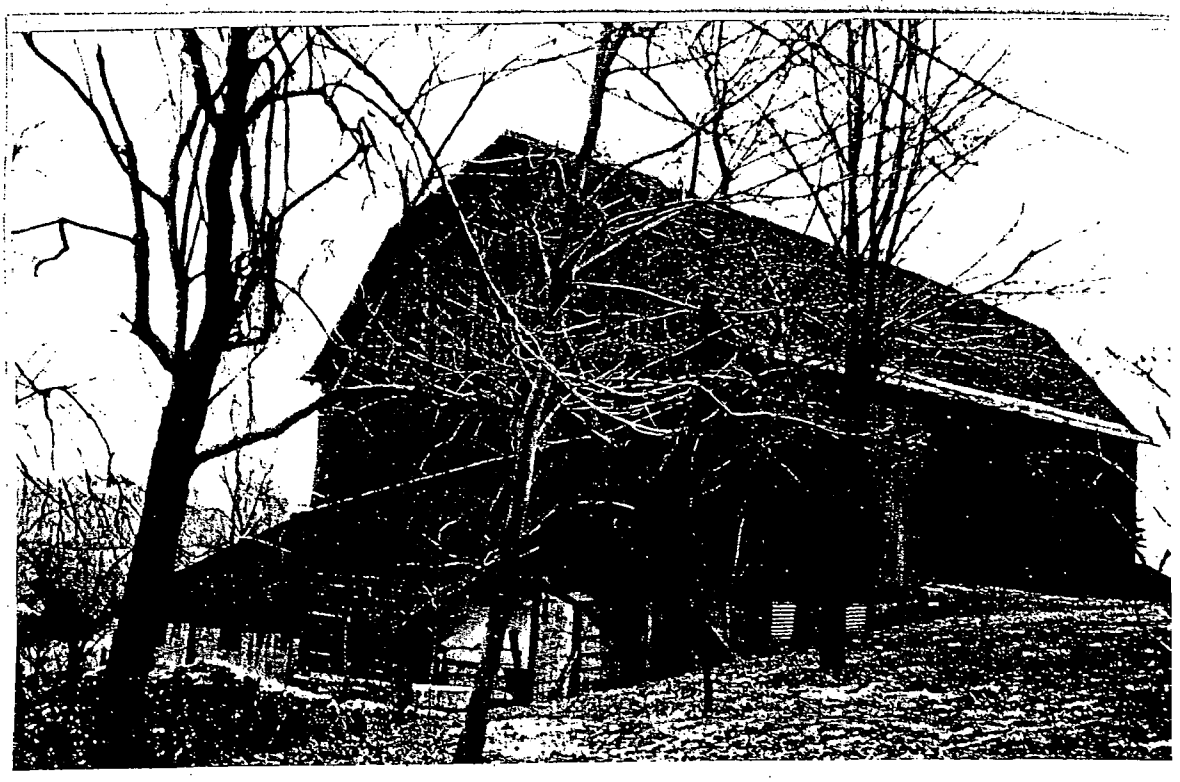
21-173 Shed Back

22-174 House Front

22-175 House Back

22-176 Barn Front

22-177 Barn Back



22-178 Garage Front

22-179 Garage Back

22-180 Shed Front

22-181 Shed Back

22-182 Outbuilding Front

22-183 Outbuilding Back

ADDENDUM TO PART 2, PAGE 16, ITEM B(1)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425-5

GEOLOGY DESCRIPTION

The majority of the D-0425-5 area of the Century Mine is located in Monroe County in southeastern Ohio. A very small portion of the proposed shadow area is located within the southernmost boundary of Belmont County, in Washington Township. The topography of the entire application area is typical of the Appalachian Plateau Province and is characterized by narrow rounded ridges and deep V-shaped valleys dissecting the terrain, which is underlain by essentially horizontal sedimentary rocks. Topographic relief within the D-0425-5 Application Area is approximately 436 feet. The lowest surface elevation within the application area is approximately 980 feet located where Ackerson Run crosses the southern application area boundary. The highest surface elevation is 1416 feet located southeast of the intersection of S.R. 556 and C.R. 38, which is a benchmark at the highest point in Monroe County. According to Mr. James M. Raab, a hydrogeologist with the Ohio Department of Natural Resources, water below 250 feet beneath the stream bottoms is brackish (personal communication).

Stratigraphy of the proposed application area is formed by the Monongahela formation of the Pennsylvanian period, and the Dunkard Group of Permian time. The primary strata of both sections consists of an alternating sequence of limestone, sandstone, shale, claystone, and coal.

The Monongahela formation averages 250 feet in thickness within the proposed shadow area. In ascending order, it occupies the interval from the Pittsburgh #8 coal seam to the Waynesburg #11 coal seam. The primary rock units are limestone, shale, and claystone. Limestone forms 15 to 63% of this stratigraphic interval. As a result of longwall mining, the immediate strata overlying the Pittsburgh #8 coal seam will cave to a height of 3 to 6 times the mining height, depending on the bulking factor of roof strata. The beds above this caved zone are provided some support by the caved rock but may sag and give rise to bed separation and may be subject to fracturing to heights 24 to 54 times the mining height (120 to 270 feet above the mine).

The Dunkard group is approximately 425 feet thick within the proposed shadow area, occupying the interval from the Waynesburg #11 coal seam to the ground surface. The primary rock units here are shale and claystone. These soft units form about 76 percent of this stratigraphic interval. This strata is primarily located within the constrained zone of disturbance resulting from longwall mining. The constrained zone is defined as that interval above 24 to 54 times the mining height and below 50 feet from the ground surface. This strata is expected to be sufficiently confined to prevent development of any fractures. Rock beds here will tend to absorb most of the strain energy without fracturing.

Strata close to the surface, however, are not sufficiently confined and may move in any direction. Surface cracks may be produced from tensile strains resulting from longwall mining. The depth of these cracks is generally estimated to be less than 50 feet.

ADDENDUM TO PART 2, PAGE 16, ITEM B(1), continued;

The main safety against inflow of groundwater into the Century Mine is afforded by the constrained zone. The nature and thickness of the individual beds found here are of particular importance. Through extensive core drilling, multiples beds of claystone, with total thicknesses of 2 to 197 feet, have been identified. These claystone beds are relatively impermeable and generally capable of absorbing large amounts of strain energy before fracturing. It is the applicants opinion the sufficient claystones are in-place to provide an adequate barrier against inflow from surface water and shallow groundwater disruptions caused by longwall mining. Where stream valleys are encountered, longwall operations are generally not planned under less than about 200 feet of cover to further protect the mine and overlying groundwater resources. No longwall operations will occur within the proposed permit area with less than 350 feet of cover, the minimum overburden. The rock strata of Belmont and northern Monroe counties typically form a gentle monocline that dips southeasterly at grades less than one percent. This dip trend accurately represents the proposed application area with the base elevation of the #8 coal seam ranging from approximately 610 feet in the southeast corner to approximately 682 feet in the northwest corner.

The orientation of the major joints in rock and face cleat is approximately N 75° W. The minor joints and butt cleats are generally perpendicular to these (N 15° E).

(Please refer to this addendum in Permit D-0425-3, Page 2, third paragraph for discussion of anticline and graben structure located several miles to the northeast of this proposed application area).

ADDENDUM TO PART 2, PAGE 16, ITEM B(2)

GEOLOGICAL IMPACT OF COAL REMOVAL UPON GROUND WATER

The geological impact of coal removal is expected to vary from short term to long term. The Pittsburgh #8 coal seam will be mined, and in this area has dip of approximately 0.5% to the southeast, with the strike to the northeast. Groundwater occurs in this area in several disconnected saturated zones associated with the occurrence of claystone units that prevent downward migration of the ground water. Ground water is generally limited to within 100 feet of the surface. Since primary porosity in the rock units is poor, nearly all of the ground water in this area of Ohio occurs as secondary porosity in the joints, cleats, fractures, and bedding planes of the rocks.

As longwall mining progresses, a caved area occurs immediately over the coal seam mined. Above this area, fractures occur in hard rocks and extend upward to about 200 feet above the coal seam. In the area above these fractures, a zone known as the continuous deformation zone develops where rocks bend down and form the classic subsidence basin. In the center of the basin, the rocks may be fractured and bedding planes may open as a result of this deformation. This process provides new openings to contain additional ground water, with a lowering of the phreatic surface of the water in the area. After mining, the aquifers are more connected and provide a larger source of water for well recharge.

Aquifers identified on the Attachment 14B are not related to the post-subsidence zones with the exception of Zone A. Zone A is comparable to the "near surface zone". All aquifers identified on the Attachment 14B

are above the caved zone and zone of fracturing. After mining, new wells will be drilled, or existing wells may be re-drilled. The success of re-drilling existing wells has not been documented. Groundwater still is available after subsidence. When subsidence occurs, the water levels in some wells drops, sometimes to below the bottom of the well bore. Ground water is not lost to the mine, but the water table is lowered in response to changes in rock permeability. The Century mine is a dry mine which indicates that the groundwater does not flow into the mine. Rather, layers of rock that act as aquatards prevent downward migration of water into the mine. The other layers of rock, being more plastic than elastic, tend to fracture or the bedding planes separate and make more channels for the ground water to reside. Existing wells can be deepened or new ones drilled to encounter the new water table and to increase well bore reservoir storage to provide similar quantities of water after mining.

The geologic structures in the application area consist of gently folded rocks that dip to the southeast at approximately 22 feet per mile. Overburden thickness above the Pittsburgh seam ranges from a low of approximately 350 feet along Ackerson Run near the southern limits of the proposed deep mine, to 761 feet under the hilltop which is the highest point in Monroe County, south of the intersection of S.R. 556 and C.R. 38. While geologic structure can influence regional groundwater flow patterns, local variations in hydraulic properties of the rocks tend to accentuate localized flow systems.

In summary, the coal removal is expected to have some impact on ground water in the Application area. The impacts are described in the PHC and in the Addendum to Page 18 F(1).

(3) For those areas to be affected by underground mining surface operations where removal of the overburden down to the level of the coal seam will occur, submit Attachment 12(s) as required by paragraphs (C)(2)(a) and (C) of rule 1501:13-4-13 of the Administrative Code.

N/A

(4) For those areas within the shadow area where the stratum above the coal seam to be mined will not be removed, submit Attachment 13(s) as required by paragraphs (C)(2)(d) and (e) of rule 1501:13-4-13 of the Administrative Code.

SEE APPROVED TEST HOLE VARIANCE REQUEST AND ATTACHMENTS

C. GROUND WATER INFORMATION-Permit, **Shadow Area, and Adjacent Area**

(1) Submit an Attachment 14B which describes the ground water hydrology of the proposed permit area, shadow area, and adjacent area. The Attachment 14B is to include information on each waterbearing stratum or zone as required by paragraph (D) of rule 1501:13-4-13 of the Administrative Code, including the first waterbearing stratum below the coal to be mined.

SEE ATTACHMENT 14B AND ADDENDA

(2) Are there any wells on the proposed permit area, shadow area, and adjacent area? __X__ Yes, _____ No. If yes, submit Attachment 14C.

(3) Are there any springs on the proposed permit area, or developed springs on the shadow area and adjacent area? __X__ Yes, ____ No. If yes, submit Attachment 14C.

(4) Are there any public water supply sources on the proposed permit area, shadow area, and adjacent area? ____ Yes, __X__ No. If yes, submit Attachment 14A, Attachment 14D, and show location on the hydrology map.

(5) Submit Attachment 14A for representative wells and developed springs as required by paragraph (D)(4) of rule 1501:13-4-13. Based on this data identify the seasonal variations of ground water quality and quantity.

D. SURFACE WATER INFORMATION-Permit, **Shadow Area, and Adjacent Area**

(1) List the name of the watershed that will receive water discharges from the proposed permit, shadow and adjacent areas as listed in the Gazetteer of Ohio Streams published by the Ohio Department of Natural Resources.

SUNFISH CREEK AND CAPTINA CREEK

(2) Are there any perennial or intermittent streams or other surface water bodies on the proposed permit, shadow area, and adjacent area? __X__ Yes, No. If yes, submit Attachment 14A and Attachment 14D and show location on application and hydrology map.

SEE ATTACHMENT 14A, 14D, AND APPLICATION AND HYDROLOGY MAP

February 10, 2004

Mr. Michael S. Sponsler, Chief
Ohio Department of Natural Resources
Division of Mineral Resources Management
1855 Fountain Square Court, Bldg. H-2
Columbus, Ohio 43224-1383

Attn: Mr. George Mychkovsky, Hydrogeologist

Dear George,

The American Energy Corporation is preparing an application to add 2,680 acres of underground (Pittsburgh No. 8 Seam) reserves adjacent to our currently approved underground mining area, referred to as Century Mine, Permit D-0425-3. The proposed workings are located in Sections 19 and 25, T-5 R-4, Washington Township, Belmont County, Ohio; and Sections 22, 23, 24, 28, 29, 30, 34 and 35, T-4 R-4, and Section 5, T-4 R-5, Sunsbury Township, Monroe County, Ohio. With the exception of the mains and entries, American Energy Corporation plans to use full-recovery mining for the entire application area.

The Pittsburgh No. 8 Coal seam ranges in elevation from approximately 615 feet to 695 feet msl, with overburden ranging from approximately 394 feet to 745 feet within the proposed shadow area. The lowest overburden thickness of 394 feet was determined at Test Hole CLC-2001-27 located in the NE Qtr. of Section 28. Due to the fact that the Pittsburgh #8 coal lies at least 394 below the surface, there is no potential for acid mine drainage. All water that cannot be utilized within the mine for dust control will be pumped to a surface sediment pond for treatment, if necessary, before being released to the stream system. A 200-foot wide barrier will be maintained between the permit limits and the limits of abandoned deep mine Bt-270 as shown on the Test Hole Variance Request map.

Pursuant to OAC 1501:13-4-13 (C)(2)(e)(ii), seventeen (17) test holes are required. A total of thirty seven (37) test holes are being submitted on Attachment 13's, nineteen (19) of which have complete chemical analysis.The remaining eighteen (18) are being submitted to represent geologic data only. Seven (7) of the Attachment 13's having chemical analysis are located within the proposed permit limits. In summary, ten (10) test holes are lacking pursuant to the above referenced rule. See attached Addendum to this variance request.

The following information is submitted in support of this request:

1. A Test Hole Variance Request Map showing existing test holes, their surface elevations, their coal elevations and the structural contours based on these holes and the surrounding test holes. The proposed mining area boundary and panel layout, hydrologic

boundary, and location of geologic cross sections are also shown on the map.

2. Logs of test holes and/or Attachment 13's for each hole.

3. A total of two (2) cross sections, A - A' taken along the approximate strike of the #8 coal seam, and B - B' taken along the approximate dip of the #8 coal seam.

We believe that all the data submitted with the original permit application and the previous adjacent area applications D-0425-1 and D-0425-3, combined with the information submitted herein demonstrates that the structure and stratigraphy of this application area is well known, and adequately represents the conditions of the proposed shadow area. Your prompt review and approval of this variance request is appreciated.

The approved test hole variance request with all attached information will be submitted with the application. Should you have any questions, please contact me as soon as possible.

Sincerely,

Jack A. Hamilton & Associates, Inc.
Consultants for American Energy Corporation

James Chuckery

James M. Chuckery, Permitting

Enclosures

cc: American Energy Corporation
File

APPROVED ☒
DISAPPROVED ☐
DATE: 2/13/04
SIGNED Michael Y Sponsler
by R W Ortiz

ADDENDUM TO TEST HOLE VARIANCE REQUEST
AMERICAN ENERGY CORPORATION
APPLICATION D-0425-3

Test Hole	Location	Surf. Elev.	Top of Coal Elev.	Overburden Thickness	Attachment 13	Drill Log	Chemical Analysis
AEC-2000-01	NE Qtr. Sec. 36	1023	682	341	X		Yes
AEC-2000-02	NE Qtr. Sec. 30	1264	664	600	X		Yes
AEC-2000-03	NE Qtr. Sec. 31	976	676	300	X		Yes
AEC-2000-04	NE Qtr. Sec. 19	1267	670	597	X		Yes
AEC-2001-02	NE Qtr. Sec. 25	1239	677	562	X		Yes
AEC-2001-04	NW Qtr. Sec. 31	1004	676	328	X		Yes
AEC-2001-09	NE Qtr. Sec. 35	1244	663	581	X		Yes
AEC-2001-10	NW Qtr. Sec. 36	1267	693	574	X		Yes
AEC-2001-11	NW Qtr. Sec. 29	1087	646	441	X		Yes
AEC-2001-12	SE Qtr. Sec. 5	1075	668	407	X		Yes
AEC-2001-14	SE Qtr. Sec. 30	1315	648	667	X		Yes
AEC-2001-15	NE Qtr. Sec. 23	1220	634	586	X		Yes
AEC-2001-16	SW Qtr. Sec. 31	1225	694	531	X		Yes
AEC-2001-24	SE Qtr. Sec. 7	1140	717	423	X		Yes
AEC-2001-25	SW Qtr. Sec. 1	1220	714	506	X		Yes
AEC-2001-29	NW Qtr. Sec. 5	1110	686	424	X		
AEC-2001-30	NW Qtr. Sec. 34	1080	677	403	X		
CLC-2001-27	NE Qtr. Sec. 28	1014	627	387	X		
CLC-2001-29	SE Qtr. Sec. 31	1210	695	515	X		
CLC-2002-08	SE Qtr. Sec. 30	1250	666	584	X		
CLC-2002-11	SW Qtr. Sec. 23	1230	617	613	X		Yes
CLC-2002-13	SE Qtr. Sec. 29	1035	629	406	X		
CLC-2002-31	NW Qtr. Sec. 23	1310	637	673	X		
CLC-2002-32	NW Qtr. Sec. 30	1230	681	549	X		
CLC-2002-34	NW Qtr. Sec. 24	1230	650	580	X		
CLC-2002-35	SW Qtr. Sec. 36	1160	689	471	X		

Test Hole	Location	Surf. Elev.	Top of Coal Elev.	Overburden Thickness	Attachment 13	Drill Log	Chemical Analysis
CLC-2002-36	NW Qtr. Sec. 4	1175	678	497	X		Yes
CLC-2002-38	NE Qtr. Sec. 34	1310	646	664	X		Yes
CLC-2002-41	NW Qtr. Sec. 29	1105	647	458	X		
CLC-2002-43	SW Qtr. Sec. 24	1330	657	673	X		
N94-41	NE Qtr. Sec. 5	1149	684	465	X		Yes
NA-87-09	SW Qtr. Sec. 23	1329	626	703	X		
NA-87-10	SE Qtr. Sec. 30	1332	663	669	X		
N94-15	SE Qtr. Sec. 36	1199	659	540	X		
N94-16	SE Qtr. Sec. 25	1279	685	594	X		
N94-17	NW Qtr. Sec. 6	1183	711	472	X		
Y&O-7	SE Qtr. Sec. 1	1060	708	352	X		

Ohio Department of Natural Resources

BOB TAFT, GOVERNOR

SAMUEL W. SPECK, DIRECTOR

Division of Mineral Resources Management
Michael L. Sponsler • Chief
1855 Fountain Square Court-Bldg. H-2
Columbus, Ohio 43224-1383
Telephone (614) 265-6633 Fax: (614) 265-7999

June 30, 2004

Mrs. Melanie Murray,
Engineer in training
American Energy Corporation
43521 Mayhugh Hill Rd.
Twp. Rd. 88
Beallsville, OH 43716

RE: American Energy Corporation, adjacent area application D-0425-5
Test hole variance request for 931 acres of total 3611 acres

Dear Mrs. Murray:

In response to the above-captioned variance request, submitted on your behalf by Jack A. Hamilton & Associates, Inc., and dated June 10, 2004, the Division has determined that the request contains equivalent information in a satisfactory form as a result of revisions that were performed in response to the review conducted by the Division per OAC 1501:13-4-13. Be sure to enclose this cover letter and the entire variance request (with the approval stamp and signature) with the application package when it is submitted. Note that the approved variance request for 2680 acres dated February 13, 2004 should also be submitted with application for D-0425-5. To avoid redundancy, do not send identical documents from the two approved request packages. If you have any questions, please feel free to call me at 614-265-1024. You may also choose to e-mail me at george.Mychkovsky@dnr.state.oh.us.

Sincerely,

George Mychkovsky

George Mychkovsky, Hydrologist

cc: James M. Chuckery, Permitting Coordinator
Jack A. Hamilton & Associates, Inc.

APPROVED ☒
DISAPPROVED ☐
DATE: June 30 2004
SIGNED Michael L. Sponsler
Chief

AEC 06293

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Flushing, OH 43977
Ph: (740) 968-4947
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www.hamiltonandassoc.com

Jack A.
HAMILTON
& Associates, Inc.

Civil E
Lanc
Mine
GIS Da
Land De
Global Positionir

June 10, 2004

Mr. George Mychkovsky
Ohio Department of Natural Resources
Division of Mineral Resources Management
1855 Fountain Square Court, Bldg. H-2
Columbus, Ohio 43224-1383

Re: American Energy Corporation - Test Hole Variance Request

Dear George,

The American Energy Corporation is preparing an application (D-0425-5) to add 3,611 acres of underground (Pittsburgh No. 8 Seam) reserves adjacent to our currently approved underground mining area, referred to as Century Mine, Permit D-0425. The proposed workings are located in Sections 19 and 25, T-5 R-4, Washington Township, Belmont County, Ohio; and Sections 22, 23, 24, 28, 29, 30, 34 and 35, T-4 R-4, and Sections 4 and 5, T-5 R-5, Sunsbury Township, Monroe County, Ohio. With the exception of the mains and entries, American Energy Corporation plans to use full-recovery mining for the entire application area.

A Test Hole Variance Request approval was granted for 2,680 acres on February 13, 2004. This acreage is a portion of the aforementioned 3,611 acres. Therefore, this letter is being submitted for approval of a variance from the requirements of OAC 1501:13-4-13 (c)(2)(e)(ii) for an additional 931 acres of proposed underground mining.

The Pittsburgh No. 8 Coal seam ranges in elevation from approximately 610 feet to 685 feet msl, with overburden ranging from approximately 355 feet to 685 feet within the proposed shadow area. The lowest overburden thickness of 355 feet was determined at Test Hole NA-87-06 located in the NE Qtr. of Section 28. Due to the fact that the Pittsburgh #8 coal lies at least 355 below the surface, there is no potential for acid mine drainage. All water that cannot be utilized within the mine for dust control will be pumped to a surface sediment pond for treatment, if necessary, before being released to the stream system. A 200-foot wide barrier will be maintained between the permit limits and the limits of abandoned deep mine Bt-270 as shown on the Test Hole Variance Request map.

Pursuant to OAC 1501:13-4-13 (C)(2)(e)(ii), six (6) test holes are required. A total of fifty one (51) test holes are being submitted on Attachment 13's, twenty two (22) of which have complete chemical analysis.The remaining twenty nine (29) are being submitted to represent geologic data only. Four (4) test holes with Attachment 13's are located within the proposed 931 acre proposed deep mine limits. One (1) of the Attachment 13's (AEC-2001-12) having chemical analysis is located within the proposed 931 acre portion of the proposed deep mine limits. In summary, five (5) test holes are lacking pursuant to the above referenced rule. See attached Addendum to this variance

request for a list of Attachment 13's being submitted.

The following information is submitted in support of this request:

1. A Test Hole Variance Request Map showing existing test holes, their surface elevations, their coal elevations and the structural contours based on these holes and the surrounding test holes. The proposed mining area boundary and panel layout, hydrologic boundary, and location of geologic cross sections are also shown on the map.

2. Logs of test holes and/or Attachment 13's for each hole.

3. A total of two (2) cross sections, A - A' taken along the approximate dip of the #8 coal seam, and B - B' taken along the approximate strike of the #8 coal seam.

We believe that all the data submitted with the original permit application and the previous adjacent area applications D-0425-1 and D-0425-3, and the data submitted for the approved Test Hole Variance Request for 2,680 acres, combined with the information submitted herein demonstrates that the structure and stratigraphy of this application area is well known, and adequately represents the conditions of the proposed shadow area. Your prompt review and approval of this variance request is appreciated.

The approved test hole variance request with all attached information will be submitted with the application. Should you have any questions, please contact me as soon as possible.

Sincerely,

Jack A. Hamilton & Associates, Inc.
Consultants for American Energy Corporation

James Chuckery

James M. Chuckery, Permitting

Enclosures

cc: American Energy Corporation
File

APPROVED ☒
DISAPPROVED ☐
DATE: June 30 2004
SIGNED Michael Sponsler
Chief

AEC 06295

ADDENDUM TO TEST HOLE VARIANCE REQUEST
AMERICAN ENERGY CORPORATION
APPLICATION D-0425-5

Note: Items with asterisk are newly submitted Attachment 13's
Items in bold print are test holes located within the proposed 931 acre deep mine limits

Test Hole	Location	Surf. Elev.	Top of Coal Elev.	Overburden Thickness	Attachment 13	Drill Log	Chemical Analysis
AEC-2000-01	NE Qtr. Sec. 36	1023	682	341	X		Yes
AEC-2000-02	NE Qtr. Sec. 30	1264	664	600	X		Yes
AEC-2000-03	NE Qtr. Sec. 31	976	676	300	X		Yes
AEC-2000-04	NE Qtr. Sec. 19	1267	670	597	X		Yes
AEC-2001-02	NE Qtr. Sec. 25	1239	677	562	X		Yes
AEC-2001-04	NW Qtr. Sec. 31	1004	677	328	X		Yes
AEC-2001-09	NE Qtr. Sec. 35	1244	663	581	X		Yes
AEC-2001-10	NW Qtr. Sec. 36	1267	693	574	X		Yes
AEC-2001-11	NW Qtr. Sec. 29	1087	646	441	X		Yes
AEC-2001-12	**SE Qtr. Sec. 5**	**1075**	**668**	**407**	**X**		**Yes**
AEC-2001-14	SE Qtr. Sec. 30	1315	648	667	X		Yes
AEC-2001-15	NE Qtr. Sec. 23	1220	634	586	X		Yes
AEC-2001-16	SW Qtr. Sec. 31	1225	694	531	X		Yes
AEC-2001-24	SE Qtr. Sec. 7	1140	717	423	X		Yes
AEC-2001-25	SW Qtr. Sec. 1	1220	714	506	X		Yes
*AEC-2001-26	SW Qtr. Sec.6	1230	701	529	X		Yes
AEC-2001-29	NW Qtr. Sec. 5	1110	686	424	X		
AEC-2001-30	**NW Qtr. Sec. 34**	**1080**	**677**	**403**	**X**		
*AEC-2001-31	SW Qtr. Sec. 28	1310	639	671	X		
***AEC-2001-32**	**NW Qtr. Sec. 34**	**1100**	**659**	**441**	**X**		
CLC-2001-27	NE Qtr. Sec. 28	1014	627	387	X		
CLC-2001-29	SE Qtr. Sec. 31	1210	695	515	X		
*CLC-2001-32	SW Qtr. Sec. 4	1273	693	580	X		

Test Hole	Location	Surf. Elev.	Top of Coal Elev.	Overburden Thickness	Attachment 13	Drill Log	Chemical Analysis
*CLC-2001-33	SW Qtr. Sec. 11	1205	714	491	X		
CLC-2002-08	SE Qtr. Sec. 30	1250	666	584	X		
*CLC-2002-01	NE Qtr. Sec. 11	1230	684	546	X		
CLC-2002-11	SW Qtr. Sec. 23	1230	617	613	X		Yes
CLC-2002-13	SE Qtr. Sec. 29	1035	629	406	X		
CLC-2002-31	NW Qtr. Sec. 23	1310	637	673	X		
CLC-2002-32	NW Qtr. Sec. 30	1230	681	549	X		
CLC-2002-34	NW Qtr. Sec. 24	1230	650	580	X		
CLC-2002-35	SW Qtr. Sec. 36	1160	689	471	X		
CLC-2002-36	NW Qtr. Sec. 4	1175	678	497	X		Yes
*CLC-2002-37	SE Qtr. Sec. 34	1250	651	599	X		Yes
CLC-2002-38	NE Qtr. Sec. 34	1310	646	664	X		Yes
*CLC-2002-39	SW Qtr. Sec. 4	1225	680	545	X		Yes
*CLC-2002-40	NW Qtr. Sec. 28	1225	635	590	X		
CLC-2002-41	NW Qtr. Sec. 29	1105	647	458	X		
CLC-2002-43	SW Qtr. Sec. 24	1330	657	673	X		
N94-41	NE Qtr. Sec. 5	1149	684	465	X		Yes
NA-87-09	SW Qtr. Sec. 23	1329	626	703	X		
NA-87-10	SE Qtr. Sec. 30	1332	663	669	X		
N94-15	SE Qtr. Sec. 36	1199	659	540	X		
N94-16	SE Qtr. Sec. 25	1279	685	594	X		
N94-17	NW Qtr. Sec. 6	1183	711	472	X		
Y&O-7	SE Qtr. Sec. 1	1060	708	352	X		
*NA-87-02	SE Qtr. Sec. 16	1259	632	627	X		
*NA-87-05	NE Qtr. Sec.21	1248	613	635	X		
*NA-87-06	NE Qtr. Sec. 28	979	624	355	X		
*NA-87-07	NE Qtr. Sec. 22	1301	612	689	X		
*NA-87-08	NE Qtr. Sec. 16	1320	619	701	X		

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 14B
(WELL/SPRING INVENTORY)

AEC 06298

Applicant's Name American Energy Corporation (D-0425-5)

Aquifer/Zone Identification	Aquifer/Zone Lithology	Aquifer/Zone Thickness Well/Spring	Aquifer/Zone Elev. (msl)	Aquifer/Zone Horizontal Extent	Aquifer/Zone Known Uses	Approx. Rate of Discharge/Usage of Aquifer/Zone (gpm or cfs)
A (comparable to post-subsidence "near surface zone")	Claystone, Shale, Sandstone	106'	1250 TO 1356	Uppermost Ridges, Outcrop to Outcrop	Domestic, Livestock	<1 to 8.8 gpm
B	Shale, Claystone, Sandstone	77'	1167 TO 1244	Upper Ridge, Outcrop to Outcrop	Recreational, Domestic, Livestock	<1 to 3.4 gpm
C	Sandstone	5'	1152 TO 1157	Mid Ridge, Outcrop to Outcrop	Recreational, Domestic, Livestock	<1 gpm
D	Shale, Claystone, Limestone	100'	1040 to 1140	Lower Ridge, Outcrop to Outcrop	Recreational, Domestic, Livestock	<1 gpm
E	Sandstone, Shale, Limestone, Waynesburg "A" coal, Claystone	60'	940 to 1000	Valley Floor, Regional	None within hydrology limits of shadow area	Unknown, does not discharge/not in use within hydrology limits

Ohio Department of Natural Resources

BOB TAFT, GOVERNOR SAMUEL W. SPECK, DIRECTOR

Richard S. Bartz • Chief

Division of Water

Date: April 27, 2004

ANALYSIS OF EXISTING GROUND WATER FILE DATA

Prepared By: Bill Haiker, Hydrogeologist

Operator: American Energy Corporation

County: Monroe and Belmont

Township: Sunsbury and Washington

Section (s): 5, 6, 17, 23, 24, 28, 29, 30, 34, 35, 36 and 19 & 25

Number of water well logs within 1,000 foot radius of site (copies attached): 22 Field located: 22

General description of local hydrology:

Ground water is obtained from interbedded sandstone, shale and limestone bedrock. Well depths range from 50 to 175 feet with yields of less than two gallons per minute.

Areas of particular concern:

Longwall mining the #8 coal seam at an approximate elevation of 615 to 695 feet M.S.L. could adversely impact wells within the 1000 foot boundary.

1939 Fountain Square Court/Building E, Columbus, Ohio 43224

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

AC 65

No. 3163
WL-11.01

County MONROE Township SUNSBURY Section of Township 24

Owner CARL CHADWELL Address RED BEALLSVILLE,

Location of property ON ST RT 556 4 MILES

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 22.9

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion 10-28-65

BAILING OR PUMPING TEST

Pumping Rate 31 G.P.M. Duration of test

Drawdown ft. Date

Static level-depth to water 26

Quality (clear, cloudy, taste, odor)

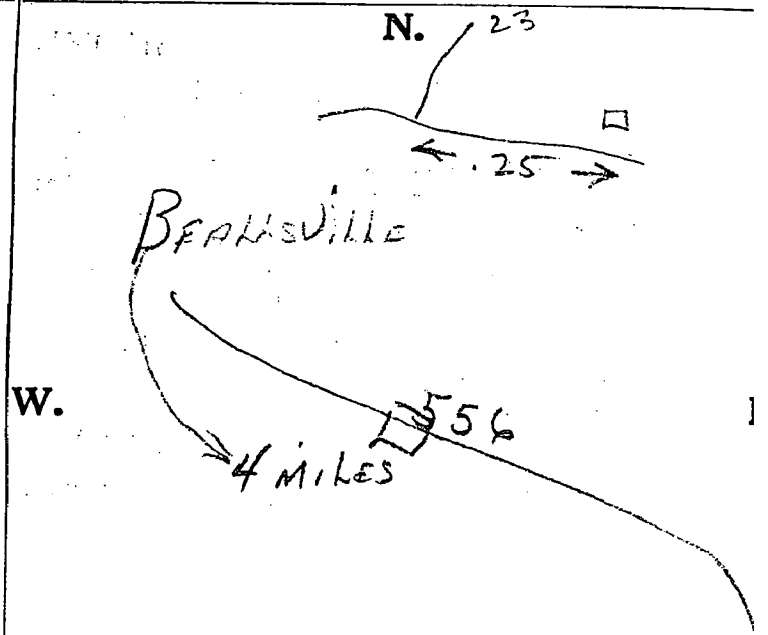
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
RED CLAY	0 Feet	1 Ft.
SAND STONE	1	7
GRAY SHALE	7	11
SAND STONE	11	24
WATER 37 GRAY SHALE	24	41
RED CLAY	41	53
WHITE SAND	53	84
GRAY SHALE	84	90

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, et



S.

See reverse side for instructions

Drilling Firm Billman Drilling Date 10-28-65

Address 211 Green St Signed M. H. Billman
Woodsfield, Ohio

AEC 06300

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

(45) CN2

No. 24593(
WE25.00

County Monroe Township Sunsbury Section of Township 24

Owner Bill Mullett Address Beallsville O.

Location of property 3 Miles East of Beallsville O. on State Route on South side of Road.

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 16

Type of screen ..... Length of screen .....

Type of pump .....

Capacity of pump .....

Depth of pump setting .....

Date of completion .....

BAILING OR PUMPING TEST

Pumping rate ..... G.P.M. Duration of test .....

Drawdown ..... ft. Date .....

Developed capacity .....

Static level—depth to water 50

Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
clay	0 Feet	8 Ft.
Sandstone	8	19
Clay	19	31
Shale	31	50
Sandstone	50	56
Red	56	65
Shale	65	80

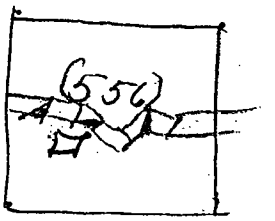
Water 55

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, e

N.

W.



S.

See reverse side for instructions

Drilling Firm L. A. Mat[illegible] Date 10/13/61

Address Woodsfield O. Signed L. A. Mat[illegible]

22

AEC 06301

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

(110) ORIG

504858
WL-33.00

COUNTY Monroe TOWNSHIP Sunsbury SECTION OF TOWNSHIP

OWNER Ralph Perkins ADDRESS Rt. 3 Beallsville

LOCATION OF PROPERTY 1/4 mi. from St. Rt. 556 on County Rd. 38

CONSTRUCTION DETAILS

Casing diameter 8" Length of casing 20'

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 1/2 gpm Duration of test 24

Drawdown ft Date

Static level (depth to water)

Quality (clear, cloudy, taste, odor) Cloudy

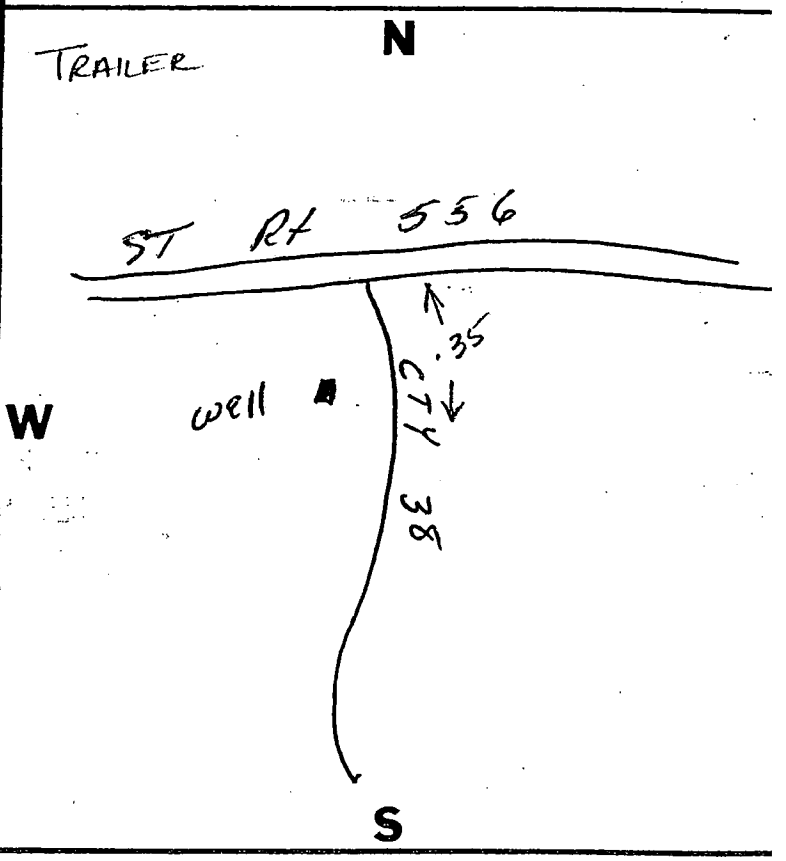
Pump installed by

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Top	0 ft	14 ft
Red Rock	14	19
Red Clay	19	27
Lime Clay	27	36
Limestone	36	38
Limestone Clay	38	44
Sandstone	44	48
Sandy-Clay	48	54
Sandstone	54	60
Sandy-Clay	60	70
Limestone	70	80
Sandy-Clay	80	85
Red Rock	85	90
Vein @ 70'		

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM Mann Drilling DATE 8-9-76

ADDRESS Rt. 3 Woodsfield O. SIGNED Rick Mann

*If additional space is needed to complete well log, use next consecutive numbered form.

29

AEC 06302

WL-34.

Water Well Log and Drilling Report

Ohio Department of Natural Resources
Division of Water
Phone: 614-265-6740 Fax: 614-265-6767

Well Log Number: 245949

ORIGINAL OWNER AND LOCATION

Original Owner Name: *ARLY JOHNSON*

County: *MONROE*	Township: *SUNSBURY*	Section Number: *24*
Address: *ST RT 556*		Lot Number:
City:	State: *OH*	Zip Code:
Location Number: *30*	Location Map Year: *1988*	Location Area:
Latitude:	Longitude:	

CONSTRUCTION DETAILS

Borehole Diameter:	Depth to Bedrock:	Total Depth: *70 ft.*
Casing Diameter: *8 in.*	Casing Thickness:	Casing Length: *29 ft.*
Well Use:	Screen Length:	Date of Completion: *9/21/62*
Aquifer Type: *ROCK*	Driller's Name: *MATZ L A*	

WELL TEST DETAILS

Static Water Level: *40 ft.*	Test Rate:	Associated Reports
Drawdown:	Test Duration:	*NONE*

COMMENTS:

WELL LOG

Formations	From	To
CLAY	0	3
SAND	3	16
SHALE	16	28
SAND	28	31
SHALE	31	64
RED ROCK	64	70
WATER AT	32	32
WATER AT	50	50

Printing Tips (opens in new window)

Conduct Another Search
OR use your browsers back button to see the last list of addresses or roads.

Well log questions - Web site questions - Web policies

AEC 06303

WL-4

Water Well Log and Drilling Report

Ohio Department of Natural Resources
Division of Water
Phone: 614-265-6740 Fax: 614-265-6767

Well Log Number: 624677

ORIGINAL OWNER AND LOCATION

Original Owner Name: *KEVIN NEISWANGER*

County: *MONROE*	Township: *SUNSBURY*	Section Number:
Address: *CO RD 38*		Lot Number:
City:	State: *OH*	Zip Code:
Location Number:	Location Map Year:	Location Area:
Latitude:	Longitude:	

CONSTRUCTION DETAILS

Borehole Diameter:	Depth to Bedrock:	Total Depth: *90 ft.*
Casing Diameter: *8 in.*	Casing Thickness:	Casing Length: *92 ft.*
Well Use:	Screen Length:	Date of Completion: *7/17/84*
Aquifer Type: *SHALE*	Driller's Name: *C & D DRILLING*	

WELL TEST DETAILS

Static Water Level: *50 ft.*	Test Rate: *2 gpm*	Associated Reports
Drawdown:	Test Duration: *4 hrs.*	*NONE*

COMMENTS:

WELL LOG

Formations	From	To
TOP SOIL	0	4
SANDSTONE	4	10
SHALE	10	30
SANDSTONE	30	34
CLAY	34	46
SHALE	46	71
CLAY	71	79
SHALE	79	90

Printing Tips (opens in new window)

Conduct Another Search
OR use your browsers back button to see the last list of addresses or roads.

Well log questions - Web site questions - Web policies

AEC 06304

County Permit No. _____

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

(112) ORIG

540723
WL-84.00
OK

COUNTY Monroe TOWNSHIP Sunsbury SECTION OF TOWNSHIP _____

OWNER Bill Bauer ADDRESS Rt # 3 Beallsville, Oh

LOCATION OF PROPERTY Co Rd. # 31, 1 1/2 mi. S. ST. R.T. 556.

CONSTRUCTION DETAILS

Casing diameter 8" Length of casing 120

Type of screen _____ Length of screen _____

Type of pump Submersible

Capacity of pump 5 GPM.

Depth of pump setting _____

Date of completion _____

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 4 GPH ~~gpm~~ Duration of test _____

Drawdown _____ ft Date _____

Static level (depth to water) _____

Quality (clear, cloudy, taste, odor) Clear

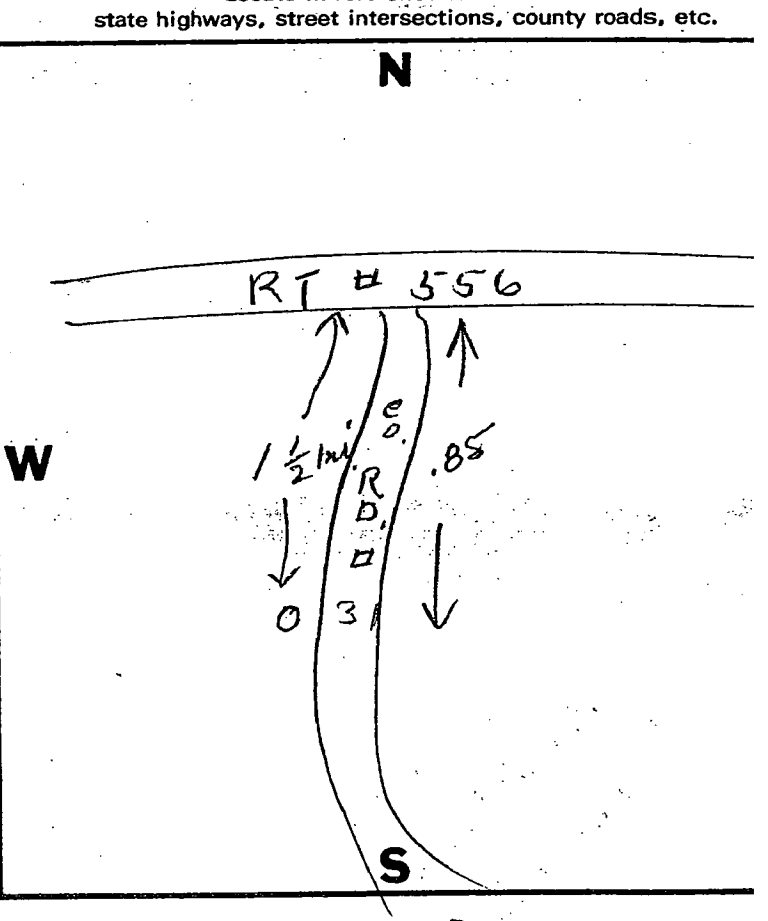
Pump installed by Self

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Top Soil	0 ft	3 ft
Red Clay	3	8
Sandstone	8	17
Lime Clay	17	38
Limestone	38	43
Red Clay	43	71
Lime Clay	71	75
Limestone	75	79
Lime Clay	79	90
Red Clay	90	113
Lime Clay	113	118
Red Clay	118	120

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM Mann Drilling DATE 9-15-78

ADDRESS RT. 3, Woodsfield, O SIGNED Floyd E. Mann

*If additional space is needed to complete well log, use next consecutive numbered form.

55

AEC 06305

County Permit No. _____

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

113

540724
WL-86.00

COUNTY Monroe TOWNSHIP Sunsbury SECTION OF TOWNSHIP _____

OWNER Duane Bauer ADDRESS Rt#3 Beallsville, Ohio

LOCATION OF PROPERTY CO RD #31, 1½ mi. S. ST. RT. 556

CONSTRUCTION DETAILS

Casing diameter 8" Length of casing 110

Type of screen _____ Length of screen _____

Type of pump Submersible

Capacity of pump 5 GPM

Depth of pump setting _____

Date of completion _____

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 1 gpm Duration of test _____

Drawdown _____ ft Date _____

Static level (depth to water) _____

Quality (clear, cloudy, taste, odor) Clear

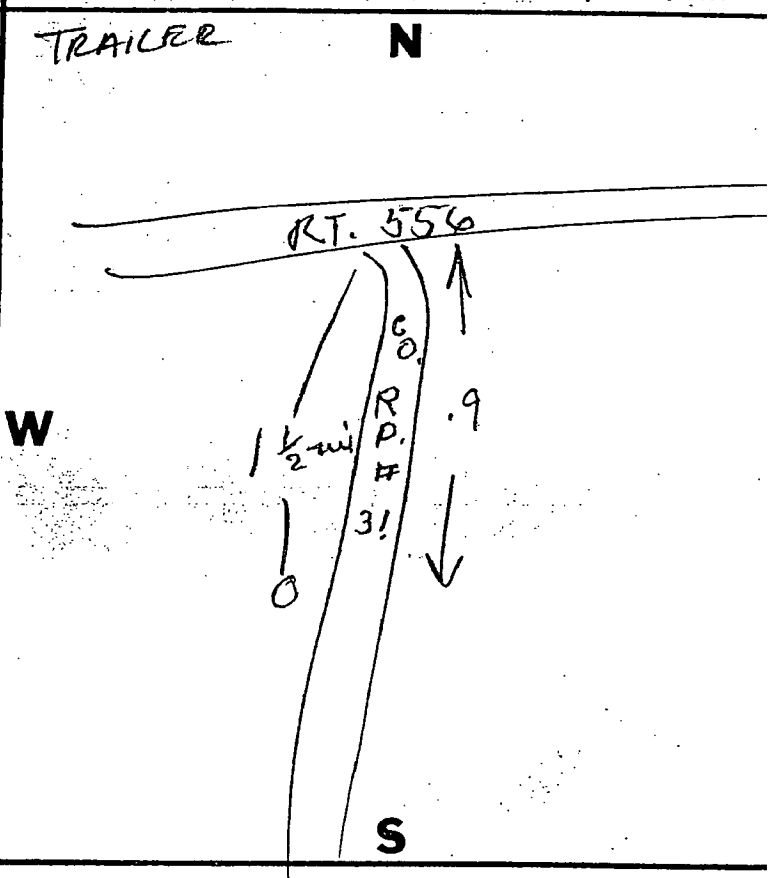
Pump installed by Self

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Top Soil	0 ft	3 ft
Shale Sandy	3	19
Red Clay	19	31
Lime Clay	31	47
Limestone	47	53
Red Clay	53	59
Lime Clay	59	73
Red Clay	73	95
Lime Clay	95	110

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM Marion Drilling

ADDRESS RT. 3, Woodsfield, O

DATE 9-23-78

SIGNED Floyd E. Mann

*If additional space is needed to complete well log, use next consecutive numbered form.

AEC 06306

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

55 OK

No. 24594
WL-88.0

County Monroe Township Sunbury Section of Township 35

Owner Benard Craig Address Beallsville O.

Location of property 1 Mile South of State Route (556) along C 31 on the West side of Road

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 20-6

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping rate G.P.M. Duration of test

Drawdown ft. Date

Developed capacity

Static level—depth to water 20

Pump installed by

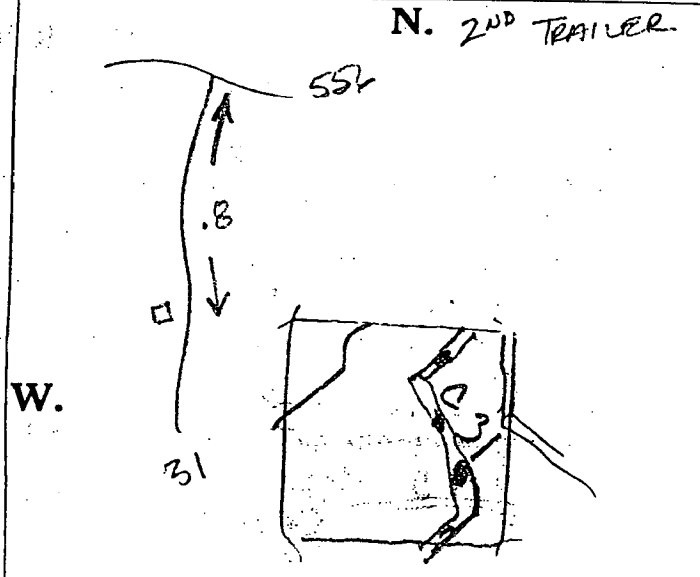
WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	12 Ft.
Lime	12	23
Shale	23	42
Sandstone	42	46
Red Rock	46	70

Water 43

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads,



See reverse side for instructions

Drilling Firm L. A. Matz Date 8/7/62

Address Woodsfield O Signed L. A. Matz

52

AEC 06307

WL- 90

Water Well Log and Drilling Report

Ohio Department of Natural Resources
Division of Water
Phone: 614-265-6740 Fax: 614-265-6767

Well Log Number: 366726

ORIGINAL OWNER AND LOCATION

Original Owner Name: *ROGER PITTTMAN*

County: *MONROE*	Township: *SUNSBURY*	Section Number: *34*
Address: *CO RD 31*		Lot Number:
City:	State: *OH*	Zip Code:
Location Number: *56*	Location Map Year: *1988*	Location Area:
Latitude:	Longitude:	

CONSTRUCTION DETAILS

Borehole Diameter:	Depth to Bedrock:	Total Depth: *100 ft.*
Casing Diameter: *8 in.*	Casing Thickness:	Casing Length: *21 ft.*
Well Use:	Screen Length:	Date of Completion: *6/1/69*
Aquifer Type: *SAND*	Driller's Name: *MATZ L A*	

WELL TEST DETAILS

Static Water Level: *50 ft.*	Test Rate:	Associated Reports
Drawdown:	Test Duration:	*NONE*

COMMENTS:

WELL LOG

Formations	From	To
CLAY	0	3
SANDY SHALE	3	20
GRY SHALE	20	32
RED ROCK	32	65
SANDY SHALE	65	79
SHALE	79	93
SAND	93	100
WATER AT	65	65

Printing Tips (opens in new window)

Conduct Another Search
OR use your browsers back button to see the last list of addresses or roads.

Well log questions - Web site questions - Web policies

AEC 06308

WELL LOG AND DRILLING REPORT

(109) ORIGIN

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

442597
WL-92.00 K

County MONROE Township SUNSBURY Section of Township 32

Owner EUGENE BARONE Address CENTER ST, WOODSFIELD

Location of property ON MELLOT RIDGE

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 21

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion 6-12-74

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate 3 G.P.M. Duration of test

Drawdown ft. Date

Static level-depth to water 58

Quality (clear, cloudy, taste, odor) CLEAR

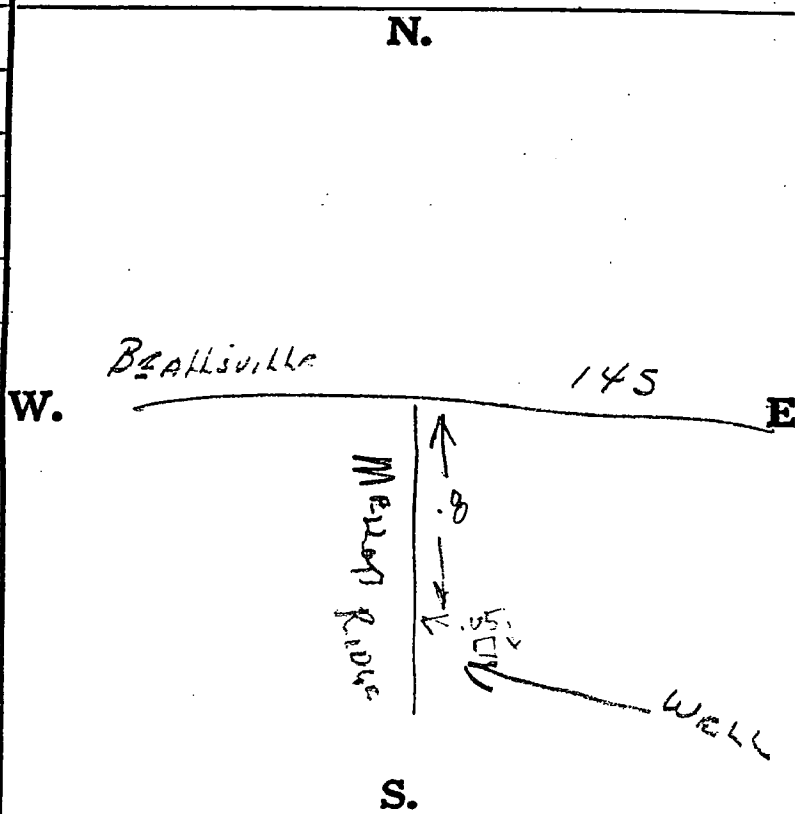
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
SANDSTONE	0 Feet	39 Ft.
GRAY SHALE	39	67
RED CLAY	67	100
WATER 67		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm HARLAN BILLMAN
~~317 Guilford Avenue~~
Address Woodsfield, Ohio 43793

Date 6-12-74

Signed H. H. Billman

*If additional space is needed to complete well log, use next consecutive numbered form

AEC 06309

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1500 Dublin Road
Columbus, Ohio

(27) CW

No. 21300
WL-94.0

County Monroe Township Sunsbury Section of Township 35

Owner Atkinson Address Beallsville O

Location of property 1 Mile South of St RT 556

CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 6 1/4 Length of casing 12	Pumping rate ..... G.P.M. Duration of test .....
Type of screen ..... Length of screen	Drawdown ..... ft. Date .....
Type of pump	Developed capacity .....
Capacity of pump	Static level—depth to water 47
Depth of pump setting	Pump installed by .....
Date of completion	

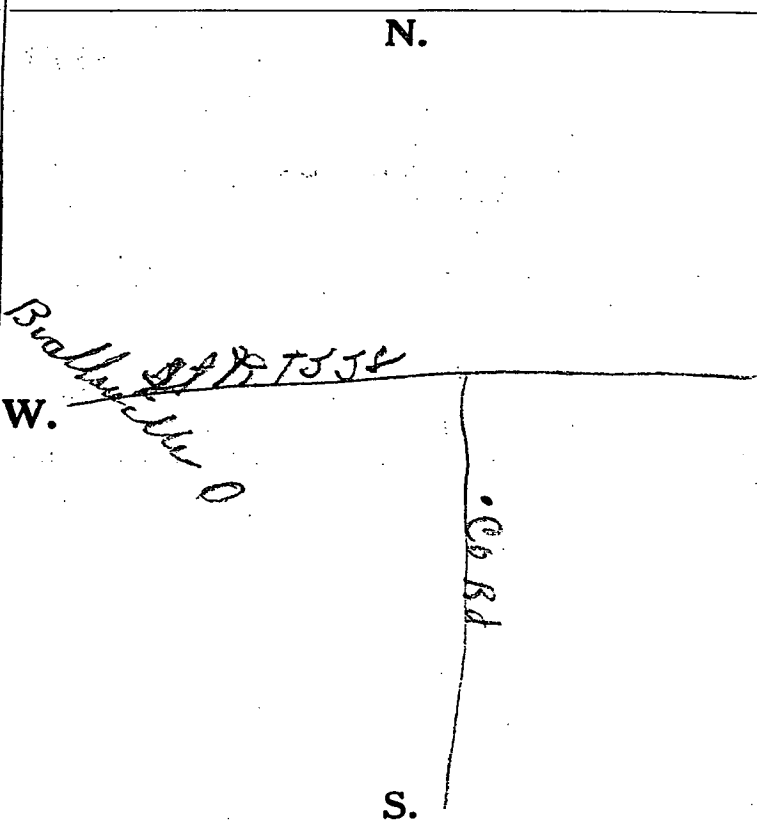
WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Top Soil	0 Feet	4 Ft.
Sand Stone	4	9
Red Rock	9	17
Sand Brown	17	22
Pink Rock	22	30
Shale Grey	30	63
Red Rock	63	67
Shale Blue	67	75
Shale Grey	75	89
Red Rock	89	96
Shale Grey	96	112
Red Rock	112	120

Water 67

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, e



See reverse side for instructions

Drilling Firm Bellman Drilling Co Date July 14-58

Address Woodsfield O Signed Chas S. Bellman

51

AEC 06310

WELL LOG AND DRILLING REPORT

ORI

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey
Fountain Square
Columbus, Ohio 43224 Phone (614) 466-5344

109
497995
WL-108.00

COUNTY Monroe TOWNSHIP Sunsbury SECTION OF TOWNSHIP OR LOT NUMBER

OWNER C. Abarigg ADDRESS Market St. Clarington

LOCATION OF PROPERTY Mellott Ridge 1½ mi. S. of 556 S.R

CONSTRUCTION DETAILS

Casing diameter 8" Length of casing 20'

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 2 gpm Duration of test 24

Drawdown ft Date

Static level (depth to water)

Quality (clear, cloudy, taste, odor) Cloudy
Sweet taste no odor

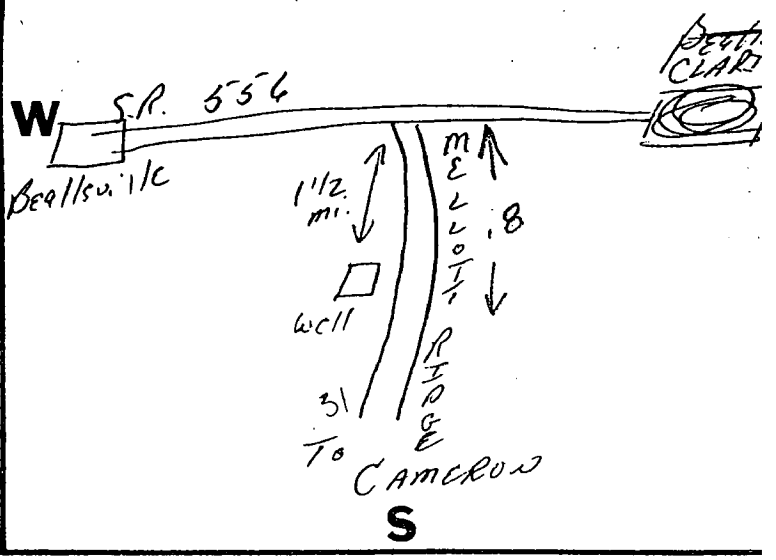
Pump installed by

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Clay	0 ft	10 ft
Sandstone	10	18
Limestone	18	24
Coal	24	26
Limestone	26	38
Red Clay	38	50
Limestone	50	65
Water at 30'		

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM Mann Drilling DATE

ADDRESS Rt 3
Woodsfield O.

SIGNED Floyd E. Mann
(Owner)

*If additional space is needed to complete well log, use next consecutive numbered form.

AEC 06311

WL-1

Water Well Log and Drilling Report

Ohio Department of Natural Resources
Division of Water
Phone: 614-265-6740 Fax: 614-265-6767

Well Log Number: 245935

ORIGINAL OWNER AND LOCATION

Original Owner Name: *STEARLING RILEY*

County: *MONROE*	Township: *SUNSBURY*	Section Number: *34*
Address: *CO RD 31*		Lot Number:
City:	State: *OH*	Zip Code:
Location Number: *57*	Location Map Year: *1988*	Location Area:
Latitude:	Longitude:	

CONSTRUCTION DETAILS

Borehole Diameter:	Depth to Bedrock:	Total Depth: *90 ft.*
Casing Diameter: *8 in.*	Casing Thickness:	Casing Length: *18 ft.*
Well Use:	Screen Length:	Date of Completion: *3/30/62*
Aquifer Type: *SHALE*	Driller's Name: *MATZ L A*	

WELL TEST DETAILS

Static Water Level: *45 ft.*	Test Rate:	Associated Reports
Drawdown:	Test Duration:	*NONE*

COMMENTS:

WELL LOG

Formations	From	To
CLAY	0	3
STONE	3	11
SHALE	11	50
SANDSTONE	50	68
SHALE	68	70
RED	70	90
WATER AT	48	48

Printing Tips (opens in new window)

Conduct Another Search

OR use your browsers back button to see the last list of addresses or roads.

Well log questions - Web site questions - Web policies

AEC 06312

WELL LOG AND DRILLING REPORT

ORIG

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

Outside 1000' Limit

No. 413073

OK

County MONROE Township SUNSBURY Section of Township 6

Owner HAROLD CARPENTER Address BEALLSVILLE, OHIO

Location of property ON ST RT 556

CONSTRUCTION DETAILS

Casing diameter 6 1/4 Length of casing 22

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion 3-10-71

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate 3 G.P.M. Duration of test

Drawdown ft. Date

Static level-depth to water 30

Quality (clear, cloudy, taste, odor)

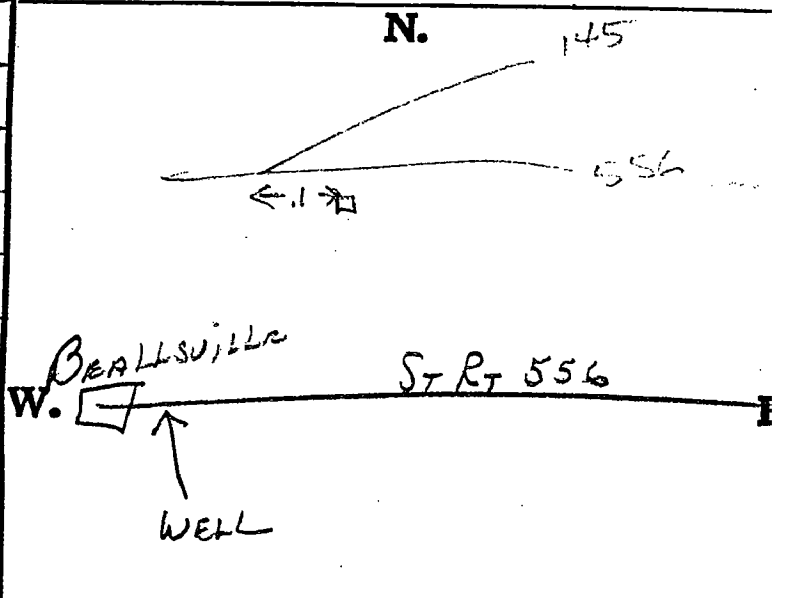
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
SANDSTONE	0 Feet	9 Ft.
RED CLAY	9	12
SAND STONE	12	24
GRAY SHALE	24	53
WHITE SAND	53	75
WATER 42		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc



Drilling Firm BILLMAN DRILLING Date 3-10-71

Address WOODSFIELD, OHIO Signed H. H. Billman

*If additional space is needed to complete well log, use next consecutive numbered form

AEC 06313

WL-12

Water Well Log and Drilling Report

Ohio Department of Natural Resources
Division of Water
Phone: 614-265-6740 Fax: 614-265-6767

Well Log Number: 542761

ORIGINAL OWNER AND LOCATION

Original Owner Name: *GARY NOLAN*
County: *MONROE*
Address: *CO RD 38*
City:
Location Number: *59*
Latitude:

Township: *SUNSBURY*
State: *OH*
Location Map Year: *1988*
Longitude:

Section Number: *22*
Lot Number:
Zip Code:
Location Area:

CONSTRUCTION DETAILS

Borehole Diameter:
Casing Diameter: *8 in.*
Well Use:
Aquifer Type: *SANDSTONE*

Depth to Bedrock:
Casing Thickness:
Screen Length:
Driller's Name: *BUCKEYE DRILLING & TEST BORING CO*

Total Depth: *199 ft.*
Casing Length: *200 ft.*
Date of Completion: *9/12/78*

WELL TEST DETAILS

Static Water Level: *100 ft.*
Drawdown:

Test Rate:
Test Duration:

Associated Reports
NONE

COMMENTS:

WELL LOG

Formations	From	To
CLAY	0	30
SANDSTONE	30	60
SHALE	60	70
RED ROCK	70	90
SANDSTONE	90	95
RED ROCK	95	105
BLU SHALE	105	135
SANDSTONE	135	160
RED ROCK	160	180
SANDSTONE	180	199
WATER AT	160	160

Printing Tips (opens in new window)

Conduct Another Search
OR use your browsers back button to see the last list of addresses or roads.

Well log questions - Web site questions - Web policies

AEC 06314

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

PLEASE USE PENCIL OR TYPEWRITER

DO NOT USE INK.

Sub

OK

Nº 3667
W-148A

County Monroe Township Sunbury Section of Township 36

Owner John Ensley Address Beallsville, O.

Location of property 1 Mile East of Beallsville O. on State Route [556]

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping Rate G.P.M. Duration of test

Drawdown ft. Date

Static level-depth to water 16

Quality (clear, cloudy, taste, odor)

Pump installed by

WELL LOG*

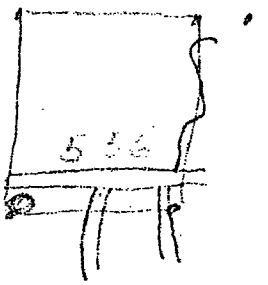
Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	11 Ft.
Sandstone	11	27
Lime	27	50
Water 19		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, et

N.

W.



S.

See reverse side for instructions

Drilling Firm L. A. Matz Date 4/25/68

Address - Woodsfield Co Signed L. A. Matz

*If additional space is needed to complete well log, use next consecutive numbered forr

AEC 06315

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1500 Dublin Road
Columbus, Ohio

OK (25)

No. 21030
WL-18

County Monroe Township Sunbury Section of Township 36

Owner Carlos Millott Address Beallsville, Ohio

Location of property prox (2) Miles East of Beallsville, O. South Side of R.T. State (556)

CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 8 Length of casing 21	Pumping rate ..... G.P.M. Duration of test .....
Type of screen ..... Length of screen	Drawdown ..... ft. Date .....
Type of pump	Developed capacity .....
Capacity of pump	Static level—depth to water 14.
Depth of pump setting	Pump installed by .....
Date of completion	

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	16 Ft.
Shale	16	30
Red	30	39
Shale	39	48
Red	48	57
Shale	57	60

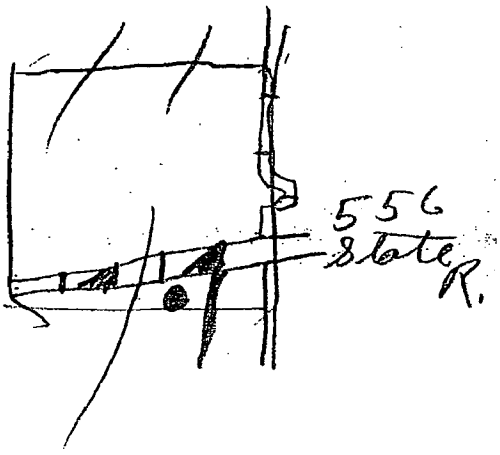
Water 28

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads,

Corner of 31/556 N.

W.



S.

See reverse side for instructions

Drilling Firm S. A. Matz Date 4/7/58

Address Woodsfield Signed S. A. Matz

AEC 06316

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

No. 2592
W-142

County MONROE Township SUNSBURY Section of Township 30

Owner IRA STAPP Address RFD BEALSVILLE, OH

Location of property 2 MILES EAST OF BEALSVILLE ON ST RT 556

CONSTRUCTION DETAILS

Casing diameter 6 5/8 Length of casing 20

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion MAY 25, 1963

BAILING OR PUMPING TEST

Pumping rate 1 1/4 G.P.M. Duration of test

Drawdown ft. Date

Developed capacity

Static level—depth to water 35

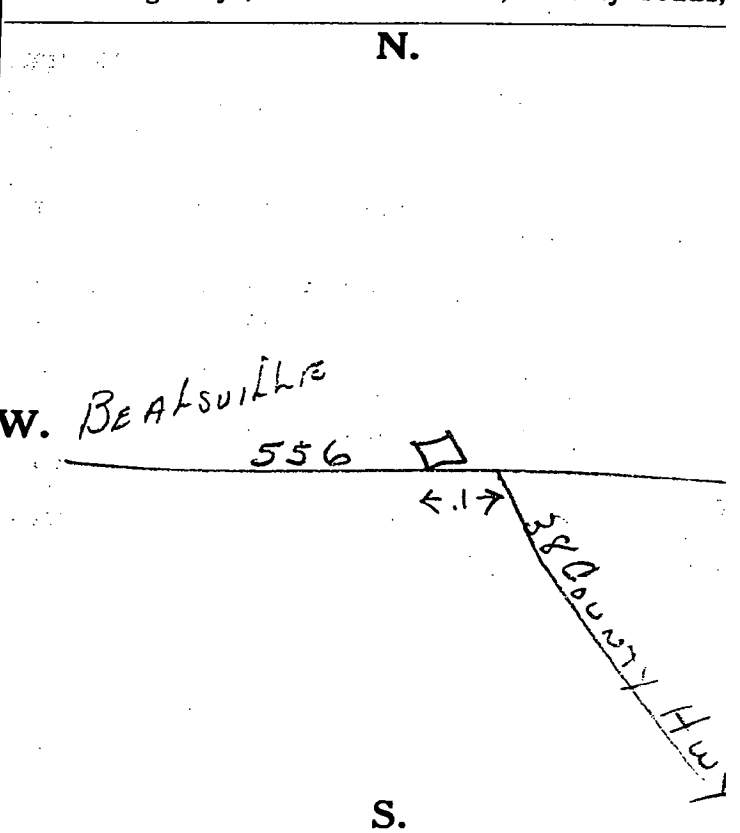
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
SOIL	0 Feet	2 Ft.
SANDSTONE	2	14
GRAY SHALE	14	17
WATER 28 RED ROCK	17	24
GRAY SHALE	24	31
LIMESTONE	31	33
WATER 42 GRAY SHALE	33	47
RED ROCK	47	62

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads,



See reverse side for instructions

Drilling Firm H.H. BILLMAN Date 5-25-63

Address 211 GREEN ST WOODSFIELD Signed H. H. Billman

AEC 06317

WELL LOG AND DRILLING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1500 Dublin Road
Columbus, Ohio

(21) No. 21032
W-600
3 6

County Monroe Township Sunsbury Section of Township

Owner Merle Mellott Address Beallsville O.

Location of property 1 Mile East of Beallsville O. State Route 5

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 14

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping rate G.P.M. Duration of test

Drawdown ft. Date

Developed capacity

Static level—depth to water 70

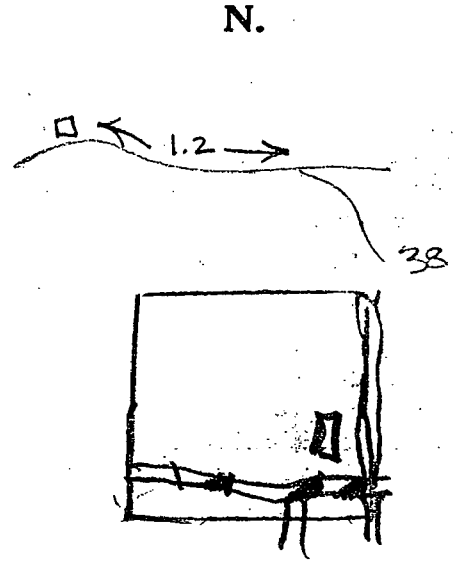
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
clay	0 Feet	10 Ft.
Sandy	10	16
Red	16	25
Shale	25	41
Sandy	41	47
Red	47	71
Sand	71	77
Shale	77	88
Red	88	95
Water 71		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads,



See reverse side for instructions

Drilling Firm L. A. Mott Date 4/25/59

Address Woodsfield O. Signed L. A. Mott

21

AEC 06318

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

OK see Quad (17)

No. 24592
WL-20

County Monroe Township Sunsbury Section of Township 3 6

Owner Glenn Mellott Address Beallsville O.

Location of property 2 Miles East of Beallsville, O. along State Rou on the South side of Road.

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 20

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping rate G.P.M. Duration of test

Drawdown ft. Date

Developed capacity

Static level—depth to water 45

Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	19 Ft.
Shale	19	20
Lime	20	26
Red	26	30
Shale	30	55
Lime	55	58
Shale	58	90

Water 24
Water 55

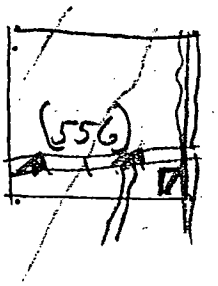
SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads,

N.

Corner of 5 & 556

W.



S.

See reverse side for instructions

Drilling Firm J. A. Moss Date 10/7/61

Address Woodsfield O. Signed J. A. Moss

75

AEC 06319

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

(49) OH

No. 27258
WL-205

County Monroe Township Sunsbury Section of Township 30

Owner James Riley Address Beallsville O

Location of property 2½ Miles from 556 east of Beallsville

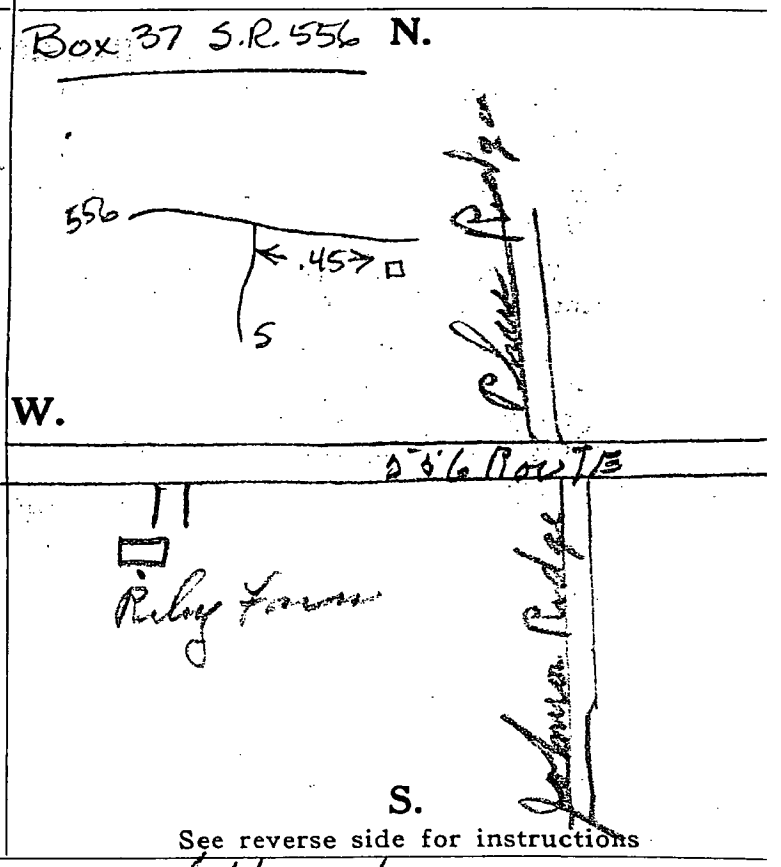
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 10 Length of casing 12	Pumping rate G.P.M. Duration of test
Type of screen Length of screen	Drawdown ft. Date
Type of pump	Developed capacity 25 gals
Capacity of pump	Static level—depth to water
Depth of pump setting	Pump installed by
Date of completion Sept 22/64	

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Loam & shale	0 Feet	12 Ft.
Sand S & Clay	12	35
Clay & Sand	35	105
Water at 31 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, e



See reverse side for instructions

Drilling Firm Chas McKinney Date Sept 22/64

Address Rowland Ave Pt Signed Chas McKinney

AEC 06320

WELL LOG AND DRILLING REPORT

ORIGI

OK (106)

426083
Abandoned

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

County MONROE Township SUNSBURY Section of Township 24

Owner JOHN HRANKO Address BOX 20 POWHATTAN

Location of property ON CO 23

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 23

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion MARCH 22, '72

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate 20 G.P.M. Duration of test

Drawdown ft. Date

Static level-depth to water 20

Quality (clear, cloudy, taste, odor)

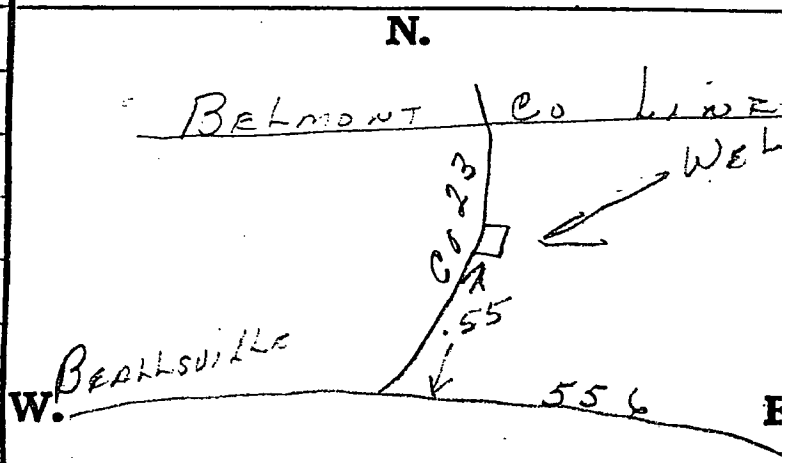
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
RED CLAY	0 Feet	2 Ft.
SAND STONE	2	27
GRAY SHALE	27	46
SANDSTONE	46	52
RED CLAY	52	70
WATER 44		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc



Drilling Firm BILLMAN DRILLING Date 3-22-72

Address WOODSFIELD, OHIO Signed H. H. Billman

*If additional space is needed to complete well log, use next consecutive numbered form

AEC 06321

Darby

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

OK - see quad (42)

No. 24593 (Darby) Abandoned

County Monroe Township Sunsbury Section of Township 24

Owner Arley Johnson Address Beallsville O. h

Location of property 2 Miles East of Beallsville, O. on the N Side of State Route (556)

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 20

Type of screen ..... Length of screen .....

Type of pump .....

Capacity of pump .....

Depth of pump setting .....

Date of completion .....

BAILING OR PUMPING TEST

Pumping rate ..... G.P.M. Duration of test .....

Drawdown ..... ft. Date .....

Developed capacity .....

Static level—depth to water 47

Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	8 Ft.
Shale	8	16
Sandstone	16	21
Shale	21	36
Sandstone	36	44
Shale	44	80

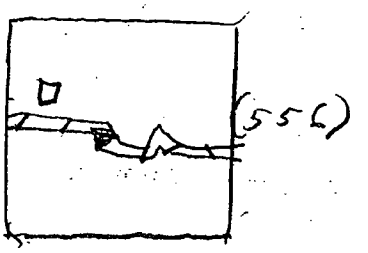
Water 21
Water 55

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads,

N.

W.



S.

See reverse side for instructions

Drilling Firm L. A. Matz Date 10/24/61

Address Woodsfield Signed L. A. Matz

AEC 06322

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1500 Dublin Road
Columbus, Ohio

(32) Oh

No. 21032

Abandoned

County Monroe Township Sunsbury Section of Township 24

Owner Bill Ward Address Beallsville Ohio

Location of property (3) Mile's East of Beallsville Oh along State R.T 5

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 18

Type of screen ..... Length of screen .....

Type of pump .....

Capacity of pump .....

Depth of pump setting .....

Date of completion .....

BAILING OR PUMPING TEST

Pumping rate ..... G.P.M. Duration of test .....

Drawdown ..... ft. Date .....

Developed capacity .....

Static level—depth to water 20

Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	7 Ft.
Sandstone	7	19
Shale	19	40
Lime	40	52
Red	52	60

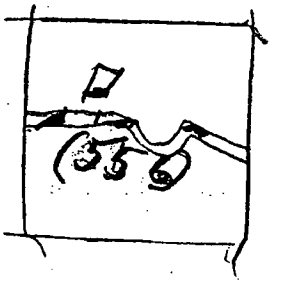
Water 24

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, e

N.

W.



S.

See reverse side for instructions

Drilling Firm L. A. Matz Date 6/11/59

Address Woodfield O. Signed L. A. Matz

32

AEC 06323

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

OIC (64)

No. 3163
Abandoned

County MONROE Township SUNSBURY Section of Township 24

Owner SHERMAN MULLETT Address RD 1 BEALLSVILLE, OHIO

Location of property ON 556 5 MILES EAST OF BEALLSVILLE

CONSTRUCTION DETAILS

Casing diameter NONE Length of casing

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion 8-31-65

BAILING OR PUMPING TEST

Pumping Rate 1 G.P.M. Duration of test

Drawdown ft. Date

Static level-depth to water

Quality (clear, cloudy, taste, odor)

Pump installed by

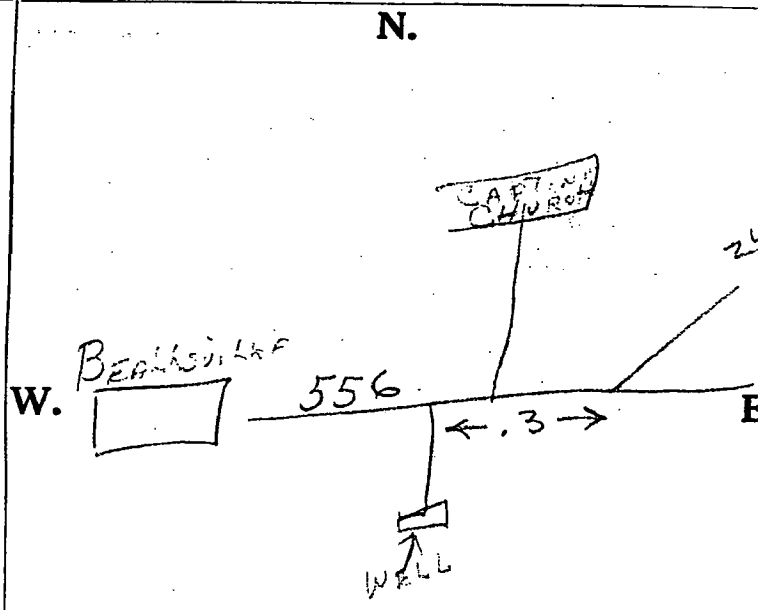
WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
SOIL	0 Feet	2 Ft.
BROWN SANDSTONE	2	9
WHITE SANDSTONE	9	53
GRAY SHALE	53	71
LIME STONE	71	75
RED CLAY	75	94
GRAY SHALE	94	106
RED CLAY	106	120
COAL	120	123
RED ROCK	123	144
GRAY SHALE	144	154

WELL PLUGGED BY OWNER, TOP WATER DEPTH UNKNOWN.

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc



See reverse side for instructions

Drilling Firm BILLMAN DRILLING Date 8-31-65

Address 211 GREEN ST. WOODSFIELD OHIO Signed H. H. Billman

34

AEC 06324

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
W-10.00	J. Smith Jr.	1345	Inaccessible	Inaccessible	Unknown	Not In Use
W-11.00 ✓	C. Chadwell	1320	Reported 110'	Buried	A & B	Not In Use
WL-11.01 ✓	C. Chadwell	1320	Well Log 90'	(Buried) Well Log 26'	A & B	Not In Use
W-12.00	L. Burkhart	1322	Buried	Buried	Unknown	Not In Use
W-14.00	D. Tubaugh	1310	51.4'	27.5' to 29'	A	Domestic
W-15.00	D. Mallett, R. Kirby	1300	Pinched off @ 24'	Dry	Unknown	Not In Use
WL-25.00	J & K Kernen Jr.	1297	Well Log 80'	(Buried) Well Log 50'	B	Not In Use
W-26.00	S. Mullett	1300	83'	30.5' to 44.8'	A & B	Not In Use
W-28.03	R. Perkins	1320	No Access From Well House		Unknown	Livestock
W-29.00	J. & L. Cox	1340	67'	29' to 30.8'	A	Domestic
W-30.00	M. Hoover	1338	66.3'	41.8' to 44'	A	Domestic
W-32.00	S. Seebach	1245	Buried	Sealed	Unknown	Not In Use
WL-33.00	R. Perkins	1355	90'	48' to 51.8'	A	Domestic
WL-34.01	S. Johnson	1360	70' (Well Log) 62' (As Measured)	47'	A	Domestic
W-37.00	B. & E. Reed	1210	82'	4' to 9.8'	B, C, & D	Occasional Domestic
W-37.02	B. & E. Reed	1215	51'	20.6' to 24.1'	B	Recreational

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
WL-49.00	K. Neiswanger	1280	90'	54' to 59.4'	B	Domestic
W-60.00	M. Shrewsbury	1295	Reported 110'	Buried/Sealed	A & B	Not In Use
W-60.01	M. Shrewsbury	1290	144'	18.2' to 20.7	A, B, & C	Not In Use
W-68.02	S & P Ackerman	1185	97'	26.9' to 34.4'	C & D	Not In Use
W-83.00	J. Abrigg	1240	75'	17' to 20'	A & B	Domestic
WL-84.00	W. Baurer	1242	120'	33' to 40'	B, C, & D	Back-up Domestic
WL-86.00	D. Baurer	1265	110'	47' to 51.5'	B	Back-up Domestic
WL-88.00	B. Craig	1250	70'	15.5' to 19.7'	B	Domestic
WL-90.00	R. Pittman	1305	Well Log 110'	Well Log 50' (Sealed)	A & B	Domestic
W-91.01	D. Carpenter, L. Caldwell, D. Ward	1250	Sanitary	Seal	Unknown	Domestic
WL-92.00	E. Barone	1260	Well Log 100'	(Covered) Well Log 58'	A & B	Domestic
WL-94.00	F. Atkinson	1240	120'	43' to 45'	B & C	Domestic
W-97.00	I. Abbott	1180	86'	28.3' to 41'	B & C	Domestic
WL-108.00	R. Pratt	1210	(Buried) Well Log 65'	(Sealed) Well Log 30'	B & C	Occasional Domestic
WL-109.00	J. Riley	1300	Well Log 90', (Buried)	Well Log 45' (Buried)	B	Partial Domestic
W-112.01	R. Neiswonger	1142	39'	36.2'	D	None

AEC 06326

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
W-113.00	F. Dietz	1130	88'	17.4'	D	Domestic
W-114.00	A Scheiderer	1090	92'	17.7'	D	Domestic
W-114.01	A. Scheiderer	1065	125'	13.4'	E	Partial Livestock
W-116.00	D & B Crall	1150	103'	38.9'	D	Domestic
W-117.00	L. McDougal	1105	Under Concrete	Sealed	Unknown	Domestic
WL-123.00	G. Nolan II & W. Arnold	1300	199' (well log) 160' (as measured)	112.5'	B, C, & D	Back-up Domestic
W-124.00	D. Mellott	1075	59.5'	21.3'	D	Not In Use
W-126.00	Quarto Mining Co.	1200	73'	Dry	D	Not In Use
DW-26.01	S. Mullett	1255	59.9'	33' (high flow only)	B	Not In Use
DW-34.00	S. Johnson	1340	41'	12.3' to 16'	A	Not In Use
DW-38.00	M. Gates, B. Reed	1300	32'	28.8' to 29.6'	A	Not In Use
DW-48.02	C. Decker, C. Warren	1305	46'	33.5' to 45'	A	Not In Use
DW-53.01	J. VanPelt	1305	32'	22.6' to 25.7'	A	Domestic
DW-58.00	F. Atkinson Sr.	990	7'	4'	E	Not In Use
DW-60.02	M. Shrewsbury	1285	16'	4.6' to 6'	A	Back-up Domestic
DW-61.00	B. Followay	1300	Dry - Filled with dirt and rubbish		Unknown	Not In Use

AEC 06327

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
DW-91.00	D. Carpenter, L. Caldwell, D. Ward	1260	28'	21.2' to 25'	B	Not In Use
DW-94.01	F. Atkinson	1240	22'	12' to 14.9'	B	Partial Domestic
DW-95.00	E. Pittman	1250	21'	2' to 5.7'	B	Not In Use
DW-96.03	R. Reed	1175	27'	18' to 19.5'	C	Domestic
DW-97.01	I. Abbott	1170	11'	3.6' to 4.4'	B	None
DW-98.01	J. Riley	1240	20'	1' to 4'	B	None
DW-112.02	R. Neiswonger	1142	17'	9.5'	D	None
DW-115.00	C. Clucas	1140	16'	9.1'	D	Domestic
DW-119.01	R. Kindleberger	1260	40'	18'	B	Domestic
DW-120.00	J. Bibler	1285	28'	18.4'	A	Domestic
DW-121.00	S. Otto	1125	15'	4.5'	D	None
DW-123.01	G. Nolan II & W. Arnold	1280	Well Sealed	Pump Broken	Unknown	None
DW-126.01	Quarto Mining Co.	1195	11'	8.8'	B	None
DS-18.00	M. Louden, II	1240	N/A	N/A	B	Livestock, 0.7 gpm
DS-26.02	S. Mullett	1240	N/A	N/A	B	None, .11 to .51 gpm
DS-26.04	S. Mullett	1210	N/A	N/A	B	None, .48 to 1.83 gpm

AEC 06328

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
DS-28.00	R. Perkins	1295	N/A	N/A	A	Livestock, .63 to 8.8 gpm
DS-28.01	R. Perkins	1300	N/A	N/A	A	Livestock, .31 to 1.2 gpm
DS-28.02	R. Perkins	1265	N/A	N/A	A	Livestock, .37 to 1.25 gpm
DS-34.01	S. Johnson	1285	N/A	N/A	A	Livestock, .05 to .88 gpm
DS-36.00	M. Gates, B. Reed	1125	N/A	N/A	D	Livestock, .03 to .39 gpm
DS-37.01	B. & E. Reed	1140	N/A	N/A	D	Livestock, .03 to .55 gpm
DS-38.01	M. Gates, B. Reed	1250	N/A	N/A	A	Livestock, 0 to .37 gpm
DS-48.00	C. Decker, C. Warren	1180	N/A	N/A	B	Domestic, .82 to 1.5 gpm
DS-5.00	R. & G. Mallett	1270	N/A	N/A	A	Livestock, 3.3 to 3.7 gpm
DS-53.00	J. VanPelt	1275	N/A	N/A	A	Domestic, .63 to 1.25 gpm
DS-58.01	F. Atkinson Sr.	1060	N/A	N/A	D	Domestic, .64 gpm
DS-6.00	S. & B. Brandon	1098	N/A	N/A	D	Domestic, No Access
DS-60.03	M. Shrewsbury	1240	N/A	N/A	B	Livestock, .07 to .5 gpm
DS-68.00	S. & P. Ackerman	1195	N/A	N/A	B	Livestock, .12 to 1.04 gpm
DS-68.01	S. & P. Ackerman	1180	N/A	N/A	B	Livestock, .15 to .85 gpm
DS-68.03	S. & P. Ackerman	1170	N/A	N/A	B	Livestock/Domestic, 0 to .47 gpm

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
DS-68.04	S. & P. Ackerman	1135	N/A	N/A	D	Livestock, .15 to.6 gpm
DS-68.06	S. & P. Ackerman	1220	N/A	N/A	B	Domestic, .2 to .52 gpm
DS-68.07	S. & P. Ackerman	1157	N/A	N/A	C	Livestock, .08 to .44 gpm
DS-70.00	F. Mankin	1157	N/A	N/A	C	Domestic, .04 to .09 gpm
DS-72.00	W. Graff	1215	N/A	N/A	B	None, .10 to .85 gpm
DS-91.02	D. Carpenter, L. Caldwell, D. Ward	1244	N/A	N/A	B	None, Cannot obtain flow rate
DS-91.03	D. Carpenter, L. Caldwell, D. Ward	1240	N/A	N/A	B	Livestock, .23 to .65 gpm
DS-91.04	D. Carpenter, L. Caldwell, D. Ward	1195	N/A	N/A	B	Livestock, .23 to .38 gpm
DS-91.05	D. Carpenter, L. Caldwell, D. Ward	1170	N/A	N/A	B	Livestock, 0 to .63 gpm
DS-91.06	D. Carpenter, L. Caldwell, D. Ward	1190	N/A	N/A	B	Livestock, .99 to 1.44 gpm
DS-91.07	D. Carpenter, L. Caldwell, D. Ward	1235	N/A	N/A	B	None, Cannot obtain flow rate
DS-96.00	R. Reed	1200	N/A	N/A	B	Livestock, 0 to .8 gpm
DS-96.02	R. Reed	1155	N/A	N/A	C	Livestock, .44 to 2.1 gpm
DS-96.04	R. Reed	1180	N/A	N/A	B	Livestock, .35 to .4 gpm
DS-96.05	R. Reed	1152	N/A	N/A	C	Livestock, .31 to .6 gpm

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
DS-96.06	R. Reed	1135	N/A	N/A	D	Livestock, .47 to .7 gpm
DS-96.08	R. Reed	1175	N/A	N/A	B	Livestock, .63 to 1.44 gpm
DS-96.10	R. Reed	1225	N/A	N/A	B	Livestock, .5 to 2.3 gpm
DS-96.11	R. Reed	1200	N/A	N/A	B	None, 0 to .31 gpm
DS-96.12	R. Reed	1120	N/A	N/A	D	None, .1 to .5 gpm
DS-96.13	R. Reed	1210	N/A	N/A	B	Livestock, 1.25 to 3.4 gpm
DS-104.00	R & A Howell	1135	N/A	N/A	D	Domestic, 1.9 gpm
DS-104.01	R & A Howell	1170	N/A	N/A	B	Livestock, 1.2 gpm
DS-109.01	J. Riley	1220	N/A	N/A	B	Livestock, .42 gpm
DS-110.00	R. Miller	1230	N/A	N/A	B	Partial Domestic, 1.3 gpm
DS-111.00	L. Caldwell, D. Ward, D. Carpenter	1220	N/A	N/A	B	Partial Domestic, 4.8 gpm
DS-112.00	R. Neiswonger	1140	N/A	N/A	D	Domestic, .23 gpm
DS-114.02	A. Scheiderer	1110	N/A	N/A	D	Livestock, .9 gpm
DS-114.03	A. Scheiderer	1077	N/A	N/A	D	Livestock, .3 gpm
DS-114.04	A. Scheiderer	1055	N/A	N/A	D	Livestock, .44 gpm
DS-117.01	L. McDougal	1105	N/A	N/A	D	Livestock, 1 gpm

AEC 06331

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level of Well in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone	Known Uses of Well/Spring (if spring give discharge rate)
DS-118.00	R. Pittman	1100	N/A	N/A	D	Livestock, .9 gpm
DS-119.00	R. Kindelberger	1093	N/A	N/A	D	None, .23 gpm
DS-119.02	C & R Kindelberger	1167	N/A	N/A	B	Livestock, 1.3 gpm
DS-119.03	R. Kindelberger	1140	N/A	N/A	D	Domestic, .9 gpm
DS-119.04	R. Kindelberger	1200	N/A	N/A	B	Livestock, .23 gpm
DS-119.05	R. Kindelberger	1200	N/A	N/A	B	Livestock, .17 gpm
DS-119.06	R. Kindelberger	1240	N/A	N/A	B	Livestock, .12 gpm
DS-119.07	R. Kindelberger	1198	N/A	N/A	B	Livestock, .14 gpm
DS-122.00	G. Nolan II & W. Arnold	1265	N/A	N/A	A	Livestock, .1 to .23 gpm
W-34.02	S. Johnson	1360	63'	44'	A	Not In Use
DW-34.03	S. Johnson	1360	23'	4'	A	Livestock @ Barn
W-48.03	C. Decker/C. Warren	1280	61'	37'	B	Not In Use
DS-95.01	E. Pittman	1202	N/A	N/A	B	No Flow, Not In Use
W-185	J & V Kernen	1290	Reported 110'	No Access-Covered	Possibly A, B, & C	Not In Use
W-142A	I Stapp & D Schnegg	1275	Buried	Buried	Unknown	Back-up Domestic

AEC 06332

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name - AMERICAN ENERGY CORPORATION D-0425-3

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone (see attch. 14B)	Known Uses of Well/Spring (if spring give discharge rate)
DS 32	Raven Rocks Inc.	1160	NA	NA	B	L, See D-0425-1
DS 91	R and M Inherst	1140	NA	NA	B	L, See Attach. 14A
DS 92	R and M Inherst	1240	NA	NA	B	L,D See Attach 14A
DS 93	R&M Inherst	1160	NA	NA	B	L
DS 94	D and K Dornon	1180	NA	NA	B	L, See Attach. 14A
DS 95	H. MELLOTT	1200	NA	NA	B	L, 0.5 GPM
DS 98	N. Perkins	1200	NA	NA	B	L
DS 100	H. Crooks, Jr.	1160	NA	NA	B	L, See Attach. 14A
DS 101	J and A Hamilton	1200	NA	NA	B	Livestock, 0.4 GPM
DS 103	L. Dalton	1190	NA	NA	B	L, See Attach. 14A
DS 112	H Mellott	1210	NA	NA	B	L
DS 113	H Mellott	1210	NA	NA	B	L
DS 114	H Mellott	1080	NA	NA	B	L
DS 116	H Mellott	1160	NA	NA	B	L
DS 117	H Mellott	1210	NA	NA	B	L
DS 145	J and M Ward	1120	NA	NA	B	Domestic
DS 151	R and D Burrow	1160	NA	NA	B	L, See Attach. 14A
DS 202	S and W Jarrett	1160	NA	NA	B	L
DS 206	J. Riley	1240	NA	NA	B	Domestic
DS 209	G and M Riley	1240	NA	NA	B	Domestic
DS 210	G and M Riley	1200	NA	NA	B	L
DS 251	C. and B Datkuliak	1220	NA	NA	B	L, 1.3 GPM
DS 252	R and D Burrow	1170	NA	NA	B	Livestock
DS 256	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 258	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 260	C and B Datkuliak	1180	NA	NA	B	Livestock
DS 267	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 269	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 270	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 271	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 272	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 273	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 274	C and B Datkuliak	1200	NA	NA	B	Livestock
DS 283	M. Datkuliak	1280	NA	NA	B	Livestock
DS 284	M. Datkuliak	1200	NA	NA	B	Livestock
DS 285	M. Datkuliak	1140	NA	NA	B	Livestock
DS 308	W. Doughty	1240	NA	NA	B	Unused
DS 309	R. Heller	1240	NA	NA	B	Livestock
DS 402	N and D Moore	1200	NA	NA	B	L, See Attach. 14A
DS 403	N and D Moore	1280	NA	NA	B	L
DS 404	N and D Moore	1180	NA	NA	B	L
DS 405	N and D Moore	1170	NA	NA	B	L

6-24-05;10:11AM; Hamilton ;1 # 2/ 14

AEC 06333

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name - AMERICAN ENERGY CORPORATION D-0425-3

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone (see attch. 14B)	Known Uses of Well/Spring (if spring give discharge rate)
DS 406	N and D Moore	1230	NA	NA	B	L, See Attach. 14A
DS 411	N and D Moore	1180	NA	NA	B	L
DS 412	N and D Moore	1160	NA	NA	B	L
DS 413	N and D Moore	1200	NA	NA	B	L
DS 414	N and D Moore	1140	NA	NA	B	Domestic, L, & Agricultural See Attach. 14A
DS 416	N and D Moore	1120	NA	NA	B	L, See Attach. 14A
DS 420	J. Brown	1260	NA	NA	B	Livestock
DS 422	J. Davis	1160	NA	NA	B	Unused
DS 423	C. Butler	1210	NA	NA	B	Livestock
DS 424	C. Butler	1220	NA	NA	B	Livestock
DS 426	N. Moore	1100	NA	NA	B	Livestock
DS 427	R. Kindelberger	1240	NA	NA	B	Domestic/Livestock
DS 435	L and L. Boan	1170	NA	NA	B	Domestic
DS 441	R. Reager	990	NA	NA	B	Domestic
DS 442	R & C. Louden	1180	NA	NA	B	Domestic
DS 445	B & L Baker	1180	NA	NA	B	Livestock
DS 446	B & L Baker	1180	NA	NA	B	Livestock
DS 447	B & L Baker	1180'	NA	NA	B	Livestock
DS 450	R & M Heller	1220	NA	NA	B	Livestock
DS 460	G. & P. Hoover	1240'	NA	NA	B	Livestock
DS 461	G. & P. Hoover	1205	NA	NA	B	Livestock
DS 462	G. & P. Hoover	1200'	NA	NA	B	Livestock
DS 463	G. & P. Hoover	1220	NA	NA	B	Livestock
DS 500	R & C MOBLEY	1180	NA	NA	B	LIVESTOCK
DS 117A	Elrod	1050'	NA	NA	B	Domestic
DS 132A	Inherst	1185'	NA	NA	B	Livestock
DS 135A	RILEY	1200'	NA	NA	B	Unused
DS 140A	Dalton	1200'	NA	NA	B	Livestock
DS 144A	C & B Datkuliak	1180	NA	NA	B	UNUSED
DS 146A	C & B Datkuliak	1260	NA	NA	B	Unused
DS 146B	C & B Datkuliak	1200'	NA	NA	B	Unused
DS 146C	C & B Datkuliak	1160	NA	NA	B	Unused
DS 146D	C & B Datkuliak	1220'	NA	NA	B	Unused
DS 146E	C & B Datkuliak	1220'	NA	NA	B	Unused
DS 150A	Crooks	1220	NA	NA	B	Livestock
DS 152A	T and J Reed	1240'	NA	NA	B	Livestock
DS 154A	B & L Baker	1200'	NA	NA	B	Livestock
DS 181A	J and A Hamilton	1260	NA	NA	B	Livestock
DS 184A	S & B Brandon Jr	1220'	NA	NA	B	Unused
DS 184B	S & B Brandon Jr	1240'	NA	NA	B	Unused

6-24-05;10:11AM; Hamilton ;1 # 3/ 14

AEC 06334

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name - AMERICAN ENERGY CORPORATION D-0425-3

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone (see attch. 14B)	Known Uses of Well/Spring (if spring give discharge rate)
DS 406	N and D Moore	1230	NA	NA	B	L, See Attach. 14A
DS 411	N and D Moore	1180	NA	NA	B	L
DS 412	N and D Moore	1160	NA	NA	B	L
DS 413	N and D Moore	1200	NA	NA	B	L
DS 414	N and D Moore	1140	NA	NA	B	Domestic, L, & Agricultural See Attach. 14A
DS 416	N and D Moore	1120	NA	NA	B	L, See Attach. 14A
DS 420	J. Brown	1260	NA	NA	B	Livestock
DS 422	J. Davis	1160	NA	NA	B	Unused
DS 423	C. Butler	1210	NA	NA	B	Livestock
DS 424	C. Butler	1220	NA	NA	B	Livestock
DS 426	N. Moore	1100	NA	NA	B	Livestock
DS 427	R. Kindelberger	1240	NA	NA	B	Domestic/Livestock
DS 435	L and L. Boan	1170	NA	NA	B	Domestic
DS 441	R. Reager	990	NA	NA	B	Domestic
DS 442	R & C. Louden	1180	NA	NA	B	Domestic
DS 445	B & L Baker	1180	NA	NA	B	Livestock
DS 446	B & L Baker	1180	NA	NA	B	Livestock
DS 447	B & L Baker	1180'	NA	NA	B	Livestock
DS 450	R & M Heller	1220	NA	NA	B	Livestock
DS 460	G. & P. Hoover	1240'	NA	NA	B	Livestock
DS 461	G. & P. Hoover	1205	NA	NA	B	Livestock
DS 462	G. & P. Hoover	1200'	NA	NA	B	Livestock
DS 463	G. & P. Hoover	1220	NA	NA	B	Livestock
DS 500	R & C MOBLEY	1180	NA	NA	B	LIVESTOCK
DS 117A	Elrod	1050'	NA	NA	B	Domestic
DS 132A	Inherst	1185'	NA	NA	B	Livestock
DS 135A	RILEY	1200'	NA	NA	B	Unused
DS 140A	Dalton	1200'	NA	NA	B	Livestock
DS 144A	C & B Datkuliak	1180	NA	NA	B	UNUSED
DS 146A	C & B Datkuliak	1260	NA	NA	B	Unused
DS 146B	C & B Datkuliak	1200'	NA	NA	B	Unused
DS 146C	C & B Datkuliak	1160	NA	NA	B	Unused
DS 146D	C & B Datkuliak	1220'	NA	NA	B	Unused
DS 146E	C & B Datkuliak	1220'	NA	NA	B	Unused
DS 150A	Crooks	1220	NA	NA	B	Livestock
DS 152A	T and J Reed	1240'	NA	NA	B	Livestock
DS 154A	B & L Baker	1200'	NA	NA	B	Livestock
DS 181A	J and A Hamilton	1260	NA	NA	B	Livestock
DS 184A	S & B Brandon Jr	1220'	NA	NA	B	Unused
DS 184B	S & B Brandon Jr	1240'	NA	NA	B	Unused

6-24-05;10:11AM; Hamilton ;1 # 3/ 14

AEC 06335

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name - AMERICAN ENERGY CORPORATION D-0425-3

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone (see attch. 14B)	Known Uses of Well/Spring (if spring give discharge rate)
DS 18A	Brown	1180'	NA	NA	B	Livestock
DS 18B	Brown	1208'	NA	NA	B	Livestock
DS 23B	Perkins	1250	NA	NA	B	Livestock
DS 27A	N. D. Moore	1100	NA	NA	B	Livestock
DS 27B	N. D. Moore	1100	NA	NA	B	Livestock
DS 27C	N. D. Moore	1160'	NA	NA	B	Livestock
DS 32A	Hibbitis	1130	NA	NA	B	Livestock
DS 32B	Hibbitis	1000	NA	NA	B	Unused - Pipe
DS 51A	N. Lucas	1220	NA	NA	B	Livestock
DS 51B	N. Lucas	1120	NA	NA	B	Livestock
DS 51C	N. Lucas	1145'	NA	NA	B	Livestock
DS 53A	G & P Hoover	1200'	NA	NA	B	Livestock
DS 54A	Jarrett	1190'	NA	NA	B	Livestock
DS 54B	Jarrett	1215'	NA	NA	B	Livestock
DS 54C	Jarrett	1140	NA	NA	B	Livestock
DW 10	M and C Beckett	980	30	See D-0425-1	A	Unused
DW 13	D. Taylor	972	15	See D-0425-1	A	Unused
DW 14	J and T Edge	957	13	See D-0425-1	A	Unused
DW 19	R and C Mobley	1260	28	See D-0425-1	A	Unused
DW 50	F. Lucas	1141	16	See D-0425-1	A	Domestic
DW 83	Raven Rocks Inc.	1140	5	See D-0425-1	A	Unused
DW 132	F. Rote	1044	9	See D-0425-1	A	Unused
DW 259	C & B Datkuliak	1190	9'	2'	A	Unused
DW 268	C and B Datkuliak	1260	32'	5.5'	A	Domestic
DW 400	N & D Moore	1240	22	15'	A	Unused
DW 408	N and D Moore	1210	20' ®	Buried	Buried	Domestic/Livestock
DW 420	N. Perkins	1240	51'	24'	A	Unused
DW 421	J. Brown	1300	NA	NA	A	Domestic
DW 422	C. Butler	1280	NA	NA	A	Unused
DW 425	Cline Palmer	1300	25	14	A	Domestic
DW 426	D. Kindelberger	1250	39	15	A	Domestic
DW 437	R. Reager	980	13	4	A	Unused
DW 581	B & L Baker	1220	21'	4'	A	Commercial & Domestic
DW 582	B & L Baker	1210	30 (R)	Unknown	A	Domestic
DW 140A	Dalton	1290'	28'	8'	A	Unused
DW 184A	S & B Brandon, Jr	1270'	21'	5'	A	Domestic
DW 23A	Perkins	1260'	23'	5'	A	Unused
DW 40B	N. D. Moore	1210'	20' (R)	Buried/Sealed	A	Domestic/Livestock
DW 423A	J.Davis	1220'	See Attach. 14A	Unknown	Unknown	Unused
DW 435B	Phillips	1240	18'	5'	A	Domestic
DW 435A	Phillips	1220	75	38	B	Domestic
W 3	O and N Perkins	1246	73	See D-0425-1	B	Unused
W 11	D. Taylor	976	25	See D-0425-1	C	Domestic
W 12	D. Taylor	976	36	See D-0425-1	C	Unused
W 16	R. Thomas	1240	Unknown	See D-0425-1	Unknown	Unused
W 17	T and P Otto	1240	76	See D-0425-1	B	Domestic
W 18	R and C Mobley	1262	104	See D-0425-1	B	Unused

6-24-05;10:11AM; Hamilton ;1 # 4/ 14

AEC 06336

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name - AMERICAN ENERGY CORPORATION D-0425-3

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone (see attch. 14B)	Known Uses of Well/Spring (if spring giv discharge rate)
W 22	C and K Brown	1060	51	See D-0425-1	C	Domestic
W 23	C. Bondy	1040	60	See D-0425-1	C	Domestic
W 33	Raven Rocks Inc.	1181	75.5	See D-0425-1	B	Unused
W 36	Raven Rocks Inc.	1240	Buried	See D-0425-1	Unknown	Unused
W 85	D. Taylor	1000	41	See D-0425-1	C	Domestic
W 179	Dornan	1240	99'	29'	B	Domestic
W 184	M. LOUDEN	1260	65	Unknown	B	Domestic
W 194	B. FISHER	1210	90, R	Sealed	B	Domestic
W 196	R and C Louden	1240	130	Sealed	B	Domestic
W 197	R and C Louden	1220	80	Sealed	B	Domestic
W 202	S & W Jarrett	1260	NA	SEALED	NA	UNUSED
W 203	R and C Louden	1260	100	Buried	B	Domestic
W 208	Hudson	1240	130	Unknown	B	Domestic
W 213	M. Lucas	1260	94	Unknown	B	Unused
W 216	C. Datkuliak	1260	Unknown	Sealed	Sealed	Unused
W 217	C. Datkuliak	1240	49	Unknown	Unknown	Unused
W 219	C. Datkuliak	1260	Unknown	Unknown	Unknown	Unused
W 224	N. Perkins	1280	100	Buried	B	Domestic
W 281	M. Datkuliak	1240	34'	14'	B	Unused
W 283	M. Datkuliak	1280	Unknown	Unknown	Unknown	Unused
W 308	Decker	1220	Unknown	Unknown	Unknown	Domestic
W 325	B. MELLOTT	1160	Unknown	Unknown	Unknown	Unused
W 401	N. D. Moore	1250'	70' (R)	19'	B	Unused
W 407	N. D. Moore	1220'	70' (R)	Buried	B	Domestic
W 409	N and D Moore	1210	61'	32'	B	Domestic/Livestock
W 410	N. D. Moore	1285'	80' (R)	Sealed	B	Unused
W 423	J. Davis	1220	94	NA	B	Domestic
W 424	Cline Palmer	1300	NA	NA	B	Unused
W 427	R. CROOKS	1240	71	5	B	Domestic
W 435	L and L. Boan	1070	65	Sealed	C	Domestic
W 436	T and T. Littleton	1020	85	30	C	Domestic
W 438	G. Maco	970	30	SEE ATTACHMENT 14A	C	Domestic
W 583	M. Meyer	1230	19'	1.5'	B	Unused
W 590	J and M Bondy	1060	85	57.5	C	Domestic
W 591	J and M Bondy	1065	82	72.5	C	Domestic
W 592	20 Buckhorn Club	1050	45, R	Dry	B	Domestic
W 593	B. Fisher	1240	Buried	Buried	Unknown	Unused
W 594	T & J Reed	1268	Unknown	Unknown	Unknown	Unused
W 595	T & J Reed	1242	21.5'	9'	B	Unused
W 601	G. Hoover Sr.	1255'	51'	14'	A	Unused
W 602	G. Hoover Sr.	1245'	65'	19'	B	Livestock
W 603	G & P Hoover	1255'	85'	35'	B	Unused
W 604	G & P Hoover	1240'	58'	14'	B	Unused
W 146A	C & B Datkuliak	1260'	34'	2.4'	A	Unused
W 148A	T.P. Bier	1210'	80' (R)	20' (R)	B	Domestic
W 180A	D and K Dornon	1240	112'	27'	B	Domestic
W 181A	J and A Hamilton	1260	85	Buried	B	Domestic
W 23A	C. Bondy	1040	NA	NA	Unknown	Unused
W 435A	Phillips	1220'	75'	38'	B	Domestic
W 583*	M. Meyer	1230	NA	NA	Unknown	Unused
WL 1	O and N Perkins	1239	63	See D-0425-1	B	Unused
WL 2	O and N Perkins	1236	62	See D-0425-1	B	Unused
WL 9	M and C Beckett	980	28	See D-0425-1	A	L, Domestic

6-24-05;10:11AM; Hamilton ;1 # 5/ 14

AEC 06337

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION

ATTACHMENT 14C
(WELL/SPRING INVENTORY)

Applicant's Name - AMERICAN ENERGY CORPORATION D-0425-3

Well/Spring Identification Number	Name of Owner of Well/Spring	Surface Elevation of Well/Spring	Depth of Well in Feet Below Land Surface	Static Water Level in Feet Below Land Surface	Lithology of Supplying Aquifer/ Waterbearing Zone (see attch. 14B)	Known Uses of Well/Spring (if spring give discharge rate)
WL 161	C Butler	1280	75	42*	B	Domestic
WL 180	C & P MELLOTT	1260	60	14*	B	Domestic
WL 181	Burrow	1210	50	19*	B	unused
WL 204	G & D MELLOTT	1200	90	45*	B	Unused
WL 205	J. Riley	1240'	100	27*	B	Unused
WL 427A	Lund	1270'	101'	41'	B	Domestic

6-24-05;10:11AM; Hamilton ;1 # 6/ 14

AEC 06338

D. (3) Based on the data listed on Attachment 14A, and other information submitted with this application, identify the seasonal variations in water quality and quantity for the streams identified Part 2, D(2).

SEE ATTACHMENT 14A, ADDENDA, PHC

E. HYDROLOGIC DETERMINATION -**Permit, Shadow Area, and Adjacent Area**

Based on the information submitted in response to items B, C, and D in this part of the permit application, submit an addendum describing the probable hydrologic consequences of this proposed underground mining operation on the hydrologic regime of the proposed permit area, shadow area, and adjacent area. The description shall include findings on each of the following items:

(1) The consequences of the proposed operation on the contents of total suspended and dissolved solids, total iron, total manganese, acidity, and pH;

(2) Whether adverse impacts may occur to the hydrologic balance; and

(3) The impact the proposed operation will have on:

(a) sediment yield from the disturbed area, flooding and stream flow alteration or diminution, ground water and surface water availability.

SEE ADDENDA TO PART 2, PAGE 18, ITEM E

F. ALTERNATIVE WATER SUPPLY INFORMATION -**Permit, Shadow Area, and Adjacent Area**

(1) Based on the response in Part 2, Item E, submit an addendum identifying the extent to which the proposed coal mining activities may proximately result in contamination, diminution, or interruption of an underground or surface source of water within the proposed permit area, shadow area, and adjacent area that is used for domestic, agricultural, industrial, or other legitimate use.

SEE ADDENDUM TO PART 2, PAGE 18, F(1)

(2) If contamination, diminution, or interruption may result, submit an addendum identifying the alternative sources of water supply that could be developed to replace the existing sources including information on water availability and suitability of alternative sources for existing pre-mining uses and postmining land use.

SEE ADDENDUM TO PART 2, PAGE 18, F(2)

REPORTS OF ANY PLUGGED WELLS WILL BE SUBMITTED AS AN APR

Village of Barnesville

An Equal Opportunity Employer

Administrator's Office

126 East Church Street
Barnesville, Ohio 43713

Phone: (740) 425-188(
Fax: (740) 425-367:

July 1, 2005

American Energy Corporation
Attn.: Melanie Murray
43521 Mayhugh Hill Rd.
Twp. Hwy. 88
Beallsville, Ohio 43716

Dear Melanie,

This letter is in response to your request dated June 20, 2005 in regards to extended water service in Belmont County sections 19, 25, Washington Township, and Monroe County sections 22, 23, 24, 28, 29, 30, 34, and 35. This area has approximately 14 residences according to your count.

These areas are serviced by the Switzerland of Ohio Water District distribution and not by the Village of Barnesville. However the Village supplies the water for Switzerland of Ohio. Our water treatment plant should be capable of bearing the burden of supplying the additional use from these residences as Switzerland has not yet reached their maximum draw from the Village.

We are currently planning an expansion to our system that will allow us to provide an additional 500,000 gallons per day over and above our current 1.7 MGD.

You will need to gain approval from the Switzerland of Ohio water system to tap on and for them to provide the distribution service to these areas.

Respectfully,

Roger A. Deal

Roger A. Deal
Administrator

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-0	D5-0	D5-0			
2.	Lab Identification Number	0404184	0405209	0408210			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	970	970	970			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	4.8 CFS	2.7	0.16 CFS			
8.	Date Above Measurements Made	4/20/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.6	7.6	8.2			
11.	Total Acidity (mg/l $CaCO_3$)	BDL	1.7	5.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	94	120	160			
13.	Specific Conductivity (umhos/cm at 25 C)	280	330	360			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.06	0.009			
16.	Total Sulfates (mg/l)	28	26	40			
17.	Total Iron (mg/l)	.08	1.2	0.09			
18.	Total Suspended Solids (mg/l)	BDL	29	BDL			
19.	Total Hardness (mg/l $CACO_3$)	120	150	170			
20.	Nitrates (mg/l)	.12	.34	0.15			
21.	Date Sampled for Analysis	4/20/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/24/2004	8/12/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-1	D5-1	D5-1			
2.	Lab Identification Number	0311045	0312327	0403109			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	980	980	980			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.14 CFS	1.8 CFS	3.705 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.5	7.8	9.0			
11.	Total Acidity (mg/l $CaCO_3$)	2.4	4.2	<1.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	68	85			
13.	Specific Conductivity (umhos/cm at 25 C)	290	210	230			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	0.01			
16.	Total Sulfates (mg/l)	30	36	28			
17.	Total Iron (mg/l)	0.07	0.14	0.12			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	160	60	100			
20.	Nitrates (mg/l)	0.14	0.20	0.31			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/4/2004			

BDL-Below detectable limit

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-2	D5-2	D5-2			
2.	Lab Identification Number	0311061	0312326	0403110			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1000	1000	1000			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.14 CFS	.26 CFS	1.083 CFS			
8.	Date Above Measurements Made	11/3/2003	12/23/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.9	8.0	8.4			
11.	Total Acidity (mg/l $CaCO_3$)	4.8	3.2	1.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	100	34	63			
13.	Specific Conductivity (umhos/cm at 25 C)	220	100	190			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.03	0.07	0.01			
16.	Total Sulfates (mg/l)	30	24	26			
17.	Total Iron (mg/l)	0.04	3.4	0.26			
18.	Total Suspended Solids (mg/l)	1.0	52	BDL			
19.	Total Hardness (mg/l $CACO_3$)	120	60	90			
20.	Nitrates (mg/l)	0.07	0.29	0.34			
21.	Date Sampled for Analysis	11/3/2003	12/23/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/4/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
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State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-3	D5-3	D5-3			
2.	Lab Identification Number	0311047	0312328	0403111			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1040	1040	1040			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.24 CFS	5.7 CFS	1.097 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.0	7.9	8.4			
11.	Total Acidity (mg/l $CaCO_3$)	3.8	2.4	3.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	78	85			
13.	Specific Conductivity (umhos/cm at 25 C)	280	200	250			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	0.01			
16.	Total Sulfates (mg/l)	34	25	32			
17.	Total Iron (mg/l)	0.06	0.32	0.17			
18.	Total Suspended Solids (mg/l)	1.0	3.3	2.7			
19.	Total Hardness (mg/l $CACO_3$)	150	100	100			
20.	Nitrates (mg/l)	0.07	0.34	0.25			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/4/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-4	D5-4	D5-4			
2.	Lab Identification Number	0311065	0312295	0402346			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1120	1120	1120			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.29 CFS	.485 CFS	.22 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	8.4	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	9.1	1.7	4.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	180	240	58			
13.	Specific Conductivity (umhos/cm at 25 C)	360	400	180			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	0.09			
16.	Total Sulfates (mg/l)	47	48	32			
17.	Total Iron (mg/l)	0.13	0.22	0.94			
18.	Total Suspended Solids (mg/l)	1.0	BDL	7.3			
19.	Total Hardness (mg/l $CACO_3$)	100	170	90			
20.	Nitrates (mg/l)	0.40	1.2	0.73			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	2/21/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-5	D5-5	D5-5			
2.	Lab Identification Number	0311164	0312294	0402316			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1085	1085	1085			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.32 CFS	.358 CFS	.206 CFS			
8.	Date Above Measurements Made	11/13/2003	12/22/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.6	8.2	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	4.4	1.9	4.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	54	84	55			
13.	Specific Conductivity (umhos/cm at 25 C)	200	210	180			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	BDL	0.03			
16.	Total Sulfates (mg/l)	27	31	28			
17.	Total Iron (mg/l)	0.72	0.13	1.8			
18.	Total Suspended Solids (mg/l)	10	BDL	31			
19.	Total Hardness (mg/l $CACO_3$)	100	90	100			
20.	Nitrates (mg/l)	2.4	1.6	3.4			
21.	Date Sampled for Analysis	11/13/2003	12/22/2003	2/20/2004			
22.	Date Last Precipitation Event Occurred	11/11/2003	12/19/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-6	D5-6	D5-6			
2.	Lab Identification Number	0311060	0312291	0403139			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	985	985	985			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.91 CFS	1.68 CFS	.34 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.5	8.2	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	3.2	2.2	2.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	87	60			
13.	Specific Conductivity (umhos/cm at 25 C)	250	230	140			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.01			
16.	Total Sulfates (mg/l)	28	31	26			
17.	Total Iron (mg/l)	0.04	0.05	0.28			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	130	100	90			
20.	Nitrates (mg/l)	0.19	0.42	2.2			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-7	D5-7	D5-7			
2.	Lab Identification Number	0311038	0312300	0403137			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1015	1015	1015			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.89 CFS	.168 CFS	1.19 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.9	8.5	8.3			
11.	Total Acidity (mg/l $CaCO_3$)	4.1	1.7	BDL			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	98	70			
13.	Specific Conductivity (umhos/cm at 25 C)	280	300	170			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.37	BDL	0.01			
16.	Total Sulfates (mg/l)	28	26	26			
17.	Total Iron (mg/l)	0.26	0.07	0.19			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	130	140	100			
20.	Nitrates (mg/l)	0.13	0.20	0.69			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-8	D5-8	D5-8			
2.	Lab Identification Number	0311043	0312364	0402257			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1115	1115	1115			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.23 CFS	.33 CFS	.009 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.7	7.5	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	2.6	2.2	3.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	92	41	72			
13.	Specific Conductivity (umhos/cm at 25 C)	230	100	170			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.02	0.01			
16.	Total Sulfates (mg/l)	31	21	22			
17.	Total Iron (mg/l)	0.07	0.38	0.13			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	110	50	100			
20.	Nitrates (mg/l)	0.13	0.74	0.46			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-9	D5-9	D5-9			
2.	Lab Identification Number	0311042	0312363	0402256			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1090	1090	1090			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.73 CFS	2.33 CFS	.52 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.7	7.6	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	2.7	16	2.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	90	49	68			
13.	Specific Conductivity (umhos/cm at 25 C)	200	100	150			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.04	0.04			
16.	Total Sulfates (mg/l)	24	22	23			
17.	Total Iron (mg/l)	0.12	0.42	0.19			
18.	Total Suspended Solids (mg/l)	1.0	6.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	120	80	100			
20.	Nitrates (mg/l)	0.17	0.82	0.58			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-10	D5-10	D5-10			
2.	Lab Identification Number	0311041	0312362	0402255			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1085	1085	1085			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.26 CFS	4.0 CFS	1.51 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.8	7.8	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	2.3	2.0	2.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	98	53	74			
13.	Specific Conductivity (umhos/cm at 25 C)	240	130	200			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.03	0.02			
16.	Total Sulfates (mg/l)	24	23	23			
17.	Total Iron (mg/l)	0.06	0.46	0.08			
18.	Total Suspended Solids (mg/l)	1.0	4.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	130	70	100			
20.	Nitrates (mg/l)	0.17	0.63	0.48			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

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1.	Identification No. of Sampling Station from Hydrology Map	D5-11	D5-11	D5-11			
2.	Lab Identification Number	0311098	0312299	0403050			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1015	1015	1015			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.17 CFS	0.073 CFS	0.48 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	3/1/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	8.4	8.20			
11.	Total Acidity (mg/l $CaCO_3$)	3.5	1.3	3.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	170	100	120			
13.	Specific Conductivity (umhos/cm at 25 C)	380	290	250			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	BDL	0.03			
16.	Total Sulfates (mg/l)	52	35	38			
17.	Total Iron (mg/l)	0.06	0.07	0.49			
18.	Total Suspended Solids (mg/l)	1.0	BDL	44			
19.	Total Hardness (mg/l $CACO_3$)	210	140	140			
20.	Nitrates (mg/l)	0.08	0.19	0.41			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	3/1/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/24/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-12	D5-12	D5-12			
2.	Lab Identification Number	0311099	0312298	0403049			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1035	1035	1035			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.48 CFS	.0132 CFS	.48 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/1/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	8.3	8.20			
11.	Total Acidity (mg/l $CaCO_3$)	2.6	3.5	2.9			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	140	130			
13.	Specific Conductivity (umhos/cm at 25 C)	280	360	270			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.17			
16.	Total Sulfates (mg/l)	34	50	38			
17.	Total Iron (mg/l)	0.05	0.42	3.3			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	150	150	180			
20.	Nitrates (mg/l)	0.08	0.44	0.71			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/1/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	2/24/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-13	D5-13	D5-13			
2.	Lab Identification Number	0404202	0405192	0408165			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1045	1045	1045			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	2.1 CFS	.27 CFS	0.24 CFS			
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	9.8	8.4	9.3			
11.	Total Acidity (mg/l $CaCO_3$)	BDL	2.1	2.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	79	96	130			
13.	Specific Conductivity (umhos/cm at 25 C)	240	230	430			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	.05	0.027			
16.	Total Sulfates (mg/l)	22	21	30			
17.	Total Iron (mg/l)	.15	.54	0.24			
18.	Total Suspended Solids (mg/l)	3.0	11	1.3			
19.	Total Hardness (mg/l $CACO_3$)	90	90	160			
20.	Nitrates (mg/l)	.43	.74	2.9			
21.	Date Sampled for Analysis	4/21/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-14	D5-14	D5-14			
2.	Lab Identification Number	0405213	0404185	0408218			
3.	High (H)/Low (L) Designation (if applicable)	I	H	L			
4.	Surface Elevation for Sampling Station (msl)	1148	1148	1148			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.005 CFS	.005 CFS	0.13 CFS			
8.	Date Above Measurements Made	5/25/2004	4/20/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.6	7.5	8.0			
11.	Total Acidity (mg/l $CaCO_3$)	4.1	2.7	5.9			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	57	200			
13.	Specific Conductivity (umhos/cm at 25 C)	270	180	490			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.03	0.11	0.140			
16.	Total Sulfates (mg/l)	28	21	45			
17.	Total Iron (mg/l)	.37	1.7	0.49			
18.	Total Suspended Solids (mg/l)	BDL	30	17			
19.	Total Hardness (mg/l $CACO_3$)	120	80	220			
20.	Nitrates (mg/l)	.43	0.22	0.77			
21.	Date Sampled for Analysis	5/25/2004	4/20/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	5/24/2004	4/19/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	D5-15	D5-15	D5-15			
2.	Lab Identification Number	0404183	0405205	0408206			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	950	950	950			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.98 CFS	1.1 CFS	0.1 CFS			
8.	Date Above Measurements Made	4/20/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.9	7.7	7.8			
11.	Total Acidity (mg/l $CaCO_3$)	BDL	5.9	15			
12.	Total Alkalinity (mg/l $CaCO_3$)	100	140	200			
13.	Specific Conductivity (umhos/cm at 25 C)	360	340	480			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.01	0.51			
16.	Total Sulfates (mg/l)	36	39	43			
17.	Total Iron (mg/l)	.12	.36	0.09			
18.	Total Suspended Solids (mg/l)	BDL	5.3	BDL			
19.	Total Hardness (mg/l $CACO_3$)	110	130	150			
20.	Nitrates (mg/l)	.28	.55	0.18			
21.	Date Sampled for Analysis	4/20/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/24/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-5.00	DS-5.00	DS-5.00			
2.	Lab Identification Number	0308142	0310174	0403056			
3.	High (H)/Low (L) Designation (if applicable)	ITL	L	H			
4.	Surface Elevation for Sampling Station (msl)	1270	1270	1270			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	3.7 GPM	3.3 GPM	3.4 GPM			
8.	Date Above Measurements Made	8/6/2003	10/8/2003	3/1/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.0	7.0	7.70			
11.	Total Acidity (mg/l $CaCO_3$)	16	20	11			
12.	Total Alkalinity (mg/l $CaCO_3$)	220	210	200			
13.	Specific Conductivity (umhos/cm at 25 C)	1400	750	650			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.02	0.02			
16.	Total Sulfates (mg/l)	35	38	40			
17.	Total Iron (mg/l)	0.04	0.04	0.25			
18.	Total Suspended Solids (mg/l)	1.0	1.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	360	350	290			
20.	Nitrates (mg/l)	2.0	1.2	2.4			
21.	Date Sampled for Analysis	8/6/2003	10/8/2003	3/1/2004			
22.	Date Last Precipitation Event Occurred	8/4/2003	10/4/2003	2/24/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-6.00	DS-6.00	DS-6.00			
2.	Lab Identification Number	0309082	0312398	0402399			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1098	1098	1098			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	No Access	No Access	No Access			
8.	Date Above Measurements Made	9/8/2003	12/30/2003	2/24/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7	7.30	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	22	5.4	11			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	170	180			
13.	Specific Conductivity (umhos/cm at 25 C)	260	360	320			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	BDL	BDL			
16.	Total Sulfates (mg/l)	25	38	32			
17.	Total Iron (mg/l)	.04	0.05	<0.0			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	150	200	200			
20.	Nitrates (mg/l)	<0.0	0.18	0.27			
21.	Date Sampled for Analysis	9/8/2003	12/30/2003	2/24/2004			
22.	Date Last Precipitation Event Occurred	9/3/2003	12/29/2003	2/23/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-18.00	DS-18.00	DS-18.00			
2.	Lab Identification Number	0308027	0310176	0403114			
3.	High (H)/Low (L) Designation (if applicable)	I	L	H			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.70 GPM	.77 GPM	1.19 GPM			
8.	Date Above Measurements Made	7/31/2003	10/8/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.0	7.4	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	23	16	20			
12.	Total Alkalinity (mg/l $CaCO_3$)	260	280	230			
13.	Specific Conductivity (umhos/cm at 25 C)	720	810	730			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	0.03			
16.	Total Sulfates (mg/l)	53	53	54			
17.	Total Iron (mg/l)	0.04	0.04	0.21			
18.	Total Suspended Solids (mg/l)	1.3	1.0	6.0			
19.	Total Hardness (mg/l $CACO_3$)	310	310	350			
20.	Nitrates (mg/l)	2.4	0.25	0.89			
21.	Date Sampled for Analysis	7/31/2003	10/8/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	7/31/2003	10/4/2003	3/4/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-26.02	DS-26.02	DS-26.02			
2.	Lab Identification Number	0309081	0312351	0402265			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1227	1227	1227			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.4 GPM	.11 GPM	.51 GPM			
			[illegible]/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
			[illegible]50	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	[illegible]	7.2	8.1			
12.	Total [illegible]ity (mg/l $CaCO_3$)	180	170	190			
13.	Specific Conductivity (umhos/cm at 25 C)	530	530	490			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	0.02	0.03			
16.	Total Sulfates (mg/l)	47	42	32			
17.	Total Iron (mg/l)	.19	0.78	0.96			
18.	Total Suspended Solids (mg/l)	BDL	7.3	38			
19.	Total Hardness (mg/l $CACO_3$)	280	220	260			
20.	Nitrates (mg/l)	3.9	4.3	3.9			
21.	Date Sampled for Analysis	9/8/2003	12/23/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	9/3/2003	12/23/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-26.04	DS-26.04	DS-26.04			
2.	Lab Identification Number	0311297	0312352	0402402			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	1.83 GPM	.48 GPM	.62 GPM			
8.	Date Above Measurements Made	11/14/2003	12/23/2003	2/24/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	8.7	6.80	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	9.0	3.0	4.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	73	44	64			
13.	Specific Conductivity (umhos/cm at 25 C)	180	130	130			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.01	0.02			
16.	Total Sulfates (mg/l)	32	26	30			
17.	Total Iron (mg/l)	0.19	0.39	1.2			
18.	Total Suspended Solids (mg/l)	1.0	BDL	21			
19.	Total Hardness (mg/l $CACO_3$)	90	70	100			
20.	Nitrates (mg/l)	0.09	0.21	0.43			
21.	Date Sampled for Analysis	11/14/2003	12/23/2003	2/24/2004			
22.	Date Last Precipitation Event Occurred	11/11/2003	12/23/2003	2/23/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-28.00	DS-28.00	DS-28.00			
2.	Lab Identification Number	0308011	0310274	0403236			
3.	High (H)/Low (L) Designation (if applicable)	I	L	H			
4.	Surface Elevation for Sampling Station (msl)	1295	1295	1295			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.88 GPM	.63 GPM	1.25 GPM			
8.	Date Above Measurements Made	7/30/2003	10/13/2003	3/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.3	7	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	11	6.4	6.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	150	170	140			
13.	Specific Conductivity (umhos/cm at 25 C)	370	8.8	340			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	0.02	BDL			
16.	Total Sulfates (mg/l)	34	35	32			
17.	Total Iron (mg/l)	.05	0.55	0.08			
18.	Total Suspended Solids (mg/l)	BDL	8.8	BDL			
19.	Total Hardness (mg/l $CACO_3$)	190	200	170			
20.	Nitrates (mg/l)	.17	0.11	0.18			
21.	Date Sampled for Analysis	7/30/2003	10/13/2003	3/17/2004			
22.	Date Last Precipitation Event Occurred	7/28/2003	10/9/2003	3/16/2004			

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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-28.01	DS-28.01	DS-28.01			
2.	Lab Identification Number	0308012	0310280	0402356			
3.	High (H)/Low (L) Designation (if applicable)	I	L	H			
4.	Surface Elevation for Sampling Station (msl)	1300	1300	1300			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	1.2 GPM	.31 GPM	.74 GPM			
8.	Date Above Measurements Made	7/30/2003	10/13/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.4	7.0	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	7.6	7.5	12			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	190	180			
13.	Specific Conductivity (umhos/cm at 25 C)	490	490	480			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.05	BDL	0.01			
16.	Total Sulfates (mg/l)	45	44	41			
17.	Total Iron (mg/l)	1	0.22	0.07			
18.	Total Suspended Solids (mg/l)	20	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	230	270	220			
20.	Nitrates (mg/l)	2.1	2.2	2.8			
21.	Date Sampled for Analysis	7/30/2003	10/13/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	7/28/2003	10/9/2003	2/21/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-28.02	DS-28.02	DS-28.02			
2.	Lab Identification Number	0308013	0310278	0402357			
3.	High (H)/Low (L) Designation (if applicable)	I	L	H			
4.	Surface Elevation for Sampling Station (msl)	1265	1265	1265			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	1.25 GPM	.84 GPM	.37 GPM			
8.	Date Above Measurements Made	7/30/2003	10/13/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.3	7	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	8.8	8.8	9.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	210	220	200			
13.	Specific Conductivity (umhos/cm at 25 C)	440	530	480			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	BDL	0.08			
16.	Total Sulfates (mg/l)	41	44	44			
17.	Total Iron (mg/l)	0.09	0.32	3.3			
18.	Total Suspended Solids (mg/l)	BDL	9.3	8.0			
19.	Total Hardness (mg/l $CACO_3$)	220	250	230			
20.	Nitrates (mg/l)	0.30	0.23	0.23			
21.	Date Sampled for Analysis	7/30/2003	10/13/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	7/28/2003	10/9/2003	2/21/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-34.01	DS-34.01	DS-34.01			
2.	Lab Identification Number	0308028	0310275	0402415			
3.	High (H)/Low (L) Designation (if applicable)	I	L	H			
4.	Surface Elevation for Sampling Station (msl)	1285	1285	1285			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.88 GPM	.20 GPM	.05 GPM			
8.	Date Above Measurements Made	7/31/2003	10/13/2003	2/25/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	6.8	6.9	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	9.5	8.7	11			
12.	Total Alkalinity (mg/l $CaCO_3$)	180	200	170			
13.	Specific Conductivity (umhos/cm at 25 C)	550	610	420			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	0.01	BDL			
16.	Total Sulfates (mg/l)	36	38	34			
17.	Total Iron (mg/l)	BDL	0.20	0.12			
18.	Total Suspended Solids (mg/l)	60	<1.0	3.3			
19.	Total Hardness (mg/l $CACO_3$)	230	240	230			
20.	Nitrates (mg/l)	0.76	0.60	0.76			
21.	Date Sampled for Analysis	7/31/2003	10/13/2003	2/25/2004			
22.	Date Last Precipitation Event Occurred	7/31/2003	10/9/2003	2/24/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-36.00	DS-36.00	DS-36.00			
2.	Lab Identification Number	0310352	0312343	0402282			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1125	1125	1125			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.03 GPM	.33 GPM	.39 GPM			
8.	Date Above Measurements Made	10/20/2003	12/23/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.3	7.0	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	5.6	6.3	6.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	180	170	190			
13.	Specific Conductivity (umhos/cm at 25 C)	410	270	440			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.02	BDL			
16.	Total Sulfates (mg/l)	36	38	38			
17.	Total Iron (mg/l)	0.04	0.20	BDL			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	210	170	190			
20.	Nitrates (mg/l)	0.12	0.22	0.17			
21.	Date Sampled for Analysis	10/20/2003	12/23/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/23/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-37.01	DS-37.01	DS-37.01			
2.	Lab Identification Number	0310353	0312345	0402283			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1140	1140	1140			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.03 GPM	.55 GPM	.15 GPM			
8.	Date Above Measurements Made	10/20/2003	12/23/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.1	7.5	6.8			
11.	Total Acidity (mg/l $CaCO_3$)	12	12	12			
12.	Total Alkalinity (mg/l $CaCO_3$)	260	210	240			
13.	Specific Conductivity (umhos/cm at 25 C)	570	360	550			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.04	BDL			
16.	Total Sulfates (mg/l)	27	26	27			
17.	Total Iron (mg/l)	0.05	0.09	0.07			
18.	Total Suspended Solids (mg/l)	1.0	29	26			
19.	Total Hardness (mg/l $CACO_3$)	240	210	250			
20.	Nitrates (mg/l)	1.7	2.3	2.4			
21.	Date Sampled for Analysis	10/20/2003	12/23/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/23/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-38.01	DS-38.01	DS-38.01			
2.	Lab Identification Number	0310356	0312341	0402279			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1250	1250	1250			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.03 GPM	.37 GPM	0			
8.	Date Above Measurements Made	10/20/2003	12/23/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.0	7.80	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	7.0	6.8	4.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	150	110	120			
13.	Specific Conductivity (umhos/cm at 25 C)	360	210	270			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.03	0.07			
16.	Total Sulfates (mg/l)	27	24	23			
17.	Total Iron (mg/l)	0.11	0.64	0.66			
18.	Total Suspended Solids (mg/l)	1.0	BDL	24			
19.	Total Hardness (mg/l $CACO_3$)	180	100	140			
20.	Nitrates (mg/l)	0.28	0.21	0.25			
21.	Date Sampled for Analysis	10/20/2003	12/23/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/23/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-48.00	DS-48.00	DS-48.00			
2.	Lab Identification Number	0310282	0312395	0402348			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1180	1180	1180			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	1.5 GPM	.82 GPM	1.29 GPM			
8.	Date Above Measurements Made	10/13/2003	12/30/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.4	7.60	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	4.0	4.2	13			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	180	190			
13.	Specific Conductivity (umhos/cm at 25 C)	420	360	440			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	BDL			
16.	Total Sulfates (mg/l)	34	30	33			
17.	Total Iron (mg/l)	0.04	BDL	BDL			
18.	Total Suspended Solids (mg/l)	1.0	10	BDL			
19.	Total Hardness (mg/l $CACO_3$)	210	200	200			
20.	Nitrates (mg/l)	0.57	0.52	0.62			
21.	Date Sampled for Analysis	10/13/2003	12/30/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	10/9/2003	12/29/2003	2/21/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-53.00	DS-53.00	DS-53.00			
2.	Lab Identification Number	0310164	0312396	0402353			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1275	1275	1275			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	1.25 GPM	.63 GPM	.63 GPM			
8.	Date Above Measurements Made	10/7/2003	12/30/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.6	7.40	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	8.7	5.9	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	190	200			
13.	Specific Conductivity (umhos/cm at 25 C)	480	460	550			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	BDL			
16.	Total Sulfates (mg/l)	42	42	48			
17.	Total Iron (mg/l)	0.05	0.19	0.04			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	230	230	250			
20.	Nitrates (mg/l)	1.6	2.4	2.4			
21.	Date Sampled for Analysis	10/7/2003	12/30/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	10/4/2003	12/29/2003	2/21/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-58.01	DS-58.01	DS-58.01			
2.	Lab Identification Number	0404223	0405207	0408208			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1060	1060	1060			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	0.64	0.04	0.08			
8.	Date Above Measurements Made	4/22/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.9	7.4	8.6			
11.	Total Acidity (mg/l $CaCO_3$)	12	11	7.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	210	210	240			
13.	Specific Conductivity (umhos/cm at 25 C)	440	470	490			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	BDL	BDL			
16.	Total Sulfates (mg/l)	43	48	490			
17.	Total Iron (mg/l)	BDL	.07	0.21			
18.	Total Suspended Solids (mg/l)	BDL	BDL	290			
19.	Total Hardness (mg/l $CACO_3$)	230	210	68			
20.	Nitrates (mg/l)	.15	.24	0.17			
21.	Date Sampled for Analysis	4/22/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/21/2004	5/24/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-60.03	DS-60.03	DS-60.03			
2.	Lab Identification Number	0310168	0312350	0402309			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.5 GPM	.5 GPM	.07 GPM			
8.	Date Above Measurements Made	10/7/2003	12/23/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	8.1	7.4	8.3			
11.	Total Acidity (mg/l $CaCO_3$)	4.0	6.6	7.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	170	100	140			
13.	Specific Conductivity (umhos/cm at 25 C)	430	270	420			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.05	0.07	0.62			
16.	Total Sulfates (mg/l)	40	32	38			
17.	Total Iron (mg/l)	0.27	0.91	24			
18.	Total Suspended Solids (mg/l)	2.7	210	310			
19.	Total Hardness (mg/l $CACO_3$)	250	150	260			
20.	Nitrates (mg/l)	3.0	3.7	5.0			
21.	Date Sampled for Analysis	10/7/2003	12/23/2003	2/20/2004			
22.	Date Last Precipitation Event Occurred	10/4/2003	12/23/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-68.00	DS-68.00	DS-68.00			
2.	Lab Identification Number	0311050	0312373	0402275			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1195	1195	1195			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.43 GPM	1.04 GPM	.12 GPM			
8.	Date Above Measurements Made	11/4/2003	12/26/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.0	6.4	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	18	11	8.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	57	190			
13.	Specific Conductivity (umhos/cm at 25 C)	450	190	510			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.22	BDL	0.17			
16.	Total Sulfates (mg/l)	62	30	58			
17.	Total Iron (mg/l)	0.26	BDL	0.09			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	230	90	220			
20.	Nitrates (mg/l)	0.20	0.68	0.14			
21.	Date Sampled for Analysis	11/4/2003	12/26/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/24/2003	2/6/2004			

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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-68.01	DS-68.01	DS-68.01			
2.	Lab Identification Number	0311051	0312372	0402274			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1180	1180	1180			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.27 GPM	.85 GPM	.1486 GPM			
8.	Date Above Measurements Made	11/4/2003	12/26/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	6.2	7.4	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	24	6.8	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	120	190			
13.	Specific Conductivity (umhos/cm at 25 C)	280	320	480			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.03	0.17	2.8			
16.	Total Sulfates (mg/l)	41	44	57			
17.	Total Iron (mg/l)	0.06	0.64	3.0			
18.	Total Suspended Solids (mg/l)	1.0	12	BDL			
19.	Total Hardness (mg/l $CACO_3$)	140	150	290			
20.	Nitrates (mg/l)	0.33	0.26	0.14			
21.	Date Sampled for Analysis	11/4/2003	12/26/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/24/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-68.03	DS-68.03	DS-68.03			
2.	Lab Identification Number	0311139	0312368	0402259			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	0	0	.47 GPM			
8.	Date Above Measurements Made	11/8/2003	12/26/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	8.0	7.6	6.8			
11.	Total Acidity (mg/l $CaCO_3$)	6.9	9.1	18			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	150	200			
13.	Specific Conductivity (umhos/cm at 25 C)	420	380	460			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.38	0.02	0.04			
16.	Total Sulfates (mg/l)	35	35	50			
17.	Total Iron (mg/l)	0.11	0.53	0.07			
18.	Total Suspended Solids (mg/l)	1.0	,1.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	240	180	260			
20.	Nitrates (mg/l)	0.61	1.1	2.7			
21.	Date Sampled for Analysis	11/8/2003	12/26/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	11/6/2003	12/24/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-68.04	DS-68.04	DS-68.04			
2.	Lab Identification Number	0311140	0312369	0402260			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1135	1135	1135			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.6 GPM	.16 GPM	.15 GPM			
8.	Date Above Measurements Made	11/8/2003	12/26/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.4	7.5	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	14	9.7	6.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	170	130			
13.	Specific Conductivity (umhos/cm at 25 C)	310	420	340			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.15	0.05	0.06			
16.	Total Sulfates (mg/l)	41	36	38			
17.	Total Iron (mg/l)	0.59	0.78	0.29			
18.	Total Suspended Solids (mg/l)	41	12	2.7			
19.	Total Hardness (mg/l $CACO_3$)	180	200	180			
20.	Nitrates (mg/l)	0.67	2.1	0.89			
21.	Date Sampled for Analysis	11/8/2003	12/26/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	11/6/2003	12/24/2003	2/6/2004			

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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-68.06	DS-68.06	DS-68.06			
2.	Lab Identification Number	0311142	0312371	0402273			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1220	1220	1220			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.5 GPM	.52 GPM	.20 GPM			
8.	Date Above Measurements Made	11/8/2003	12/26/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	6.4	6.2	6.6			
11.	Total Acidity (mg/l $CaCO_3$)	40	9.5	19			
12.	Total Alkalinity (mg/l $CaCO_3$)	78	51	57			
13.	Specific Conductivity (umhos/cm at 25 C)	200	200	250			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.20	0.11	0.12			
16.	Total Sulfates (mg/l)	41	32	58			
17.	Total Iron (mg/l)	0.04	0.05	0.10			
18.	Total Suspended Solids (mg/l)	1.0	BDL	1.3			
19.	Total Hardness (mg/l $CACO_3$)	130	110	90			
20.	Nitrates (mg/l)	0.19	0.85	0.28			
21.	Date Sampled for Analysis	11/8/2003	12/26/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	11/6/2003	12/24/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-68.07	DS-68.07	DS-68.07			
2.	Lab Identification Number	0311143	0312374	0402276			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1157	1157	1157			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (gpm unless otherwise denoted)	.3 GPM	.44 GPM	.078 GPM			
8.	Date Above Measurements Made	11/8/2003	12/26/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	C	C	C			
10.	pH(Standard Units)	7.4	7.3	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	18	12	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	210	180	210			
13.	Specific Conductivity (umhos/cm at 25 C)	470	320	650			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	BDL			
16.	Total Sulfates (mg/l)	37	34	36			
17.	Total Iron (mg/l)	0.06	0.10	0.04			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	250	220	270			
20.	Nitrates (mg/l)	3.7	5.7	5.0			
21.	Date Sampled for Analysis	11/8/2003	12/26/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	11/6/2003	12/24/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-70.00	DS-70.00	DS-70.00			
2.	Lab Identification Number	0310177	0312284	0402258			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1157	1157	1157			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.04 GPM	.07 GPM	.09 GPM			
8.	Date Above Measurements Made	10/8/2003	12/22/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring	C	C	C			
10.	pH(Standard Units)	7.7	7.60	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	4.7	3.8	2.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	81	110			
13.	Specific Conductivity (umhos/cm at 25 C)	290	190	200			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.07			
16.	Total Sulfates (mg/l)	22	22	22			
17.	Total Iron (mg/l)	0.04	0.04	0.04			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	120	80	120			
20.	Nitrates (mg/l)	0.07	<0.0	0.08			
21.	Date Sampled for Analysis	10/8/2003	12/22/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	10/4/2003	12/19/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-72.00	DS-72.00	DS-72.00			
2.	Lab Identification Number	0310349	0312348	0402314			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1215	1215	1215			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.85 GPM	.48 GPM	.10 GPM			
8.	Date Above Measurements Made	10/20/2003	12/23/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.4	7.40	7.8			
11.	Total Acidity (mg/l $CaCO_3$)	6.6	6.6	6.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	210	170	200			
13.	Specific Conductivity (umhos/cm at 25 C)	470	380	450			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.13	BDL	0.05			
16.	Total Sulfates (mg/l)	38	34	41			
17.	Total Iron (mg/l)	1.4	BDL	1.7			
18.	Total Suspended Solids (mg/l)	28	BDL	99			
19.	Total Hardness (mg/l $CACO_3$)	210	190	210			
20.	Nitrates (mg/l)	1.5	3.5	4.0			
21.	Date Sampled for Analysis	10/20/2003	12/23/2003	2/20/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/23/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-91.03	DS-91.03	DS-91.03			
2.	Lab Identification Number	0310396	0312227	0402118			
3.	High (H)/Low (L) Designation (if applicable)	supplemental	I	H			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.23 GPM	.65 GPM	.62 GPM			
8.	Date Above Measurements Made	10/23/2003	12/20/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.8	7.6	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	6.7	9.7	13			
12.	Total Alkalinity (mg/l $CaCO_3$)	170	200	190			
13.	Specific Conductivity (umhos/cm at 25 C)	460	490	430			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	BDL			
16.	Total Sulfates (mg/l)	45	45	43			
17.	Total Iron (mg/l)	0.09	0.06	.08			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	210	200	200			
20.	Nitrates (mg/l)	0.68	2.3	1.8			
21.	Date Sampled for Analysis	10/23/2003	12/20/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/22/2003	12/17/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-91.04	DS-91.04	DS-91.04			
2.	Lab Identification Number	0310397	0312228	0402119			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1195	1195	1195			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.26 GPM	.38 GPM	.23 GPM			
8.	Date Above Measurements Made	10/20/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.4	7.2	6.90			
11.	Total Acidity (mg/l $CaCO_3$)	18	16	30			
12.	Total Alkalinity (mg/l $CaCO_3$)	300	280	320			
13.	Specific Conductivity (umhos/cm at 25 C)	1100	970	970			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.01	0.06			
16.	Total Sulfates (mg/l)	170	130	160			
17.	Total Iron (mg/l)	0.04	0.06	0.49			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	490	410	510			
20.	Nitrates (mg/l)	5.2	6.5	6.0			
21.	Date Sampled for Analysis	10/20/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/16/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-91.05	DS-91.05	DS-91.05			
2.	Lab Identification Number	0310398	0312229	0402120			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0	.5 GPM	.63 GPM			
8.	Date Above Measurements Made	10/20/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.5	7.7	7.10			
11.	Total Acidity (mg/l $CaCO_3$)	7.0	3.8	7.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	100	100			
13.	Specific Conductivity (umhos/cm at 25 C)	340	250	190			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.36	0.07	0.47			
16.	Total Sulfates (mg/l)	30	30	31			
17.	Total Iron (mg/l)	0.27	0.27	1.3			
18.	Total Suspended Solids (mg/l)	11	4.0	65			
19.	Total Hardness (mg/l $CACO_3$)	180	130	120			
20.	Nitrates (mg/l)	0.07	0.26	0.12			
21.	Date Sampled for Analysis	10/20/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/16/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-91.06	DS-91.06	DS-91.06			
2.	Lab Identification Number	0310403	0312231	0402121			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1190	1190	1190			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.44 GPM	1.29 GPM	.99 GPM			
8.	Date Above Measurements Made	10/25/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	6.9	6.9	6.70			
11.	Total Acidity (mg/l $CaCO_3$)	15	4.8	9.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	71	54	54			
13.	Specific Conductivity (umhos/cm at 25 C)	230	170	130			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.14	0.05	0.05			
16.	Total Sulfates (mg/l)	22	24	22			
17.	Total Iron (mg/l)	0.08	0.05	0.05			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	120	90	90			
20.	Nitrates (mg/l)	0.09	0.28	<0.0			
21.	Date Sampled for Analysis	10/25/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/16/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.00	DS-96.00	DS-96.00			
2.	Lab Identification Number	0310452	0312273	0402171			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.8 GPM	.5 GPM	0			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.4	7.30	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	13	6.1	3.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	200	210			
13.	Specific Conductivity (umhos/cm at 25 C)	360	400	170			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	BDL	BDL			
16.	Total Sulfates (mg/l)	27	24	21			
17.	Total Iron (mg/l)	.04	BDL	BDL			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	200	200	190			
20.	Nitrates (mg/l)	.94	1.2	0.77			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.02	DS-96.02	DS-96.02			
2.	Lab Identification Number	0310454	0312277	0402176			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1155	1155	1155			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.9 GPM	2.1 GPM	.44 GPM			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	C	C	C			
10.	pH(Standard Units)	7.0	7.50	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	17	6.7	4.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	130	180			
13.	Specific Conductivity (umhos/cm at 25 C)	200	300	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	BDL	BDL			
16.	Total Sulfates (mg/l)	23	26	28			
17.	Total Iron (mg/l)	.33	0.08	BDL			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	140	140	200			
20.	Nitrates (mg/l)	.23	0.32	0.50			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.04	DS-96.04	DS-96.04			
2.	Lab Identification Number	0310456	0312274	0402173			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1180	1180	1180			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.4 GPM	.35 GPM	.38 GPM			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.5	7.80	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	10	6.4	4.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	200	210			
13.	Specific Conductivity (umhos/cm at 25 C)	340	430	190			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	BDL	BDL			
16.	Total Sulfates (mg/l)	24	22	22			
17.	Total Iron (mg/l)	BDL	BDL	BDL			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	210	180	580			
20.	Nitrates (mg/l)	.95	1.4	1.0			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.05	DS-96.05	DS-96.05			
2.	Lab Identification Number	0310457	0312275	0402174			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1152	1152	1152			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.6 GPM	.51 GPM	.31 GPM			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	C	C	C			
10.	pH(Standard Units)	7.4	6.80	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	17	14	8.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	210	230	240			
13.	Specific Conductivity (umhos/cm at 25 C)	410	490	270			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.03	0.02	BDL			
16.	Total Sulfates (mg/l)	36	39	41			
17.	Total Iron (mg/l)	.23	BDL	BDL			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	250	240	230			
20.	Nitrates (mg/l)	0.20	0.36	0.62			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.06	DS-96.06	DS-96.06			
2.	Lab Identification Number	0312278	0402188	0310458			
3.	High (H)/Low (L) Designation (if applicable)	I	H	L			
4.	Surface Elevation for Sampling Station (msl)	1135	1135	1135			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.7 GPM	.47 GPM	.6 GPM			
8.	Date Above Measurements Made	12/22/2003	2/17/2004	10/30/2003			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	6.80	7.0	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	14	8.6	23			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	200	180			
13.	Specific Conductivity (umhos/cm at 25 C)	490	480	380			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.10	0.04	.34			
16.	Total Sulfates (mg/l)	52	49	40			
17.	Total Iron (mg/l)	0.09	0.07	.26			
18.	Total Suspended Solids (mg/l)	BDL	<1.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	250	240	190			
20.	Nitrates (mg/l)	2.9	3.8	1.1			
21.	Date Sampled for Analysis	12/22/2003	2/17/2004	10/30/2003			
22.	Date Last Precipitation Event Occurred	12/19/2003	2/6/2004	10/28/2003			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.08	DS-96.08	DS-96.08			
2.	Lab Identification Number	0310460	0312280	0402190			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1175	1175	1175			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.44 GPM	1.19 GPM	.63 GPM			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7	6.70	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	25	10	8.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	160	240			
13.	Specific Conductivity (umhos/cm at 25 C)	430	380	530			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	BDL	BDL			
16.	Total Sulfates (mg/l)	46	42	57			
17.	Total Iron (mg/l)	0.08	0.09	0.04			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	210	190	270			
20.	Nitrates (mg/l)	0.88	0.80	1.0			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.10	DS-96.10	DS-96.10			
2.	Lab Identification Number	0310462	0312282	0402185			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1225	1225	1225			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	2.3 GPM	.517 GPM	1.01 GPM			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.2	7.40	7.30			
11.	Total Acidity (mg/l $CaCO_3$)	10	2.6	5.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	84	230			
13.	Specific Conductivity (umhos/cm at 25 C)	250	200	470			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.06	0.05	BDL			
16.	Total Sulfates (mg/l)	28	24	34			
17.	Total Iron (mg/l)	0.21	0.30	BDL			
18.	Total Suspended Solids (mg/l)	4.0	7.3	BDL			
19.	Total Hardness (mg/l $CACO_3$)	140	90	240			
20.	Nitrates (mg/l)	.018	0.18	0.46			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.11	DS-96.11				
2.	Lab Identification Number	0312283	0402187				
3.	High (H)/Low (L) Designation (if applicable)	I	H				
4.	Surface Elevation for Sampling Station (msl)	1200	1200				
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0	.31 CFS				
8.	Date Above Measurements Made	12/22/2003	2/17/2004				
9.	Aquifer/Zone Identification for Well/Spring	B	B				
10.	pH(Standard Units)	8.30	7.50				
11.	Total Acidity (mg/l $CaCO_3$)	3.3	5.6				
12.	Total Alkalinity (mg/l $CaCO_3$)	83	92				
13.	Specific Conductivity (umhos/cm at 25 C)	200	220				
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.07	0.57				
16.	Total Sulfates (mg/l)	23	27				
17.	Total Iron (mg/l)	0.53	4.7				
18.	Total Suspended Solids (mg/l)	8.7	280				
19.	Total Hardness (mg/l $CACO_3$)	100	150				
20.	Nitrates (mg/l)	0.20	0.59				
21.	Date Sampled for Analysis	12/22/2003	2/17/2004				
22.	Date Last Precipitation Event Occurred	12/19/2003	2/6/2004				

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.12	DS-96.12	DS-96.12			
2.	Lab Identification Number	0310467	0312289	0402180			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1120	1120	1120			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.5 GPM	.2 GPM	.1 GPM			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.7	7.10	7.7			
11.	Total Acidity (mg/l $CaCO_3$)	7.1	6.4	2.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	200	190			
13.	Specific Conductivity (umhos/cm at 25 C)	340	440	200			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.06	0.02	0.01			
16.	Total Sulfates (mg/l)	46	52	55			
17.	Total Iron (mg/l)	0.50	0.46	0.06			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	220	190	230			
20.	Nitrates (mg/l)	1.0	0.52	0.85			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-96.13	DS-96.13	DS-96.13			
2.	Lab Identification Number	0310468	0312378	0402183			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	3.4 GPM	2.21 GPM	1.25 GPM			
8.	Date Above Measurements Made	10/30/2003	12/29/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.6	7.6	7.30			
11.	Total Acidity (mg/l $CaCO_3$)	7.5	6.2	9.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	230	240	250			
13.	Specific Conductivity (umhos/cm at 25 C)	550	570	630			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.02	0.08			
16.	Total Sulfates (mg/l)	48	46	49			
17.	Total Iron (mg/l)	0.13	0.14	2.5			
18.	Total Suspended Solids (mg/l)	BDL	BDL	7.3			
19.	Total Hardness (mg/l $CACO_3$)	290	300	300			
20.	Nitrates (mg/l)	0.39	4.6	6.2			
21.	Date Sampled for Analysis	10/30/2003	12/29/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/29/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-104.00	DS-104.00	DS-104.00			
2.	Lab Identification Number	0404197	0405184	0408157			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1135	1135	1135			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (GPM unless otherwise denoted)	1.9	2.1	0.1			
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.6	7.3	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	14	13	12			
12.	Total Alkalinity (mg/l $CaCO_3$)	160	160	170			
13.	Specific Conductivity (umhos/cm at 25 C)	410	340	410			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	<.01	BDL	.002			
16.	Total Sulfates (mg/l)	21	18	20			
17.	Total Iron (mg/l)	BDL	.05	0.01			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	160	170	180			
20.	Nitrates (mg/l)	2.2	2.6	1.4			
21.	Date Sampled for Analysis	4/21/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-104.01	DS-104.01	DS-104.01			
2.	Lab Identification Number	0404198	0405185	0408158			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.2	0.99	0.2			
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.8	7.2	8.3			
11.	Total Acidity (mg/l $CaCO_3$)	11	16	11			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	130	170			
13.	Specific Conductivity (umhos/cm at 25 C)	360	360	460			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	.04	0.063			
16.	Total Sulfates (mg/l)	48	54	57			
17.	Total Iron (mg/l)	.24	.44	0.54			
18.	Total Suspended Solids (mg/l)	1.3	13	4			
19.	Total Hardness (mg/l $CACO_3$)	150	160	230			
20.	Nitrates (mg/l)	.55	.46	0.26			
21.	Date Sampled for Analysis	4/21/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-109.01	DS-109.01	DS-109.01			
2.	Lab Identification Number	0404140	0405215	0408172			
3.	High (H)/Low (L) Designation (if applicable)	H	I				
4.	Surface Elevation for Sampling Station (msl)	1220	1220	1220			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.42	0.26	0.63			
8.	Date Above Measurements Made	4/19/2004	5/25/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	8.3	7.6	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	3.5	6.2	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	78	92	150			
13.	Specific Conductivity (umhos/cm at 25 C)	220	240	320			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.24	.39	0.690			
16.	Total Sulfates (mg/l)	25	26	27			
17.	Total Iron (mg/l)	1.6	2.7	2.0			
18.	Total Suspended Solids (mg/l)	17	75	70			
19.	Total Hardness (mg/l $CACO_3$)	100	100	150			
20.	Nitrates (mg/l)	.07	.24	0.26			
21.	Date Sampled for Analysis	4/19/2004	5/25/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/18/2004	5/24/2004	8/12/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-110.00	DS-110.00	DS-110.00			
2.	Lab Identification Number	0404141	0405211	0408211			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1230	1230	1230			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.3	0.67	0.23			
8.	Date Above Measurements Made	4/19/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.2	7.0	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	15	16	16			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	120	190			
13.	Specific Conductivity (umhos/cm at 25 C)	360	400	450			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.01	0.038			
16.	Total Sulfates (mg/l)	31	27	34			
17.	Total Iron (mg/l)	.20	.83	0.03			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	150	140	210			
20.	Nitrates (mg/l)	1.3	.92	0.40			
21.	Date Sampled for Analysis	4/19/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/18/2004	5/24/2004	8/12/2004			

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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-111.00	DS-111.00				
2.	Lab Identification Number	0404142	0405210				
3.	High (H)/Low (L) Designation (if applicable)	Supplemental					
4.	Surface Elevation for Sampling Station (msl)	1220	1220				
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	4.4	4.3				
8.	Date Above Measurements Made	4/19/2004	5/25/2004				
9.	Aquifer/Zone Identification for Well/Spring	B	B				
10.	pH(Standard Units)	7.6	7.1				
11.	Total Acidity (mg/l $CaCO_3$)	15	15				
12.	Total Alkalinity (mg/l $CaCO_3$)	190	200				
13.	Specific Conductivity (umhos/cm at 25 C)	460	570				
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	BDL				
16.	Total Sulfates (mg/l)	30	26				
17.	Total Iron (mg/l)	BDL	BDL				
18.	Total Suspended Solids (mg/l)	BDL	BDL				
19.	Total Hardness (mg/l $CACO_3$)	220	210				
20.	Nitrates (mg/l)	.74	.74				
21.	Date Sampled for Analysis	4/19/2004	5/25/2004				
22.	Date Last Precipitation Event Occurred	4/18/2004	5/24/2004				

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-112.00	DS-112.00	DS-112.00			
2.	Lab Identification Number	0405212	0408152	404173			
3.	High (H)/Low (L) Designation (if applicable)	I	L	H			
4.	Surface Elevation for Sampling Station (msl)	1140	1140	1140			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	NO ACCESS	NO ACCESS	NO ACCESS			
8.	Date Above Measurements Made	5/25/2004	8/16/2004	4/20/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.2	7.9	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	24	14	8.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	270	160	82			
13.	Specific Conductivity (umhos/cm at 25 C)	810	360	200			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.007	BDL			
16.	Total Sulfates (mg/l)	87	19	15			
17.	Total Iron (mg/l)	.76	.45	BDL			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	280	160	80			
20.	Nitrates (mg/l)	5.6	.43	0.32			
21.	Date Sampled for Analysis	5/25/2004	8/16/2004	4/20/2004			
22.	Date Last Precipitation Event Occurred	5/24/2004	8/12/2004	4/19/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-114.02	DS-114.02	DS-114.02			
2.	Lab Identification Number	0404179	0405191	0408164			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1110	1110	1110			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.9	0.72	0.32			
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	9.0	8.6	9.1			
11.	Total Acidity (mg/l $CaCO_3$)	3.9	3.3	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	170	180	200			
13.	Specific Conductivity (umhos/cm at 25 C)	440	370	380			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	BDL	BDL			
16.	Total Sulfates (mg/l)	18	16	19			
17.	Total Iron (mg/l)	BDL	.17	0.03			
18.	Total Suspended Solids (mg/l)	BDL	BDL	3.3			
19.	Total Hardness (mg/l $CACO_3$)	190	190	180			
20.	Nitrates (mg/l)	.96	.56	0.43			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-114.03	DS-114.03	DS-114.03			
2.	Lab Identification Number	0404180	0405189	0408162			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1077	1077	1077			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.3	0.37 GPM	NO FLOW			
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.9	7.9	8.1			
11.	Total Acidity (mg/l $CaCO_3$)	10	8.0	16			
12.	Total Alkalinity (mg/l $CaCO_3$)	170	190	140			
13.	Specific Conductivity (umhos/cm at 25 C)	590	550	410			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	1.2	.49	.240			
16.	Total Sulfates (mg/l)	42	39	24			
17.	Total Iron (mg/l)	BDL	.04	.06			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	230	250	160			
20.	Nitrates (mg/l)	10	5.4	4.3			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-114.04	DS-114.04	DS-114.04			
2.	Lab Identification Number	0404182	0405186	0408159			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1055	1055	1055			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.44	0.55	0.06			
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	6.7	6.9	7.7			
11.	Total Acidity (mg/l $CaCO_3$)	17	8.2	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	41	46	130			
13.	Specific Conductivity (umhos/cm at 25 C)	150	130	300			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.01	.002			
16.	Total Sulfates (mg/l)	18	15	20			
17.	Total Iron (mg/l)	.05	.16	.01			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	60	60	130			
20.	Nitrates (mg/l)	.38	.22	0.49			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-117.01	DS-117.01	DS-117.01			
2.	Lab Identification Number	0404196	0405183	0408156			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1105	1105	1105			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1	3.13	NO FLOW			
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.1	6.7	8.2			
11.	Total Acidity (mg/l $CaCO_3$)	7.6	8.0	8.9			
12.	Total Alkalinity (mg/l $CaCO_3$)	32	33	89			
13.	Specific Conductivity (umhos/cm at 25 C)	110	93	220			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.18	.20	1.2			
16.	Total Sulfates (mg/l)	14	11	12			
17.	Total Iron (mg/l)	.09	.34	.38			
18.	Total Suspended Solids (mg/l)	BDL	8.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	50	50	110			
20.	Nitrates (mg/l)	<.07	.12	.18			
21.	Date Sampled for Analysis	4/21/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-118.00	DS-118.00	DS-118.00			
2.	Lab Identification Number	0404199	0405194	0408167			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1100	1100	1100			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.9	1.1	0.01			
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.6	7.0	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	18	16	BDL			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	180	100			
13.	Specific Conductivity (umhos/cm at 25 C)	510	410	240			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.05	.01	0.170			
16.	Total Sulfates (mg/l)	41	34	24			
17.	Total Iron (mg/l)	.86	.19	1.4			
18.	Total Suspended Solids (mg/l)	120	1.3	51			
19.	Total Hardness (mg/l $CACO_3$)	200	180	100			
20.	Nitrates (mg/l)	.51	.47	0.26			
21.	Date Sampled for Analysis	4/21/2004	4/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-119.00	DS-119.00	DS-119.00			
2.	Lab Identification Number	0404200	0405196	0408169			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1093	1093	1093			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.23	0.38	0.08			
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	8.1	7.8	8.5			
11.	Total Acidity (mg/l $CaCO_3$)	8.2	7.5	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	200	230			
13.	Specific Conductivity (umhos/cm at 25 C)	460	420	490			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	BDL	.005			
16.	Total Sulfates (mg/l)	23	22	28			
17.	Total Iron (mg/l)	.05	.04	0.16			
18.	Total Suspended Solids (mg/l)	2.0	BDL	20			
19.	Total Hardness (mg/l $CACO_3$)	180	190	210			
20.	Nitrates (mg/l)	.76	.83	0.57			
21.	Date Sampled for Analysis	4/21/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-119.02	DS-119.02	DS-119.02			
2.	Lab Identification Number	0404217	0405195	0408168			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1167	1167	1167			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	1.3	0.99	0.21			
8.	Date Above Measurements Made	4/22/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.7	7.3	7.7			
11.	Total Acidity (mg/l $CaCO_3$)	16	13	16			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	200	200			
13.	Specific Conductivity (umhos/cm at 25 C)	380	450	470			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	BDL	0.004			
16.	Total Sulfates (mg/l)	42	43	50			
17.	Total Iron (mg/l)	BDL	.05	0.06			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	210	220	240			
20.	Nitrates (mg/l)	.36	.40	0.31			
21.	Date Sampled for Analysis	4/22/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/21/2004	5/23/2004	8/12/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-119.03	DS-119.03	DS-119.03			
2.	Lab Identification Number	0404218	0405217	0408215			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1140	1140	1140			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.9	0.48	0.12			
8.	Date Above Measurements Made	4/22/2004	5/25/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.1	7.0	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	29	21	13			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	150	150			
13.	Specific Conductivity (umhos/cm at 25 C)	260	300	340			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.03	BDL	0.009			
16.	Total Sulfates (mg/l)	18	14	20			
17.	Total Iron (mg/l)	.09	.04	0.16			
18.	Total Suspended Solids (mg/l)	1.3	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	150	160	160			
20.	Nitrates (mg/l)	.35	.29	0.14			
21.	Date Sampled for Analysis	4/22/2004	5/25/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/21/2004	5/24/2004	8/12/2003			

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ATTACHMENT 14A
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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-119.04	DS-119.04	DS-119.04			
2.	Lab Identification Number	N/A	0404219	0405218			
3.	High (H)/Low (L) Designation (if applicable)	L	H	I			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	N/A*	0.23	0.09			
8.	Date Above Measurements Made	8/17/2004	4/22/2004	5/25/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)		7.2	7.7			
11.	Total Acidity (mg/l $CaCO_3$)		16	7.1			
12.	Total Alkalinity (mg/l $CaCO_3$)		92	120			
13.	Specific Conductivity (umhos/cm at 25 C)		190	430			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)		.01	.02			
16.	Total Sulfates (mg/l)		18	21			
17.	Total Iron (mg/l)		.11	.17			
18.	Total Suspended Solids (mg/l)		BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)		100	170			
20.	Nitrates (mg/l)		.49	6.2			
21.	Date Sampled for Analysis		4/22/2004	5/25/2004			
22.	Date Last Precipitation Event Occurred		4/21/2004	5/24/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-119.05	DS-119.05	DS-119.05			
2.	Lab Identification Number	0404220	0405219	0408216			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.17	0.11	0.10			
8.	Date Above Measurements Made	4/22/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.3	7.1	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	17	17	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	140	170			
13.	Specific Conductivity (umhos/cm at 25 C)	340	360	440			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.03	0.015			
16.	Total Sulfates (mg/l)	36	32	42			
17.	Total Iron (mg/l)	BDL	.04	0.03			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	160	160	210			
20.	Nitrates (mg/l)	1.0	.84	0.86			
21.	Date Sampled for Analysis	4/22/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/21/2004	5/24/2004	8/12/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-119.06	DS-119.06	DS-119.06			
2.	Lab Identification Number	0404221	0405220				
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.12	0.07	no access*			
8.	Date Above Measurements Made	4/22/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.9	6.8				
11.	Total Acidity (mg/l $CaCO_3$)	7.1	23				
12.	Total Alkalinity (mg/l $CaCO_3$)	130	110				
13.	Specific Conductivity (umhos/cm at 25 C)	340	450				
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	.08				
16.	Total Sulfates (mg/l)	22	51				
17.	Total Iron (mg/l)	.10	2.3				
18.	Total Suspended Solids (mg/l)	BDL	68				
19.	Total Hardness (mg/l $CACO_3$)	160	170				
20.	Nitrates (mg/l)	6.7	5.0				
21.	Date Sampled for Analysis	4/22/2004	5/25/2004				
22.	Date Last Precipitation Event Occurred	4/21/2004	5/24/2004				

* pipe plugged, no flow

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-119.07	DS-119.07	DS-119.07			
2.	Lab Identification Number	0404222	0405221	0405217			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1198	1198	1198			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.14	0.73	0.05			
8.	Date Above Measurements Made	4/22/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.0	7.7	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	26	17	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	94	180			
13.	Specific Conductivity (umhos/cm at 25 C)	410	240	450			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.05	.01	0.018			
16.	Total Sulfates (mg/l)	54	17	42			
17.	Total Iron (mg/l)	1.5	.23	0.03			
18.	Total Suspended Solids (mg/l)	25	5.3	BDL			
19.	Total Hardness (mg/l $CACO_3$)	190	110	240			
20.	Nitrates (mg/l)	5.8	4.9	0.86			
21.	Date Sampled for Analysis	4/22/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/21/2004	5/24/2004	8/12/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DS-122.00	DS-122.00	DS-122.00			
2.	Lab Identification Number	0310172	0312385	0402344			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1265	1265	1265			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (GPM unless otherwise denoted)	.1 GPM	.16 GPM	.19 GPM			
8.	Date Above Measurements Made	10/8/2003	12/29/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.0	7.7	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	12	6.6	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	160	150	110			
13.	Specific Conductivity (umhos/cm at 25 C)	390	440	430			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	BDL	0.03			
16.	Total Sulfates (mg/l)	98	95	77			
17.	Total Iron (mg/l)	0.09	0.07	0.08			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	280	220	220			
20.	Nitrates (mg/l)	0.18	0.48	0.50			
21.	Date Sampled for Analysis	10/8/2003	12/29/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	10/4/2003	12/29/2003	2/21/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-34.00	DW-34.00	DW-34.00			
2.	Lab Identification Number	0311165	0308029	0403116			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1340	1340	1340			
5.	Depth of Well below Land Surface (msl)	41	41	41			
6.	Static Water Level of Well below Land Surface (feet)	12.	15.	16			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	11/13/2003	7/31/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.2	7.0	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	7.8	16	12			
12.	Total Alkalinity (mg/l $CaCO_3$)	72	130	160			
13.	Specific Conductivity (umhos/cm at 25 C)	220	380	450			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.04	0.05			
16.	Total Sulfates (mg/l)	31	31	50			
17.	Total Iron (mg/l)	0.60	0.71	1.4			
18.	Total Suspended Solids (mg/l)	3.3	11	23			
19.	Total Hardness (mg/l $CACO_3$)	90	150	190			
20.	Nitrates (mg/l)	1.0	2.2	2.6			
21.	Date Sampled for Analysis	11/13/2003	7/31/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	11/11/2003	7/31/2003	3/4/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-38.00	DW-38.00	DW-38.00			
2.	Lab Identification Number	0310355	0312340	0402278			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1300	1300	1300			
5.	Depth of Well below Land Surface (msl)	32	32	32			
6.	Static Water Level of Well below Land Surface (feet)	29.6	28.8	29.0			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/20/2003	12/23/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.0	7.60	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	7.1	11	17			
12.	Total Alkalinity (mg/l $CaCO_3$)	180	90	230			
13.	Specific Conductivity (umhos/cm at 25 C)	610	460	630			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.05	0.04	2.5			
16.	Total Sulfates (mg/l)	94	89	78			
17.	Total Iron (mg/l)	0.23	0.15	0.50			
18.	Total Suspended Solids (mg/l)	49	11	BDL			
19.	Total Hardness (mg/l $CACO_3$)	250	190	360			
20.	Nitrates (mg/l)	5.6	8.0	2.4			
21.	Date Sampled for Analysis	10/20/2003	12/23/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/23/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-48.02	DW-48.02	DW-48.02			
2.	Lab Identification Number	0310277	0312346	0402308			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1305	1305	1305			
5.	Depth of Well below Land Surface (msl)	46	46	46			
6.	Static Water Level of Well below Land Surface (feet)	34.	45	33.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/13/2003	12/23/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7	7.60	7.2			
11.	Total Acidity (mg/l $CaCO_3$)	9	10	23			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	180	170			
13.	Specific Conductivity (umhos/cm at 25 C)	460	360	410			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	0.09	0.19			
16.	Total Sulfates (mg/l)	36	36	25			
17.	Total Iron (mg/l)	0.04	0.05	0.24			
18.	Total Suspended Solids (mg/l)	15	BDL	10			
19.	Total Hardness (mg/l $CACO_3$)	200	180	210			
20.	Nitrates (mg/l)	1.6	0.92	0.23			
21.	Date Sampled for Analysis	10/13/2003	12/23/2003	2/20/2004			
22.	Date Last Precipitation Event Occurred	10/9/2003	12/23/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-53.01	DW-53.01	DW-53.01			
2.	Lab Identification Number	0310165	0312397	0402352			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1305	1305	1305			
5.	Depth of Well below Land Surface (msl)	32	32	32			
6.	Static Water Level of Well below Land Surface (feet)	25	22.	25.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/7/2003	12/30/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.4	7.80	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	18	11	13			
12.	Total Alkalinity (mg/l $CaCO_3$)	250	260	220			
13.	Specific Conductivity (umhos/cm at 25 C)	690	770	810			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.01			
16.	Total Sulfates (mg/l)	82	96	89			
17.	Total Iron (mg/l)	0.07	0.04	0.09			
18.	Total Suspended Solids (mg/l)	1.0	BDL	4.7			
19.	Total Hardness (mg/l $CACO_3$)	340	340	360			
20.	Nitrates (mg/l)	7.6	8.5	1.1			
21.	Date Sampled for Analysis	10/7/2003	12/30/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	10/4/2003	12/29/2003	2/21/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-58.00	DW-58.00	DW-58.00			
2.	Lab Identification Number	0404186	0405208	0408209			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	990	990	990			
5.	Depth of Well below Land Surface (msl)	7.0	7.0	7.0			
6.	Static Water Level of Well below Land Surface (feet)	4.0	4.0	5.0			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/20/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	E	E	E			
10.	pH(Standard Units)	6.4	6.2	6.1			
11.	Total Acidity (mg/l $CaCO_3$)	13	16	19			
12.	Total Alkalinity (mg/l $CaCO_3$)	51	40	44			
13.	Specific Conductivity (umhos/cm at 25 C)	150	100	110			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.09	.01	0.066			
16.	Total Sulfates (mg/l)	10	14	16			
17.	Total Iron (mg/l)	2.7	.50	4.5			
18.	Total Suspended Solids (mg/l)	3.3	4.0	2.0			
19.	Total Hardness (mg/l $CACO_3$)	50	50	70			
20.	Nitrates (mg/l)	1.6	3.4	2.1			
21.	Date Sampled for Analysis	4/20/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/24/2004	8/12/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-60.02	DW-60.02	DW-60.02			
2.	Lab Identification Number	0310167	0312399	0402312			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1285	1285	1285			
5.	Depth of Well below Land Surface (msl)	16	16	16			
6.	Static Water Level of Well below Land Surface (feet)	5.5	4.6	6.0			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/7/2003	12/30/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	6.7	7.20	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	20	3.5	5.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	94	81			
13.	Specific Conductivity (umhos/cm at 25 C)	360	280	340			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	BDL			
16.	Total Sulfates (mg/l)	43	44	31			
17.	Total Iron (mg/l)	0.04	0.06	BDL			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	150	140	140			
20.	Nitrates (mg/l)	2.1	2.4	3.6			
21.	Date Sampled for Analysis	10/7/2003	12/30/2003	2/20/2004			
22.	Date Last Precipitation Event Occurred	10/4/2003	12/29/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-91.00	DW-91.00	DW-91.00			
2.	Lab Identification Number	0310394	0312226	0402116			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1260	1260	1260			
5.	Depth of Well below Land Surface (msl)	28	28	28			
6.	Static Water Level of Well below Land Surface (feet)	25	21.	23.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/25/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.7	7.8	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	9.1	10	11			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	200	200			
13.	Specific Conductivity (umhos/cm at 25 C)	490	490	440			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	.0.1			
16.	Total Sulfates (mg/l)	29	33	33			
17.	Total Iron (mg/l)	0.07	0.08	0.38			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	220	230	220			
20.	Nitrates (mg/l)	1.5	3.0	1.8			
21.	Date Sampled for Analysis	10/25/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/16/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-94.01	DW-94.01	DW-94.01			
2.	Lab Identification Number	0310401	0312338	0402125			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)	22	22	22			
6.	Static Water Level of Well below Land Surface (feet)	14	12	14.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/25/2003	12/23/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.5	7.70	7.30			
11.	Total Acidity (mg/l $CaCO_3$)	5.8	7.2	13			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	150	200			
13.	Specific Conductivity (umhos/cm at 25 C)	440	380	440			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.04			
16.	Total Sulfates (mg/l)	42	44	88			
17.	Total Iron (mg/l)	0.04	0.09	0.05			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	160	150	260			
20.	Nitrates (mg/l)	11	9.6	1.2			
21.	Date Sampled for Analysis	10/25/2003	12/23/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/23/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-95.00	DW-95.00	DW-95.00			
2.	Lab Identification Number	0310404	0312233	0402123			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1250	1250	1250			
5.	Depth of Well below Land Surface (msl)	21	21	21			
6.	Static Water Level of Well below Land Surface (feet)	4	2	5.7			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/25/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.5	7.5	6.90			
11.	Total Acidity (mg/l $CaCO_3$)	9.2	6.4	15			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	170	160			
13.	Specific Conductivity (umhos/cm at 25 C)	320	490	340			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.07	0.26			
16.	Total Sulfates (mg/l)	34	41	34			
17.	Total Iron (mg/l)	0.13	0.08	0.38			
18.	Total Suspended Solids (mg/l)	1.0	BDL	13			
19.	Total Hardness (mg/l $CACO_3$)	160	220	180			
20.	Nitrates (mg/l)	1.4	3.2	0.09			
21.	Date Sampled for Analysis	10/25/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/16/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-96.03	DW-96.03	DW-96.03			
2.	Lab Identification Number	0312272	0402172	310455			
3.	High (H)/Low (L) Designation (if applicable)	I	H	L			
4.	Surface Elevation for Sampling Station (msl)	1175	1175	1175			
5.	Depth of Well below Land Surface (msl)	27	27	27			
6.	Static Water Level of Well below Land Surface (feet)	18	19.	18			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	12/22/2003	2/17/2004	10/29/2003			
9.	Aquifer/Zone Identification for Well/Spring	C	C	C			
10.	pH(Standard Units)	7.60	7.2	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	5.4	4.2	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	210	240	220			
13.	Specific Conductivity (umhos/cm at 25 C)	550	360	530			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.02			
16.	Total Sulfates (mg/l)	80	94	92			
17.	Total Iron (mg/l)	0.10	0.08	0.08			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	230	280	220			
20.	Nitrates (mg/l)	0.54	1.1	1/0/1900			
21.	Date Sampled for Analysis	12/22/2003	2/17/2004	10/30/2003			
22.	Date Last Precipitation Event Occurred	12/19/2003	2/6/2004	10/28/2003			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-97.01	DW-97.01	DW-97.01			
2.	Lab Identification Number	0310464	0312286	0402177			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)	11	11	11			
6.	Static Water Level of Well below Land Surface (feet)	4	3.6	4.4			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/25/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.4	7.40	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	17	9.6	8.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	160	170			
13.	Specific Conductivity (umhos/cm at 25 C)	390	380	140			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	BDL	0.07			
16.	Total Sulfates (mg/l)	30	29	25			
17.	Total Iron (mg/l)	0.10	BDL	1.3			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	200	160	170			
20.	Nitrates (mg/l)	2.0	2.1	2.7			
21.	Date Sampled for Analysis	10/25/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-98.01	DW-98.01	DW-98.01			
2.	Lab Identification Number	0310490	0401009	0402262			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)	20	20	20			
6.	Static Water Level of Well below Land Surface (feet)	4	1	3			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/30/2003	1/5/2004	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.6	7.15	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	11	7.5	6.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	120	100			
13.	Specific Conductivity (umhos/cm at 25 C)	250	270	270			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.08	0.12	0.06			
16.	Total Sulfates (mg/l)	20	18	12			
17.	Total Iron (mg/l)	0.26	0.13	0.07			
18.	Total Suspended Solids (mg/l)	1.0	2.0	1.3			
19.	Total Hardness (mg/l $CACO_3$)	110	130	130			
20.	Nitrates (mg/l)	0.18	0.09	0.13			
21.	Date Sampled for Analysis	10/30/2003	1/5/2004	2/18/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	1/4/2004	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-112.02	DW-112.02	DW-112.02			
2.	Lab Identification Number	0404175	0405178	0408151			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1142	1142	1142			
5.	Depth of Well below Land Surface (msl)	17	17	17			
6.	Static Water Level of Well below Land Surface (feet)	9.5	11.9	11.9			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.6	6.6	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	14	11	9.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	150	38	28			
13.	Specific Conductivity (umhos/cm at 25 C)	380	100	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.01	.048			
16.	Total Sulfates (mg/l)	25	14	19			
17.	Total Iron (mg/l)	.19	.62	.26			
18.	Total Suspended Solids (mg/l)	BDL	BDL	43			
19.	Total Hardness (mg/l $CACO_3$)	80	40	90			
20.	Nitrates (mg/l)	2.4	.64	4.2			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-115.00	DW-115.00	DW-115.00			
2.	Lab Identification Number	0404193	0405176	0408150			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1140	1140	1140			
5.	Depth of Well below Land Surface (msl)	16	16	16			
6.	Static Water Level of Well below Land Surface (feet)	9.1	13.0	13.0			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.5	6.9	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	8.4	9.5	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	60	48	63			
13.	Specific Conductivity (umhos/cm at 25 C)	220	100	360			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.01	.003			
16.	Total Sulfates (mg/l)	16	16	20			
17.	Total Iron (mg/l)	.59	.70	0.08			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	70	50	100			
20.	Nitrates (mg/l)	3.4	1.8	5.6			
21.	Date Sampled for Analysis	4/21/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-119.01	DW-119.01	DW-119.01			
2.	Lab Identification Number	0404215	0405216	0408214			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1260	1260	1260			
5.	Depth of Well below Land Surface (msl)	40	40	40			
6.	Static Water Level of Well below Land Surface (feet)	18	18.0	24.0			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/22/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	8.1	7.8	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	6.5	6.8	8.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	130	150			
13.	Specific Conductivity (umhos/cm at 25 C)	400	480	460			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	BDL	BDL			
16.	Total Sulfates (mg/l)	37	36	38			
17.	Total Iron (mg/l)	BDL	.12	0.04			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	190	170	210			
20.	Nitrates (mg/l)	9.0	9.0	8.3			
21.	Date Sampled for Analysis	4/30/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/22/2004	5/24/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-120.00	DW-120.00	DW-120.00			
2.	Lab Identification Number	0404201	0405212	0408212			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1285	1285	1285			
5.	Depth of Well below Land Surface (msl)	28	28	28			
6.	Static Water Level of Well below Land Surface (feet)	18.4	19	22.0			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/21/2004	5/25/2004	8/17/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.2	7.2	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	30	24	30			
12.	Total Alkalinity (mg/l $CaCO_3$)	260	270	300			
13.	Specific Conductivity (umhos/cm at 25 C)	750	810	790			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.01	0.05			
16.	Total Sulfates (mg/l)	84	87	100			
17.	Total Iron (mg/l)	.08	.76	0.05			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	290	280	430			
20.	Nitrates (mg/l)	5.9	5.6	3.5			
21.	Date Sampled for Analysis	4/21/2004	5/25/2004	8/17/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/24/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-121.00	DW-121.00	DW-121.00			
2.	Lab Identification Number	0404216	0405197	0408170			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1125	1125	1125			
5.	Depth of Well below Land Surface (msl)	15	15	15			
6.	Static Water Level of Well below Land Surface (feet)	4.5	4.5	6.0			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/22/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	6.5	6.2	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	31	26	24			
12.	Total Alkalinity (mg/l $CaCO_3$)	53	60	69			
13.	Specific Conductivity (umhos/cm at 25 C)	120	160	190			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.05	.07	0.013			
16.	Total Sulfates (mg/l)	21	16	20			
17.	Total Iron (mg/l)	.63	.52	0.31			
18.	Total Suspended Solids (mg/l)	28	BDL	2.0			
19.	Total Hardness (mg/l $CACO_3$)	50	90	80			
20.	Nitrates (mg/l)	.34	.29	0.84			
21.	Date Sampled for Analysis	4/22/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/21/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-123.01					
2.	Lab Identification Number						
3.	High (H)/Low (L) Designation (if applicable)						
4.	Surface Elevation for Sampling Station (msl)	1275					
5.	Depth of Well below Land Surface (msl)	sealed					
6.	Static Water Level of Well below Land Surface (feet)	SEALED					
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	5/25/2004					
9.	Aquifer/Zone Identification for Well/Spring	Unknown					
10.	pH(Standard Units)						
11.	Total Acidity (mg/l $CaCO_3$)						
12.	Total Alkalinity (mg/l $CaCO_3$)						
13.	Specific Conductivity (umhos/cm at 25 C)						
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)						
16.	Total Sulfates (mg/l)						
17.	Total Iron (mg/l)						
18.	Total Suspended Solids (mg/l)						
19.	Total Hardness (mg/l $CACO_3$)						
20.	Nitrates (mg/l)						
21.	Date Sampled for Analysis						
22.	Date Last Precipitation Event Occurred						

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-126.01		DW-126.01			
2.	Lab Identification Number	0404226					
3.	High (H)/Low (L) Designation (if applicable)	H					
4.	Surface Elevation for Sampling Station (msl)	1195		1195			
5.	Depth of Well below Land Surface (msl)	11		11			
6.	Static Water Level of Well below Land Surface (feet)	8.8		DRY WELL			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/23/2004		5/25/2004			
9.	Aquifer/Zone Identification for Well/Spring	B		B			
10.	pH(Standard Units)	7.8					
11.	Total Acidity (mg/l $CaCO_3$)	37					
12.	Total Alkalinity (mg/l $CaCO_3$)	230					
13.	Specific Conductivity (umhos/cm at 25 C)	510					
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.14					
16.	Total Sulfates (mg/l)	30					
17.	Total Iron (mg/l)	.42					
18.	Total Suspended Solids (mg/l)	19					
19.	Total Hardness (mg/l $CACO_3$)	190					
20.	Nitrates (mg/l)	.38					
21.	Date Sampled for Analysis	4/23/2004					
22.	Date Last Precipitation Event Occurred	4/22/2004					

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-5.01	P-5.01	P-5.01			
2.	Lab Identification Number	0308143	0310175	0402404			
3.	High (H)/Low (L) Designation (if applicable)	ITL	L	H			
4.	Surface Elevation for Sampling Station (msl)	1265	1265	1265			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)	33	35	37			
7.	Flow for Spring/Stream (cfs)	.006 CFS	0	.001 CFS			
8.	Date Above Measurements Made	8/6/2003	10/8/2003	2/24/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.0	7.0	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	26	17	5.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	220	220	69			
13.	Specific Conductivity (umhos/cm at 25 C)	1200	750	120			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.02	0.17			
16.	Total Sulfates (mg/l)	35	38	21			
17.	Total Iron (mg/l)	0.31	0.04	0.65			
18.	Total Suspended Solids (mg/l)	71	1.0	12			
19.	Total Hardness (mg/l $CACO_3$)	360	300	90			
20.	Nitrates (mg/l)	2.5	0.62	0.35			
21.	Date Sampled for Analysis	8/6/2003	10/8/2003	2/24/2004			
22.	Date Last Precipitation Event Occurred	8/4/2003	10/4/2003	2/23/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-48.01	P-48.01	P-48.01			
2.	Lab Identification Number	0310281	0312382	0402349			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1235	1235	1235			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)	25	27	29			
7.	Flow for Spring/Stream (cfs)	0	.001 CFS	.17 CFS			
8.	Date Above Measurements Made	10/13/2003	12/29/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.7	7.4	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	6.9	5.5	7.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	180	120	120			
13.	Specific Conductivity (umhos/cm at 25 C)	490	340	380			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	1.2	0.14			
16.	Total Sulfates (mg/l)	35	47	46			
17.	Total Iron (mg/l)	1.1	14	0.85			
18.	Total Suspended Solids (mg/l)	4.7	180	27			
19.	Total Hardness (mg/l $CACO_3$)	200	300	180			
20.	Nitrates (mg/l)	0.16	2.1	2.2			
21.	Date Sampled for Analysis	10/13/2003	12/29/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	10/9/2003	12/29/2003	2/21/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-68.05	P-68.05	P-68.05			
2.	Lab Identification Number	0311141	0312370	0402261			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.002 CFS	.008 CFS	.001 CFS			
8.	Date Above Measurements Made	11/8/2003	12/26/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.1	8.0	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	5.3	4.1	3.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	65	99			
13.	Specific Conductivity (umhos/cm at 25 C)	230	130	200			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.60	0.11	0.12			
16.	Total Sulfates (mg/l)	22	20	18			
17.	Total Iron (mg/l)	0.73	0.86	0.37			
18.	Total Suspended Solids (mg/l)	4.7	2.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	150	80	100			
20.	Nitrates (mg/l)	0.10	7.1	0.26			
21.	Date Sampled for Analysis	11/8/2003	12/26/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	11/6/2003	12/24/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-96.01	P-96.01	P-96.01			
2.	Lab Identification Number	0310453	0312276	0402175			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1160	1160	1160			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.014 CFS	.002 CFS	.001 CFS			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.9	7.90	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	4.4	4.0	4.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	140	140			
13.	Specific Conductivity (umhos/cm at 25 C)	270	300	130			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.17	0.24	0.60			
16.	Total Sulfates (mg/l)	26	29	28			
17.	Total Iron (mg/l)	.72	1.4	4.0			
18.	Total Suspended Solids (mg/l)	9.3	39	190			
19.	Total Hardness (mg/l $CACO_3$)	150	150	100			
20.	Nitrates (mg/l)	.08	0.20	0.35			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-96.07	P-96.07	P-96.07			
2.	Lab Identification Number	0310459	0312279	0402189			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1130	1130	1130			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.006 CFS	.001 CFS	.002 CFS			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	7.30	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	12	2.4	3.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	96	73			
13.	Specific Conductivity (umhos/cm at 25 C)	290	240	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.10	0.26	2.8			
16.	Total Sulfates (mg/l)	40	31	29			
17.	Total Iron (mg/l)	0.78	2.7	19			
18.	Total Suspended Solids (mg/l)	17	40	300			
19.	Total Hardness (mg/l $CACO_3$)	150	140	180			
20.	Nitrates (mg/l)	0.21	0.34	0.44			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-96.09	P-96.09	P-96.09			
2.	Lab Identification Number	0310461	0312281	0402186			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.017 CFS	.003 CFS	.003 CFS			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.5	7.70	7.30			
11.	Total Acidity (mg/l $CaCO_3$)	7.6	2.0	2.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	84	94			
13.	Specific Conductivity (umhos/cm at 25 C)	280	210	250			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.17	0.06	0.20			
16.	Total Sulfates (mg/l)	28	25	32			
17.	Total Iron (mg/l)	0.23	0.29	1.0			
18.	Total Suspended Solids (mg/l)	1.3	3.3	9.3			
19.	Total Hardness (mg/l $CACO_3$)	170	100	110			
20.	Nitrates (mg/l)	0.09	0.28	0.65			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-97.02	P-97.02	P-97.02			
2.	Lab Identification Number	0310465	0312287	0402178			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1180	1180	1180			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0	0	0			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.2	7.20	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	16	12	4.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	120	170			
13.	Specific Conductivity (umhos/cm at 25 C)	240	270	180			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.54	0.34	BDL			
16.	Total Sulfates (mg/l)	23	23	39			
17.	Total Iron (mg/l)	0.26	0.33	0.05			
18.	Total Suspended Solids (mg/l)	1.0	4.7	BDL			
19.	Total Hardness (mg/l $CACO_3$)	150	130	210			
20.	Nitrates (mg/l)	0.12	0.14	3.9			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-97.03	P-97.03	P-97.03			
2.	Lab Identification Number	0310466	0312288	0402179			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1145	1145	1145			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0	.007 CFS	0.0 CFS			
8.	Date Above Measurements Made	10/30/2003	12/22/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.2	7.60	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	3.3	3.8	3.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	170	130	170			
13.	Specific Conductivity (umhos/cm at 25 C)	390	320	180			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.09	0.07	BDL			
16.	Total Sulfates (mg/l)	33	33	37			
17.	Total Iron (mg/l)	0.23	0.81	0.04			
18.	Total Suspended Solids (mg/l)	BDL	7.5	BDL			
19.	Total Hardness (mg/l $CACO_3$)	200	170	230			
20.	Nitrates (mg/l)	0.15	2.5	4.4			
21.	Date Sampled for Analysis	10/30/2003	12/22/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-98.00	P-98.00	P-98.00			
2.	Lab Identification Number	0310481	0401008	0402403			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1215	1215	1215			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0	.001 CFS	.0 CFS			
8.	Date Above Measurements Made	10/30/2003	1/5/2004	2/24/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.3	7.0	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	22	3.6	5.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	35	80			
13.	Specific Conductivity (umhos/cm at 25 C)	270	93	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	3.7	0.26	0.43			
16.	Total Sulfates (mg/l)	22	28	30			
17.	Total Iron (mg/l)	4.5	3.0	4.4			
18.	Total Suspended Solids (mg/l)	6.0	73	100			
19.	Total Hardness (mg/l $CACO_3$)	170	60	160			
20.	Nitrates (mg/l)	0.07	0.39	1.3			
21.	Date Sampled for Analysis	10/30/2003	1/5/2004	2/24/2004			
22.	Date Last Precipitation Event Occurred	10/28/2003	1/4/2004	2/23/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	P-108.01	P-108.01	P-108.01			
2.	Lab Identification Number	0311144	0312383	0402254			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)	7	9	11			
7.	Flow for Spring/Stream (cfs)	0	.001 CFS	0			
8.	Date Above Measurements Made	11/8/2003	12/29/2003	2/18/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.3	8.1	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	5.2	2.0	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	34	35	63			
13.	Specific Conductivity (umhos/cm at 25 C)	62	93	120			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.05	0.08	1.3			
16.	Total Sulfates (mg/l)	20	18	15			
17.	Total Iron (mg/l)	0.07	0.11	0.10			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	70	50	90			
20.	Nitrates (mg/l)	0.07	0.11	0.23			
21.	Date Sampled for Analysis	11/8/2003	12/29/2003	2/18/2004			
22.	Date Last Precipitation Event Occurred	11/6/2003	12/29/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-1	U5-1	U5-1			
2.	Lab Identification Number	0311049	0312290	0403058			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1190	1190	1190			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.13 CFS	.087 CFS	.319 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/1/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.6	7.7	7.50			
11.	Total Acidity (mg/l $CaCO_3$)	6.3	2.5	BDL			
12.	Total Alkalinity (mg/l $CaCO_3$)	92	78	52			
13.	Specific Conductivity (umhos/cm at 25 C)	200	210	240			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.07	0.05	0.24			
16.	Total Sulfates (mg/l)	24	26	34			
17.	Total Iron (mg/l)	0.33	0.10	1.7			
18.	Total Suspended Solids (mg/l)	7.5	BDL	21			
19.	Total Hardness (mg/l $CACO_3$)	100	90	90			
20.	Nitrates (mg/l)	0.22	0.38	0.50			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/1/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	2/24/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-2	U5-2	U5-2			
2.	Lab Identification Number	0311061	0312292	0403144			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1065	1065	1065			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.18 CFS	.275 CFS	.23 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.7	8.3	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	1.2	2.5	5.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	100	81			
13.	Specific Conductivity (umhos/cm at 25 C)	260	270	230			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.01	0.01			
16.	Total Sulfates (mg/l)	30	35	31			
17.	Total Iron (mg/l)	0.08	0.38	0.34			
18.	Total Suspended Solids (mg/l)	1.3	BDL	1.3			
19.	Total Hardness (mg/l $CACO_3$)	140	130	110			
20.	Nitrates (mg/l)	0.27	0.56	2.2			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-3	U5-3	U5-3			
2.	Lab Identification Number	0311062	0312293	0403145			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1090	1090	1090			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.29 CFS	.12 CFS	.37 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.5	8.2	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	2.8	1.7	3.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	90	71			
13.	Specific Conductivity (umhos/cm at 25 C)	290	270	210			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.01			
16.	Total Sulfates (mg/l)	34	34	28			
17.	Total Iron (mg/l)	0.07	0.35	0.35			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	130	130	110			
20.	Nitrates (mg/l)	0.16	0.46	0.63			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-4	U5-4	U5-4			
2.	Lab Identification Number	0311086	0312358	0403146			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1070	1070	1070			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.15 CFS	.6 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.2	7.9	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	11	3.1	4.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	56	68			
13.	Specific Conductivity (umhos/cm at 25 C)	300	150	210			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.81	0.07	0.03			
16.	Total Sulfates (mg/l)	43	25	27			
17.	Total Iron (mg/l)	0.42	0.79	0.53			
18.	Total Suspended Solids (mg/l)	1.0	6.0	40			
19.	Total Hardness (mg/l $CACO_3$)	160	80	110			
20.	Nitrates (mg/l)	0.55	0.66	0.32			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-5	U5-5	U5-5			
2.	Lab Identification Number	0311085	0312357	0402478			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1150	1150	1150			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.13 CFS	.319 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/26/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.1	8.2	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	6.7	3.6	7.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	97	69	86			
13.	Specific Conductivity (umhos/cm at 25 C)	220	230	290			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.12	0.17	0.69			
16.	Total Sulfates (mg/l)	51	30	46			
17.	Total Iron (mg/l)	2.3	1.1	1.4			
18.	Total Suspended Solids (mg/l)	85	17	19			
19.	Total Hardness (mg/l $CACO_3$)	70	90	130			
20.	Nitrates (mg/l)	0.20	0.90	0.53			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/26/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/24/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-6	U5-6	U5-6			
2.	Lab Identification Number	0311040	0312302	0403143			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1115	1115	1115			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.02 CFS	.104 CFS	.24 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	8.1	8.1			
11.	Total Acidity (mg/l $CaCO_3$)	9.4	1.5	4.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	75	72			
13.	Specific Conductivity (umhos/cm at 25 C)	310	200	200			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	0.01			
16.	Total Sulfates (mg/l)	30	29	28			
17.	Total Iron (mg/l)	0.04	0.09	0.23			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	160	100	100			
20.	Nitrates (mg/l)	0.51	1.4	6.5			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-7	U5-7	U5-7			
2.	Lab Identification Number	0311036	0312303	0403140			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1110	1110	1110			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.090 CFS	.07 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.8	8.0	8.2			
11.	Total Acidity (mg/l $CaCO_3$)	3.1	1.6	2.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	77	95	73			
13.	Specific Conductivity (umhos/cm at 25 C)	240	230	140			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.01			
16.	Total Sulfates (mg/l)	28	29	26			
17.	Total Iron (mg/l)	0.07	0.07	0.20			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	100	100	100			
20.	Nitrates (mg/l)	0.54	0.28	0.31			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-8	U5-8	U5-8			
2.	Lab Identification Number	0311093	0312305	0403142			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1155	1155	1155			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.007 CFS	.169 CFS	.027 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.5	8.3	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	7.3	1.4	5.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	150	83	58			
13.	Specific Conductivity (umhos/cm at 25 C)	280	220	140			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.22	BDL	0.03			
16.	Total Sulfates (mg/l)	31	26	25			
17.	Total Iron (mg/l)	0.74	0.06	0.78			
18.	Total Suspended Solids (mg/l)	31	BDL	11			
19.	Total Hardness (mg/l $CACO_3$)	170	90	90			
20.	Nitrates (mg/l)	0.18	0.25	0.41			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-9	U5-9	U5-9			
2.	Lab Identification Number	0311034	0312322	0405214			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1100	1100	1100			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.03 CFS	.27 CFS			
8.	Date Above Measurements Made	11/3/2003	12/23/2003	3/1/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	6.9	7.8	8.20			
11.	Total Acidity (mg/l $CaCO_3$)	14	7.6	3.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	87	83	120			
13.	Specific Conductivity (umhos/cm at 25 C)	250	250	220			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.06	0.03			
16.	Total Sulfates (mg/l)	25	22	30			
17.	Total Iron (mg/l)	0.16	0.42	0.51			
18.	Total Suspended Solids (mg/l)	3.3	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	130	90	140			
20.	Nitrates (mg/l)	0.33	0.60	0.62			
21.	Date Sampled for Analysis	11/3/2003	12/23/2003	3/1/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/24/2004			

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1.	Identification No. of Sampling Station from Hydrology Map	U5-10	U5-10	U5-10			
2.	Lab Identification Number	0311029	0312365	0402133			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1190	1190	1190			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.0176 CFS	.135 CFS	.045 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	5.04	7.9	6.90			
11.	Total Acidity (mg/l $CaCO_3$)	12	4.6	11			
12.	Total Alkalinity (mg/l $CaCO_3$)	160	51	92			
13.	Specific Conductivity (umhos/cm at 25 C)	30	120	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.06	0.03	0.06			
16.	Total Sulfates (mg/l)	24	22	19			
17.	Total Iron (mg/l)	0.15	0.31	2.0			
18.	Total Suspended Solids (mg/l)	1.0	4.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	160	80	110			
20.	Nitrates (mg/l)	0.25	0.81	0.58			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-11	U5-11	U5-11			
2.	Lab Identification Number	0311026	0312366	0402127			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.10 CFS	.053 CFS	.001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.0	7.8	7.40			
11.	Total Acidity (mg/l $CaCO_3$)	3.2	3.6	3.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	67	43	28			
13.	Specific Conductivity (umhos/cm at 25 C)	160	140	93			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.03	0.03	0.08			
16.	Total Sulfates (mg/l)	27	23	34			
17.	Total Iron (mg/l)	0.26	0.48	1.5			
18.	Total Suspended Solids (mg/l)	3.3	2.0	53			
19.	Total Hardness (mg/l $CACO_3$)	90	90	90			
20.	Nitrates (mg/l)	0.11	0.31	0.16			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map		U5-12	U5-12	U5-12		
2.	Lab Identification Number		0311025	0312230	0402122		
3.	High (H)/Low (L) Designation (if applicable)		supplemental	I	H		
4.	Surface Elevation for Sampling Station (msl)		1190	1190	1190		
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)		.07 CFS	.0003 CFS	.001 CFS		
8.	Date Above Measurements Made		11/3/2003	12/16/2003	2/16/2004		
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)		7.3	6.9	6.60		
11.	Total Acidity (mg/l $CaCO_3$)		3.6	3.4	18		
12.	Total Alkalinity (mg/l $CaCO_3$)		74	46	55		
13.	Specific Conductivity (umhos/cm at 25 C)		170	120	110		
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)		0.01	0.07	0.13		
16.	Total Sulfates (mg/l)		25	24	30		
17.	Total Iron (mg/l)		0.07	2.2	1.5		
18.	Total Suspended Solids (mg/l)		1.0	34	100		
19.	Total Hardness (mg/l $CACO_3$)		80	70	100		
20.	Nitrates (mg/l)		0.24	0.22	0.17		
21.	Date Sampled for Analysis		11/3/2003	12/16/2003	2/16/2004		
22.	Date Last Precipitation Event Occurred		11/2/2003	12/16/2003	2/6/2004		

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-13	U5-13	U5-13			
2.	Lab Identification Number	0311083	0312325	0403113			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.004 CFS	.02 CFS	.005 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.3	7.5	8.1			
11.	Total Acidity (mg/l $CaCO_3$)	6.3	2.1	3.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	28	33			
13.	Specific Conductivity (umhos/cm at 25 C)	240	100	120			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.07	0.05	0.02			
16.	Total Sulfates (mg/l)	25	27	18			
17.	Total Iron (mg/l)	1.6	3.8	1.1			
18.	Total Suspended Solids (mg/l)	63	49	25			
19.	Total Hardness (mg/l $CACO_3$)	150	50	60			
20.	Nitrates (mg/l)	0.30	0.38	0.45			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/4/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-14	U5-14	U5-14			
2.	Lab Identification Number	0311024	0312324	0403112			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1220	1220	1220			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.01 CFS	.013 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.34	7.7	8.4			
11.	Total Acidity (mg/l $CaCO_3$)	3.0	1.9	1.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	98	45	40			
13.	Specific Conductivity (umhos/cm at 25 C)	200	120	120			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.02	0.02			
16.	Total Sulfates (mg/l)	24	20	22			
17.	Total Iron (mg/l)	0.78	0.69	1.4			
18.	Total Suspended Solids (mg/l)	18	15	8.7			
19.	Total Hardness (mg/l $CACO_3$)	100	60	70			
20.	Nitrates (mg/l)	0.12	0.19	0.37			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/4/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-15	U5-15	U5-15			
2.	Lab Identification Number	0311027	0312234	0402124			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1225	1225	1225			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.001 CFS	.003 CFS			
8.	Date Above Measurements Made	11/4/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.30	8.2	7.00			
11.	Total Acidity (mg/l $CaCO_3$)	4.8	2.5	8.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	86	60	62			
13.	Specific Conductivity (umhos/cm at 25 C)	180	150	170			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.21	0.03	0.48			
16.	Total Sulfates (mg/l)	30	25	33			
17.	Total Iron (mg/l)	4.1	1.3	0.65			
18.	Total Suspended Solids (mg/l)	190	20	13			
19.	Total Hardness (mg/l $CACO_3$)	100	70	100			
20.	Nitrates (mg/l)	0.56	1.8	1.6			
21.	Date Sampled for Analysis	11/4/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/16/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-16	U5-16	U5-16			
2.	Lab Identification Number	0311028	0312235	0402134			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.001 CFS	.001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.35	7.8	7.30			
11.	Total Acidity (mg/l $CaCO_3$)	5.2	3.1	6.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	70	89			
13.	Specific Conductivity (umhos/cm at 25 C)	240	200	190			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.11	0.07	0.02			
16.	Total Sulfates (mg/l)	28	26	21			
17.	Total Iron (mg/l)	1.5	1.2	0.30			
18.	Total Suspended Solids (mg/l)	220	45	13			
19.	Total Hardness (mg/l $CACO_3$)	120	100	110			
20.	Nitrates (mg/l)	0.23	0.38	0.15			
21.	Date Sampled for Analysis	11/4/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/16/2003	2/6/2004			

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1.	Identification No. of Sampling Station from Hydrology Map	U5-17	U5-17	U5-17			
2.	Lab Identification Number	0311030	0312323	0402184			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.15 CFS	0 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	2/17/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.61	8.1	7.30			
11.	Total Acidity (mg/l $CaCO_3$)	6.7	3.2	4.2			
12.	Total Alkalinity (mg/l $CaCO_3$)	160	88	200			
13.	Specific Conductivity (umhos/cm at 25 C)	460	250	470			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.30	0.03	0.26			
16.	Total Sulfates (mg/l)	30	26	38			
17.	Total Iron (mg/l)	0.85	0.35	4.3			
18.	Total Suspended Solids (mg/l)	1.0	BDL	61			
19.	Total Hardness (mg/l $CACO_3$)	190	100	250			
20.	Nitrates (mg/l)	0.30	0.48	1.1			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	2/17/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-21	U5-21	U5-21			
2.	Lab Identification Number	0311048	0312320	0403123			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1160	1160	1160			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.02 CFS	.21 CFS	.0033 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.8	7.9	6.50			
11.	Total Acidity (mg/l $CaCO_3$)	5.8	3.4	2.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	85	77			
13.	Specific Conductivity (umhos/cm at 25 C)	260	280	210			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.01	0.29			
16.	Total Sulfates (mg/l)	30	28	27			
17.	Total Iron (mg/l)	0.12	0.18	4.8			
18.	Total Suspended Solids (mg/l)	1.0	BDL	210			
19.	Total Hardness (mg/l $CACO_3$)	140	110	110			
20.	Nitrates (mg/l)	0.08	0.17	0.34			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-22	U5-22	U5-22			
2.	Lab Identification Number	0311096	0312319	0403124			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.006 CFS	.03 CFS	.0005 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.2	8.0	7.30			
11.	Total Acidity (mg/l $CaCO_3$)	5.9	5.5	4.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	170	120	74			
13.	Specific Conductivity (umhos/cm at 25 C)	340	400	230			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.10	0.27	0.29			
16.	Total Sulfates (mg/l)	25	27	35			
17.	Total Iron (mg/l)	0.15	0.20	3.4			
18.	Total Suspended Solids (mg/l)	1.0	BDL	410			
19.	Total Hardness (mg/l $CACO_3$)	180	130	110			
20.	Nitrates (mg/l)	0.10	0.41	0.48			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-23	U5-23	U5-23			
2.	Lab Identification Number	0311052	0312306	0403125			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.15 CFS	.032 CFS	.03 CFS			
8.	Date		[illegible]				
	Aquifer/Zone Identification [illegible]						
10.	pH(Standard [illegible]						
11.	Total [illegible]ity (mg/l $CaCO_3$)	5.1	3.1	4.1			
12.	Total Alk[illegible]	[illegible]					
13.	Specific Conductivity (umhos [illegible] at 25 C)	38	[illegible]				
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.04	0.05			
16.	Total Sulfates (mg/l)	32	29	30			
17.	Total Iron (mg/l)	0.07	0.13	1.6			
18.	Total Suspended Solids (mg/l)	1.0	BDL	68			
19.	Total Hardness (mg/l $CACO_3$)	160	140	140			
20.	Nitrates (mg/l)	0.10	0.27	0.42			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-24	U5-24	U5-24			
2.	Lab Identification Number	0311053	0312307	0403126			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.04 CFS	.029 CFS	.004 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.5	8.2	6.60			
11.	Total Acidity (mg/l $CaCO_3$)	3.2	4.6	2.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	210	120	30			
13.	Specific Conductivity (umhos/cm at 25 C)	410	300	110			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.03	0.01	0.01			
16.	Total Sulfates (mg/l)	37	34	24			
17.	Total Iron (mg/l)	0.26	0.16	0.19			
18.	Total Suspended Solids (mg/l)	6.7	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	210	120	60			
20.	Nitrates (mg/l)	0.15	0.23	0.37			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-25	U5-25	U5-25			
2.	Lab Identification Number	0311033	0312333	0402476			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1180	1180	1180			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0	.51 CFS	.002 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	2/26/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.13	8.0	6.7			
11.	Total Acidity (mg/l $CaCO_3$)	5.0	5.3	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	72	87	55			
13.	Specific Conductivity (umhos/cm at 25 C)	190	150	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.04	0.01			
16.	Total Sulfates (mg/l)	36	24	23			
17.	Total Iron (mg/l)	0.83	0.42	0.69			
18.	Total Suspended Solids (mg/l)	120	BDL	61			
19.	Total Hardness (mg/l $CACO_3$)	90	90	90			
20.	Nitrates (mg/l)	0.23	2.2	0.45			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	2/26/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/24/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-26	U5-26	U5-26			
2.	Lab Identification Number	0311055	0312334	0403135			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.64 CFS	.24CFS	.338 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	8.1	8.3			
11.	Total Acidity (mg/l $CaCO_3$)	4.0	2.8	BDL			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	91	88			
13.	Specific Conductivity (umhos/cm at 25 C)	300	170	220			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.05			
16.	Total Sulfates (mg/l)	32	26	28			
17.	Total Iron (mg/l)	0.04	0.29	1.4			
18.	Total Suspended Solids (mg/l)	1.0	BDL	46			
19.	Total Hardness (mg/l $CACO_3$)	150	90	110			
20.	Nitrates (mg/l)	0.12	0.26	0.48			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-27	U5-27	U5-27			
2.	Lab Identification Number	0311056	0312335	0403136			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1175	1175	1175			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.007 CFS	.009 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	6.0	7.3	7.8			
11.	Total Acidity (mg/l $CaCO_3$)	13	5.6	BDL			
12.	Total Alkalinity (mg/l $CaCO_3$)	100	60	53			
13.	Specific Conductivity (umhos/cm at 25 C)	250	130	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.03	0.01			
16.	Total Sulfates (mg/l)	42	31	34			
17.	Total Iron (mg/l)	0.27	0.49	0.19			
18.	Total Suspended Solids (mg/l)	10	11	2.0			
19.	Total Hardness (mg/l $CACO_3$)	140	70	90			
20.	Nitrates (mg/l)	0.58	0.84	2.6			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-28	U5-28	U5-28			
2.	Lab Identification Number	0311057	0312336	0403128			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1205	1205	1205			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.002 CFS	.01 CFS	.007 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	6.5	7.9	6.40			
11.	Total Acidity (mg/l $CaCO_3$)	8.9	5.8	2.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	58	38	36			
13.	Specific Conductivity (umhos/cm at 25 C)	150	93	140			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.46	0.24	0.33			
16.	Total Sulfates (mg/l)	21	22	23			
17.	Total Iron (mg/l)	1.6	1.3	6.4			
18.	Total Suspended Solids (mg/l)	13	BDL	140			
19.	Total Hardness (mg/l $CACO_3$)	100	60	100			
20.	Nitrates (mg/l)	0.10	0.40	0.42			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-29	U5-29	U5-29			
2.	Lab Identification Number	0311058	0312330	0403129			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.03 CFS	.132 CFS	.003 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.3	7.4	6.20			
11.	Total Acidity (mg/l $CaCO_3$)	8.1	3.8	5.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	110	64	56			
13.	Specific Conductivity (umhos/cm at 25 C)	220	180	190			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.17	0.04	0.02			
16.	Total Sulfates (mg/l)	28	26	28			
17.	Total Iron (mg/l)	0.62	0.34	0.36			
18.	Total Suspended Solids (mg/l)	2.0	4.0	6.7			
19.	Total Hardness (mg/l $CACO_3$)	100	90	90			
20.	Nitrates (mg/l)	0.08	0.52	0.37			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-30	U5-30	U5-30			
2.	Lab Identification Number	0311064	0312297	0402310			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1190	1190	1190			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.009 CFS	.069 CFS	.001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	8.0	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	3.3	2.5	4.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	71	51	54			
13.	Specific Conductivity (umhos/cm at 25 C)	200	160	203			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.01			
16.	Total Sulfates (mg/l)	30	31	36			
17.	Total Iron (mg/l)	0.08	0.40	0.64			
18.	Total Suspended Solids (mg/l)	1.0	BDL	7.0			
19.	Total Hardness (mg/l $CACO_3$)	100	80	90			
20.	Nitrates (mg/l)	0.11	0.21	4.2			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	2/20/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-31	U5-31	U5-31			
2.	Lab Identification Number	0311063	0312296	0402345			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.007 CFS	0 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.0	7.6	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	4.7	3.0	11			
12.	Total Alkalinity (mg/l $CaCO_3$)	78	58	33			
13.	Specific Conductivity (umhos/cm at 25 C)	200	200	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.11	0.04	0.02			
16.	Total Sulfates (mg/l)	44	37	35			
17.	Total Iron (mg/l)	1.2	0.57	0.43			
18.	Total Suspended Solids (mg/l)	29	11	44			
19.	Total Hardness (mg/l $CACO_3$)	140	80	90			
20.	Nitrates (mg/l)	0.20	0.28	0.28			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	2/21/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-32	U5-32	U5-32			
2.	Lab Identification Number	0311084	0312329	0402315			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1220	1220	1220			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.01 CFS	0 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	6.2	6.8	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	19	4.9	1.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	54	40	35			
13.	Specific Conductivity (umhos/cm at 25 C)	100	130	150			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.07	0.01	0.02			
16.	Total Sulfates (mg/l)	29	28	30			
17.	Total Iron (mg/l)	1.2	0.17	0.62			
18.	Total Suspended Solids (mg/l)	40	BDL	31			
19.	Total Hardness (mg/l $CACO_3$)	90	50	70			
20.	Nitrates (mg/l)	0.16	0.49	2.5			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	2/20/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-33	U5-33	U5-33			
2.	Lab Identification Number	0311059	0312309	0403130			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.09 CFS	.132 CFS	1.04 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	6.7	7.5	6.20			
11.	Total Acidity (mg/l $CaCO_3$)	4.2	2.6	2.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	46	30	24			
13.	Specific Conductivity (umhos/cm at 25 C)	120	130	140			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.10	0.05	0.03			
16.	Total Sulfates (mg/l)	28	26	27			
17.	Total Iron (mg/l)	0.24	0.15	0.34			
18.	Total Suspended Solids (mg/l)	9.5	BDL	32			
19.	Total Hardness (mg/l $CACO_3$)	60	40	60			
20.	Nitrates (mg/l)	0.67	1.1	2.4			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-34	U5-34	U5-34			
2.	Lab Identification Number	0311031	0312331	0403131			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.008 CFS	.27 CFS	.002 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.25	7.4	6.0			
11.	Total Acidity (mg/l $CaCO_3$)	5.8	5.8	6.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	85	68	51			
13.	Specific Conductivity (umhos/cm at 25 C)	190	190	170			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	1.2	0.01	0.26			
16.	Total Sulfates (mg/l)	28	26	24			
17.	Total Iron (mg/l)	14	0.71	3.1			
18.	Total Suspended Solids (mg/l)	380	8.0	160			
19.	Total Hardness (mg/l $CACO_3$)	150	90	90			
20.	Nitrates (mg/l)	0.34	2.0	0.28			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-35	U5-35	U5-35			
2.	Lab Identification Number	0311032	0312332	0402284			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.12 CFS	.09 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.15	7.3	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	6.4	4.2	9.9			
12.	Total Alkalinity (mg/l $CaCO_3$)	99	66	80			
13.	Specific Conductivity (umhos/cm at 25 C)	250	160	250			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.09	0.03	0.42			
16.	Total Sulfates (mg/l)	35	26	37			
17.	Total Iron (mg/l)	1.1	2.2	4.9			
18.	Total Suspended Solids (mg/l)	53	43	43			
19.	Total Hardness (mg/l $CACO_3$)	160	80	130			
20.	Nitrates (mg/l)	0.21	2.4	0.42			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/6/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-36	U5-36	U5-36			
2.	Lab Identification Number	0311054	0312337	0403127			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.07 CFS	.008 CFS	.0033 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.0	6.9	6.20			
11.	Total Acidity (mg/l $CaCO_3$)	7.0	3.7	4.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	65	45	42			
13.	Specific Conductivity (umhos/cm at 25 C)	170	93	180			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.36	0.04	0.02			
16.	Total Sulfates (mg/l)	26	24	25			
17.	Total Iron (mg/l)	1.6	0.20	0.33			
18.	Total Suspended Solids (mg/l)	14	BDL	13			
19.	Total Hardness (mg/l $CACO_3$)	100	60	70			
20.	Nitrates (mg/l)	0.11	0.32	0.42			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-37	U5-37	U5-37			
2.	Lab Identification Number	0311089	0312361	0402401			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.3 CFS	.025 CFS	.23 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/24/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	7.5	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	12	<1.0	4.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	93	42	60			
13.	Specific Conductivity (umhos/cm at 25 C)	220	260	140			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.03	0.09			
16.	Total Sulfates (mg/l)	34	25	27			
17.	Total Iron (mg/l)	0.08	0.27	0.93			
18.	Total Suspended Solids (mg/l)	1.0	BDL	67			
19.	Total Hardness (mg/l $CACO_3$)	110	90	100			
20.	Nitrates (mg/l)	0.08	0.18	0.55			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/24/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/23/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-38	U5-38	U5-38			
2.	Lab Identification Number	0311087	0312359	0402479			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1220	1220	1220			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.05 CFS	.001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	2/26/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.4	8.1	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	7.5	6.7	6.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	160	200	200			
13.	Specific Conductivity (umhos/cm at 25 C)	400	610	670			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.25	0.08	0.06			
16.	Total Sulfates (mg/l)	32	46	54			
17.	Total Iron (mg/l)	0.91	0.93	1.0			
18.	Total Suspended Solids (mg/l)	9.3	24	27			
19.	Total Hardness (mg/l $CACO_3$)	170	270	280			
20.	Nitrates (mg/l)	0.16	2.7	2.3			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	2/26/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/24/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-39	U5-39	U5-39			
2.	Lab Identification Number	0311039	0312301	0403138			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1100	1100	1100			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.02 CFS	.825 CFS	.32 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.9	8.2	8.2			
11.	Total Acidity (mg/l $CaCO_3$)	3.1	1.4	2.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	100	87	59			
13.	Specific Conductivity (umhos/cm at 25 C)	210	230	170			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.01			
16.	Total Sulfates (mg/l)	22	20	26			
17.	Total Iron (mg/l)	0.30	0.04	0.32			
18.	Total Suspended Solids (mg/l)	6.7	BDL	6.0			
19.	Total Hardness (mg/l $CACO_3$)	110	120	120			
20.	Nitrates (mg/l)	0.15	0.36	3.1			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-40	U5-40	U5-40			
2.	Lab Identification Number	0311088	0312360	0403132			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1225	1225	1225			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.008 CFS	.009 CFS	.0008 CFS			
8.	Date Above Measurements Made	11/4/2003	12/24/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.5	8.0	7.00			
11.	Total Acidity (mg/l $CaCO_3$)	9.5	8.2	8.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	230	220	200			
13.	Specific Conductivity (umhos/cm at 25 C)	750	1300	1500			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.07	0.12	0.19			
16.	Total Sulfates (mg/l)	32	31	36			
17.	Total Iron (mg/l)	0.38	0.82	3.2			
18.	Total Suspended Solids (mg/l)	16	31	180			
19.	Total Hardness (mg/l $CACO_3$)	280	310	350			
20.	Nitrates (mg/l)	0.68	2.0	0.80			
21.	Date Sampled for Analysis	11/4/2003	12/24/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-41	U5-41	U5-41			
2.	Lab Identification Number	0311037	0312304	0403141			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1105	1105	1105			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.182 CFS	.48 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.8	8.2	6.5			
11.	Total Acidity (mg/l $CaCO_3$)	5.3	2.1	8.5			
12.	Total Alkalinity (mg/l $CaCO_3$)	150	93	40			
13.	Specific Conductivity (umhos/cm at 25 C)	320	240	180			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.05	BDL	0.03			
16.	Total Sulfates (mg/l)	31	26	26			
17.	Total Iron (mg/l)	0.10	0.06	0.54			
18.	Total Suspended Solids (mg/l)	1.0	BDL	12			
19.	Total Hardness (mg/l $CACO_3$)	170	90	100			
20.	Nitrates (mg/l)	0.14	0.32	0.78			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-42	U5-42	U5-42			
2.	Lab Identification Number	0311092	0312317	0403134			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.003 CFS	.008 CFS	.009 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	6.0	7.1	6.40			
11.	Total Acidity (mg/l $CaCO_3$)	7.3	4.1	150			
12.	Total Alkalinity (mg/l $CaCO_3$)	46	31	<1.3			
13.	Specific Conductivity (umhos/cm at 25 C)	92	84	890			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.07	BDL	0.02			
16.	Total Sulfates (mg/l)	22	21	37			
17.	Total Iron (mg/l)	0.98	0.05	0.19			
18.	Total Suspended Solids (mg/l)	36	BDL	6.0			
19.	Total Hardness (mg/l $CACO_3$)	90	40	180			
20.	Nitrates (mg/l)	0.06	<0.0	0.47			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-43	U5-43	U5-43			
2.	Lab Identification Number	0311090	0312315	0402397			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.11 CFS	.0001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	2/24/2003			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	6.5	7.3	8.3			
11.	Total Acidity (mg/l $CaCO_3$)	1.0	4.0	BDL			
12.	Total Alkalinity (mg/l $CaCO_3$)	44	44	20			
13.	Specific Conductivity (umhos/cm at 25 C)	100	120	62			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.30	0.03	0.05			
16.	Total Sulfates (mg/l)	33	29	24			
17.	Total Iron (mg/l)	1.3	0.13	0.59			
18.	Total Suspended Solids (mg/l)	86	BDL	17			
19.	Total Hardness (mg/l $CACO_3$)	70	70	50			
20.	Nitrates (mg/l)	0.46	0.56	0.54			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	2/24/2003			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/23/2003			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-44	U5-44	U5-44			
2.	Lab Identification Number	0311091	0312316	0402398			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.12 CFS	.001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	2/24/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.3	8.0	7.8			
11.	Total Acidity (mg/l $CaCO_3$)	9.9	4.9	4.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	180	100	120			
13.	Specific Conductivity (umhos/cm at 25 C)	360	250	240			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.32	0.08	0.07			
16.	Total Sulfates (mg/l)	26	28	31			
17.	Total Iron (mg/l)	0.45	2.0	2.1			
18.	Total Suspended Solids (mg/l)	5.3	34	96			
19.	Total Hardness (mg/l $CACO_3$)	210	120	140			
20.	Nitrates (mg/l)	0.22	0.61	0.70			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	2/24/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/23/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-45	U5-45	U5-45			
2.	Lab Identification Number	0311095	0312318	0403133			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.006 CFS	.02 CFS	.004 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/8/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.3	7.9	6.60			
11.	Total Acidity (mg/l $CaCO_3$)	4.4	5.4	4.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	150	140	140			
13.	Specific Conductivity (umhos/cm at 25 C)	290	420	710			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.10	0.06	0.07			
16.	Total Sulfates (mg/l)	42	42	37			
17.	Total Iron (mg/l)	1.1	1.2	0.46			
18.	Total Suspended Solids (mg/l)	52	49	13			
19.	Total Hardness (mg/l $CACO_3$)	190	160	250			
20.	Nitrates (mg/l)	0.37	0.41	0.26			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/8/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	3/7/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-46	U5-46	U5-46			
2.	Lab Identification Number	0311097	0312308	0402477			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.0001 CFS	.004 CFS	.001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/22/2003	2/26/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.0	7.4	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	24	12	8.3			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	190	110			
13.	Specific Conductivity (umhos/cm at 25 C)	460	510	440			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	1.7	0.56	0.07			
16.	Total Sulfates (mg/l)	28	29	28			
17.	Total Iron (mg/l)	0.54	0.18	0.45			
18.	Total Suspended Solids (mg/l)	1.0	BDL	19			
19.	Total Hardness (mg/l $CACO_3$)	230	260	180			
20.	Nitrates (mg/l)	0.37	0.64	2.2			
21.	Date Sampled for Analysis	11/4/2003	12/22/2003	2/26/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/19/2003	2/24/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-47	U5-47	U5-47			
2.	Lab Identification Number	0311035	0312321	0403054			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1230	1230	1230			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.0002 CFS	.001 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	3/1/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.7	8.0	8.0			
11.	Total Acidity (mg/l $CaCO_3$)	5.7	3.7	3.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	52	77			
13.	Specific Conductivity (umhos/cm at 25 C)	360	170	160			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.02	0.02	0.17			
16.	Total Sulfates (mg/l)	41	26	28			
17.	Total Iron (mg/l)	0.26	1.1	1.5			
18.	Total Suspended Solids (mg/l)	3.3	4.0	41			
19.	Total Hardness (mg/l $CACO_3$)	150	80	130			
20.	Nitrates (mg/l)	0.41	0.79	0.48			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	3/1/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/24/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-48	U5-48	U5-48			
2.	Lab Identification Number	0311094	0312314	0402400			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1200	1200	1200			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001 CFS	.003 CFS	0 CFS			
8.	Date Above Measurements Made	11/4/2003	12/23/2003	2/24/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	7.5	8.5	7.8			
11.	Total Acidity (mg/l $CaCO_3$)	5.6	3.2	3.1			
12.	Total Alkalinity (mg/l $CaCO_3$)	150	47	86			
13.	Specific Conductivity (umhos/cm at 25 C)	290	120	180			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.04	0.02	0.10			
16.	Total Sulfates (mg/l)	32	23	38			
17.	Total Iron (mg/l)	1.1	0.42	3.1			
18.	Total Suspended Solids (mg/l)	79	11	150			
19.	Total Hardness (mg/l $CACO_3$)	180	60	130			
20.	Nitrates (mg/l)	0.31	0.41	0.78			
21.	Date Sampled for Analysis	11/4/2003	12/23/2003	2/24/2004			
22.	Date Last Precipitation Event Occurred	11/2/2003	12/23/2003	2/23/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-50	U5-50	U5-50			
2.	Lab Identification Number	0404181	0405190	0408163			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1080	1080	1080			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	.001	0.73 CFS	0.01 CFS			
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.8	7.9	7.8			
11.	Total Acidity (mg/l $CaCO_3$)	1.1	4.2	10			
12.	Total Alkalinity (mg/l $CaCO_3$)	65	76	80			
13.	Specific Conductivity (umhos/cm at 25 C)	210	200	240			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	.07	0.240			
16.	Total Sulfates (mg/l)	24	24	30			
17.	Total Iron (mg/l)	.42	1.2	0.16			
18.	Total Suspended Solids (mg/l)	6.5	32	BDL			
19.	Total Hardness (mg/l $CACO_3$)	180	90	100			
20.	Nitrates (mg/l)	.36	.52	0.17			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-51	U5-51	U5-51			
2.	Lab Identification Number	0404172	0405175	0408149			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1100	1100	1100			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	3.45 CFS	3.24 CFS	0.04 CFS			
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.9	7.8	8.2			
11.	Total Acidity (mg/l $CaCO_3$)	2.2	7.5	7.9			
12.	Total Alkalinity (mg/l $CaCO_3$)	74	99	120			
13.	Specific Conductivity (umhos/cm at 25 C)	240	200	360			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.04	.06	0.05			
16.	Total Sulfates (mg/l)	22	20	17			
17.	Total Iron (mg/l)	.24	.43	0.24			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	90	90	150			
20.	Nitrates (mg/l)	.10	.23	0.12			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	U5-52	U5-52	U5-52			
2.	Lab Identification Number	0404171	0405174	0408148			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1170	1170	1170			
5.	Depth of Well below Land Surface (msl)						
6.	Static Water Level of Well below Land Surface (feet)						
7.	Flow for Spring/Stream (cfs)	0.78 CFS	0.06 CFS	0.03 CFS			
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring						
10.	pH(Standard Units)	8.1	7.7	8.2			
11.	Total Acidity (mg/l $CaCO_3$)	1.3	8.0	8.6			
12.	Total Alkalinity (mg/l $CaCO_3$)	64	88	130			
13.	Specific Conductivity (umhos/cm at 25 C)	210	250	340			
14.	Total Dissolved Solids (mg/l)			NA			
15.	Total Manganese (mg/l)	.08	.06	.048			
16.	Total Sulfates (mg/l)	22	19	19			
17.	Total Iron (mg/l)	1.2	.38	.34			
18.	Total Suspended Solids (mg/l)	38	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	70	100	160			
20.	Nitrates (mg/l)	.28	.25	0.12			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-14.00	W-14.00	W-14.00			
2.	Lab Identification Number	0310222	0307363	0402475			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1310	1310	1310			
5.	Depth of Well below Land Surface (msl)	51.4	51.4	51.4			
6.	Static Water Level of Well below Land Surface (feet)	28.0	29.0	27.5			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/13/2003	7/28/2003	2/26/2004			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7	7.3	6.8			
11.	Total Acidity (mg/l $CaCO_3$)	14	20	23			
12.	Total Alkalinity (mg/l $CaCO_3$)	230	250	240			
13.	Specific Conductivity (umhos/cm at 25 C)	730	700	670			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	BDL			
16.	Total Sulfates (mg/l)	89	98	100			
17.	Total Iron (mg/l)	BDL	0.04	BDL			
18.	Total Suspended Solids (mg/l)	BDL	1.0	BDL			
19.	Total Hardness (mg/l $CACO_3$)	350	350	340			
20.	Nitrates (mg/l)	2.3	2.1	3.3			
21.	Date Sampled for Analysis	10/13/2003	7/28/2003	2/26/2004			
22.	Date Last Precipitation Event Occurred	10/9/2003	7/28/2003	2/24/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-26.00	W-26.00	W-26.00			
2.	Lab Identification Number	0309080	0401010	0403115			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1300	1300	1300			
5.	Depth of Well below Land Surface (msl)	83	83	83			
6.	Static Water Level of Well below Land Surface (feet)	35.0	30.5	44.8			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	9/8/2003	1/5/2004	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring	A and B	A and B	A and B			
10.	pH(Standard Units)	8.5	7.55	8.0			
11.	Total Acidity (mg/l $CaCO_3$)	4.2	3.0	5.0			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	120	120			
13.	Specific Conductivity (umhos/cm at 25 C)	250	250	270			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.03	BDL	0.01			
16.	Total Sulfates (mg/l)	30	29	32			
17.	Total Iron (mg/l)	.63	0.08	0.19			
18.	Total Suspended Solids (mg/l)	10	BDL	1.3			
19.	Total Hardness (mg/l $CACO_3$)	140	130	150			
20.	Nitrates (mg/l)	1.3	0.62	1.1			
21.	Date Sampled for Analysis	9/8/2003	1/5/2004	3/8/2004			
22.	Date Last Precipitation Event Occurred	9/3/2003	1/4/2004	3/7/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-28.03	W-28.03	W-28.03			
2.	Lab Identification Number	0310283	0308014	0402354			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1320	1320	1320			
5.	Depth of Well below Land Surface (msl)	N/A	N/A	N/A			
6.	Static Water Level of Well below Land Surface (feet)	No access	no access	No access			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/13/2003	7/30/2003	2/23/2004			
9.	Aquifer/Zone Identification for Well/Spring	Unknown	Unknown	Unknown			
10.	pH(Standard Units)	7.5	7.4	7.1			
11.	Total Acidity (mg/l $CaCO_3$)	6.6	7.5	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	200	260			
13.	Specific Conductivity (umhos/cm at 25 C)	490	450	630			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	0.01			
16.	Total Sulfates (mg/l)	34	37	26			
17.	Total Iron (mg/l)	0.12	0.12	BDL			
18.	Total Suspended Solids (mg/l)	1.0	1.0	11			
19.	Total Hardness (mg/l $CACO_3$)	230	230	300			
20.	Nitrates (mg/l)	2.5	2.9	0.42			
21.	Date Sampled for Analysis	10/13/2003	7/30/2003	2/23/2004			
22.	Date Last Precipitation Event Occurred	10/9/2003	7/28/2003	2/21/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-29.00	W-29.00	W-29.00			
2.	Lab Identification Number	0310276	0402474	308009			
3.	High (H)/Low (L) Designation (if applicable)	L	H	I			
4.	Surface Elevation for Sampling Station (msl)	1340	1340	1340			
5.	Depth of Well below Land Surface (msl)	67	67	67			
6.	Static Water Level of Well below Land Surface (feet)	30.8	29.5	29.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/13/2003	2/26/2004	7/30/2003			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.4	7.2	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	5	5.8	6.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	180	150	170			
13.	Specific Conductivity (umhos/cm at 25 C)	460	320	390			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	BDL	BDL			
16.	Total Sulfates (mg/l)	36	34	34			
17.	Total Iron (mg/l)	BDL	0.05	BDL			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	190	160	200			
20.	Nitrates (mg/l)	0.92	0.46	1.50			
21.	Date Sampled for Analysis	10/13/2003	2/26/2004	7/30/2003			
22.	Date Last Precipitation Event Occurred	10/9/2003	2/24/2004	7/28/2003			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-30.00	W-30.00	W-30.00			
2.	Lab Identification Number	0310223	0402355	0307324			
3.	High (H)/Low (L) Designation (if applicable)	L	H	I			
4.	Surface Elevation for Sampling Station (msl)	1338	1338	1338			
5.	Depth of Well below Land Surface (msl)	66.3	66.3	66.3			
6.	Static Water Level of Well below Land Surface (feet)	43.0	41.8	44			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/13/2003	2/23/2004	7/24/2003			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.2	7.0	7.0			
11.	Total Acidity (mg/l $CaCO_3$)	9.3	9.2	9.9			
12.	Total Alkalinity (mg/l $CaCO_3$)	130	140	110			
13.	Specific Conductivity (umhos/cm at 25 C)	300	380	300			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	0.01	BDL			
16.	Total Sulfates (mg/l)	31	38	34			
17.	Total Iron (mg/l)	0.09	0.06	0.09			
18.	Total Suspended Solids (mg/l)	BDL	BDL	1.3			
19.	Total Hardness (mg/l $CACO_3$)	170	170	150			
20.	Nitrates (mg/l)	4.6	4.6	4.0			
21.	Date Sampled for Analysis	10/13/2003	2/23/2004	7/24/2003			
22.	Date Last Precipitation Event Occurred	10/9/2003	2/21/2004	7/23/2003			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	WL-33.00	WL-33.00	WL-33.00			
2.	Lab Identification Number	0310279	0402473	308010			
3.	High (H)/Low (L) Designation (if applicable)	L	H	I			
4.	Surface Elevation for Sampling Station (msl)	1355	1355	1355			
5.	Depth of Well below Land Surface (msl)	60	60	60			
6.	Static Water Level of Well below Land Surface (feet)	51.	50.	48			
7.	Flow for Spring/Stream (cfs)						
8.	Date Above Measurements Made	10/13/2003	2/26/2004	7/30/2003			
9.	Aquifer/Zone Identification for Well/Spring	A	A	A			
10.	pH(Standard Units)	7.3	6.9	7.3			
11.	Total Acidity (mg/l $CaCO_3$)	7.6	12	7			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	200	170			
13.	Specific Conductivity (umhos/cm at 25 C)	530	530	390			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	BDL	BDL			
16.	Total Sulfates (mg/l)	48	52	47			
17.	Total Iron (mg/l)	0.44	BDL	0.1			
18.	Total Suspended Solids (mg/l)	17	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	250	250	200			
20.	Nitrates (mg/l)	1.9	2.1	1.80			
21.	Date Sampled for Analysis	10/13/2003	2/26/2004	7/30/2003			
22.	Date Last Precipitation Event Occurred	10/9/2003	2/24/2004	7/28/2003			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-37.00	W-37.00	W-37.00			
2.	Lab Identification Number	0310351	0312342	0402281			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1210	1210	1210			
5.	Depth of Well below Land Surface (msl)	82	82	82			
6.	Static Water Level of Well below Land Surface (feet)	5	4	9.8			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/20/2003	12/23/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	B, C, AND D	B, C, AND D	B, C, AND D			
10.	pH(Standard Units)	6.6	7.1	6.9			
11.	Total Acidity (mg/l $CaCO_3$)	13	13	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	95	120	160			
13.	Specific Conductivity (umhos/cm at 25 C)	340	480	670			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.04	0.11			
16.	Total Sulfates (mg/l)	73	200	160			
17.	Total Iron (mg/l)	0.32	0.36	0.17			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	120	140	330			
20.	Nitrates (mg/l)	1.7	1.9	1.0			
21.	Date Sampled for Analysis	10/20/2003	12/23/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/23/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-37.02	W-37.02	W-37.02			
2.	Lab Identification Number	0310354	0312344	0402280			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1215	1215	1215			
5.	Depth of Well below Land Surface (msl)	51	51	51			
6.	Static Water Level of Well below Land Surface (feet)	22.	20.	24.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/20/2003	12/23/2003	2/19/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.2	7.70	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	11	14	5.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	270	240	230			
13.	Specific Conductivity (umhos/cm at 25 C)	610	500	550			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.03	BDL	0.01			
16.	Total Sulfates (mg/l)	43	64	46			
17.	Total Iron (mg/l)	0.21	0.14	0.14			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	280	250	270			
20.	Nitrates (mg/l)	1.9	4.8	2.0			
21.	Date Sampled for Analysis	10/20/2003	12/23/2003	2/19/2004			
22.	Date Last Precipitation Event Occurred	10/17/2003	12/23/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-60.00					
2.	Lab Identification Number	0402313					
3.	High (H)/Low (L) Designation (if applicable)	H					
4.	Surface Elevation for Sampling Station (msl)	1295					
5.	Depth of Well below Land Surface (msl)	110					
6.	Static Water Level of Well below Land Surface (feet)	No access					
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	2/20/2004					
9.	Aquifer/Zone Identification for Well/Spring	A AND B					
10.	pH(Standard Units)	6.8					
11.	Total Acidity (mg/l $CaCO_3$)	23					
12.	Total Alkalinity (mg/l $CaCO_3$)	240					
13.	Specific Conductivity (umhos/cm at 25 C)	750					
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL					
16.	Total Sulfates (mg/l)	86					
17.	Total Iron (mg/l)	BDL					
18.	Total Suspended Solids (mg/l)	BDL					
19.	Total Hardness (mg/l $CACO_3$)	340					
20.	Nitrates (mg/l)	4.4					
21.	Date Sampled for Analysis	2/20/2004					
22.	Date Last Precipitation Event Occurred	2/6/2004					

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-60.01	W-60.01	W-60.01			
2.	Lab Identification Number	0310166	0312349	0402311			
3.	High (H)/Low (L) Designation (if applicable)	L	I	ITH			
4.	Surface Elevation for Sampling Station (msl)	1290	1290	1290			
5.	Depth of Well below Land Surface (msl)	144	144	144			
6.	Static Water Level of Well below Land Surface (feet)	20	18.	20.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/7/2003	12/23/2003	2/20/2004			
9.	Aquifer/Zone Identification for Well/Spring	A, B, AND C	A, B, AND C	A, B, AND C			
10.	pH(Standard Units)	7.2	7.20	6.8			
11.	Total Acidity (mg/l $CaCO_3$)	18	13	18			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	200	210			
13.	Specific Conductivity (umhos/cm at 25 C)	590	610	650			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	BDL			
16.	Total Sulfates (mg/l)	120	120	120			
17.	Total Iron (mg/l)	0.04	BDL	BDL			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	280	290	310			
20.	Nitrates (mg/l)	3.3	3.6	4.2			
21.	Date Sampled for Analysis	10/7/2003	12/23/2003	2/2/2004			
22.	Date Last Precipitation Event Occurred	10/4/2003	12/23/2003	1/28/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-68.02	W-68.02	W-68.02			
2.	Lab Identification Number	0311138	0312367	0403108			
3.	High (H)/Low (L) Designation (if applicable)	LTI	I	H			
4.	Surface Elevation for Sampling Station (msl)	1185	1185	1185			
5.	Depth of Well below Land Surface (msl)	97	97	97			
6.	Static Water Level of Well below Land Surface (feet)	31	26.	34.			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	11/8/2003	12/26/2003	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring	C AND D	C AND D	C AND D			
10.	pH(Standard Units)	7.8	7.7	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	12	13	8.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	240	220	200			
13.	Specific Conductivity (umhos/cm at 25 C)	500	510	650			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.07	0.03	0.03			
16.	Total Sulfates (mg/l)	25	25	30			
17.	Total Iron (mg/l)	0.52	0.48	0.38			
18.	Total Suspended Solids (mg/l)	73	21	21			
19.	Total Hardness (mg/l $CACO_3$)	250	280	280			
20.	Nitrates (mg/l)	4.2	5.0	5.1			
21.	Date Sampled for Analysis	11/8/2003	12/26/2003	3/5/2004			
22.	Date Last Precipitation Event Occurred	11/6/2003	12/24/2003	3/4/2004			

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(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-83.00	W-83.00	W-83.00			
2.	Lab Identification Number	0310379	0312237	0402131			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)	75	75	75			
6.	Static Water Level of Well below Land Surface (feet)	20	19.	17			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/20/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	A AND B	A AND B	A AND B			
10.	pH(Standard Units)	7.2	7.5	7.00			
11.	Total Acidity (mg/l $CaCO_3$)	18	8.9	20			
12.	Total Alkalinity (mg/l $CaCO_3$)	260	260	270			
13.	Specific Conductivity (umhos/cm at 25 C)	770	730	610			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.08	0.20	0.22			
16.	Total Sulfates (mg/l)	56	51	54			
17.	Total Iron (mg/l)	0.04	1.0	1.1			
18.	Total Suspended Solids (mg/l)	1.0	23	12			
19.	Total Hardness (mg/l $CACO_3$)	350	350	340			
20.	Nitrates (mg/l)	2.5	5.4	5.2			
21.	Date Sampled for Analysis	10/20/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/21/2003	12/16/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	WL-84.00	WL-84.00	WL-84.00			
2.	Lab Identification Number	0310380	0401006	0402129			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1242	1242	1242			
5.	Depth of Well below Land Surface (msl)	120	120	120			
6.	Static Water Level of Well below Land Surface (feet)	40	33	36.			
7.	Flow for Spring/Stream (cfs)						
8.	Date Above Measurements Made	10/25/2003	1/5/2004	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B, C AND D	B, C AND D	B, C AND D			
10.	pH(Standard Units)	7.6	7.0	6.80			
11.	Total Acidity (mg/l $CaCO_3$)	5.9	BDL	25			
12.	Total Alkalinity (mg/l $CaCO_3$)	270	16	250			
13.	Specific Conductivity (umhos/cm at 25 C)	770	93	650			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.02	BDL			
16.	Total Sulfates (mg/l)	70	32	96			
17.	Total Iron (mg/l)	0.04	1.5	BDL			
18.	Total Suspended Solids (mg/l)	1.0	5.3	BDL			
19.	Total Hardness (mg/l $CACO_3$)	230	70	310			
20.	Nitrates (mg/l)	1.9	3.4	2.0			
21.	Date Sampled for Analysis	10/25/2003	1/5/2004	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	1/4/2004	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	WL-86.00	WL-86.00	WL-86.00			
2.	Lab Identification Number	0310381	0401011	0403107			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1265	1265	1265			
5.	Depth of Well below Land Surface (msl)	110	110	110			
6.	Static Water Level of Well below Land Surface (feet)	50	47	51.			
7.	Flow for Spring/Stream (cfs)						
8.	Date Above Measurements Made	10/25/2003	1/5/2004	3/5/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.0	6.90	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	13	12	17			
12.	Total Alkalinity (mg/l $CaCO_3$)	160	120	160			
13.	Specific Conductivity (umhos/cm at 25 C)	430	300	500			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	0.01			
16.	Total Sulfates (mg/l)	27	24	32			
17.	Total Iron (mg/l)	0.04	BDL	BDL			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	230	180	210			
20.	Nitrates (mg/l)	5.3	5.4	6.6			
21.	Date Sampled for Analysis	10/25/2003	1/5/2004	3/5/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	1/4/2004	3/4/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	WL-88.00	WL-88.00	WL-88.00			
2.	Lab Identification Number	0310393	0312236	0402130			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1250	1250	1250			
5.	Depth of Well below Land Surface (msl)	70	70	70			
6.	Static Water Level of Well below Land Surface (feet)	17.	15.	19.			
7.	Flow for Spring/Stream (cfs)						
8.	Date Above Measurements Made	10/25/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B	B	B			
10.	pH(Standard Units)	7.3	7.3	6.80			
11.	Total Acidity (mg/l $CaCO_3$)	17	11	25			
12.	Total Alkalinity (mg/l $CaCO_3$)	270	290	300			
13.	Specific Conductivity (umhos/cm at 25 C)	810	750	670			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	BDL			
16.	Total Sulfates (mg/l)	57	62	62			
17.	Total Iron (mg/l)	0.04	BDL	BDL			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	380	360	390			
20.	Nitrates (mg/l)	3.8	3.8	3.2			
21.	Date Sampled for Analysis	10/25/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/16/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	WL90.00	WL90.00	WL90.00			
2.	Lab Identification Number	0310402	0312232	0402128			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1305	1305	1305			
5.	Depth of Well below Land Surface (msl)	Well Log 110'	Well Log 110'	Well Log 110'			
6.	Static Water Level of Well below Land Surface (feet)	Well Log 50'	Well Log 50'	Well Log 50'			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	10/24/2003	12/16/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	UNKNOWN	UNKNOWN	UNKNOWN			
10.	pH(Standard Units)	7.6	7.3	6.70			
11.	Total Acidity (mg/l $CaCO_3$)	18	6.8	27			
12.	Total Alkalinity (mg/l $CaCO_3$)	240	250	240			
13.	Specific Conductivity (umhos/cm at 25 C)	700	650	530			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.01	BDL			
16.	Total Sulfates (mg/l)	36	39	42			
17.	Total Iron (mg/l)	0.04	BDL	BDL			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	300	300	310			
20.	Nitrates (mg/l)	1.6	3.2	2.7			
21.	Date Sampled for Analysis	10/24/2003	12/16/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/16/2003	2/6/2004			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-91.01	W-91.01	W-91.01			
2.	Lab Identification Number	0312225	0402117	310395			
3.	High (H)/Low (L) Designation (if applicable)	I	H	L			
4.	Surface Elevation for Sampling Station (msl)	1250	1250	1250			
5.	Depth of Well below Land Surface (msl)	N/A	N/A	N/A			
6.	Static Water Level of Well below Land Surface (feet)	No ACCESS	No ACCESS	No ACCESS			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	12/16/2003	2/16/2004	10/23/2003			
9.	Aquifer/Zone Identification for Well/Spring	UNKNOWN	UNKNOWN	UNKNOWN			
10.	pH(Standard Units)	7.5	7.1	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	21	24	18			
12.	Total Alkalinity (mg/l $CaCO_3$)	260	270	250			
13.	Specific Conductivity (umhos/cm at 25 C)	630	630	730			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	BDL			
16.	Total Sulfates (mg/l)	73	79	73			
17.	Total Iron (mg/l)	BDL	0.47	BDL			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	300	320	310			
20.	Nitrates (mg/l)	2.5	1.8	2.00			
21.	Date Sampled for Analysis	12/16/2003	2/16/2004	10/23/2003			
22.	Date Last Precipitation Event Occurred	12/16/2003	2/6/2004	10/21/2003			

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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	WL-92.00	WL-92.00	WL-92.00			
2.	Lab Identification Number	0310399	0312384	0402132			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1260	1260	1260			
5.	Depth of Well below Land Surface (msl)	100	100	100			
6.	Static Water Level of Well below Land Surface (feet)	Well log 58	Well log 58	Well log 58			
7.	Flow for Spring/Stream (cfs)						
8.	Date Above Measurements Made	10/25/2003	12/29/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	A AND B	A AND B	A AND B			
10.	pH(Standard Units)	7.5	7.6	7.00			
11.	Total Acidity (mg/l $CaCO_3$)	16	7.8	18			
12.	Total Alkalinity (mg/l $CaCO_3$)	250	250	240			
13.	Specific Conductivity (umhos/cm at 25 C)	570	510	410			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	BDL	BDL			
16.	Total Sulfates (mg/l)	27	28	27			
17.	Total Iron (mg/l)	0.04	BDL	BDL			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	240	230	230			
20.	Nitrates (mg/l)	0.83	0.82	1.1			
21.	Date Sampled for Analysis	10/25/2003	12/29/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/29/2003	2/6/2004			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	WL-94.00	WL-94.00	WL-94.00			
2.	Lab Identification Number	0310400	0312339	0402126			
3.	High (H)/Low (L) Designation (if applicable)	L	I	H			
4.	Surface Elevation for Sampling Station (msl)	1240	1240	1240			
5.	Depth of Well below Land Surface (msl)	120	120	120			
6.	Static Water Level of Well below Land Surface (feet)	45	43	44			
7.	Flow for Spring/Stream (cfs)						
8.	Date Above Measurements Made	10/25/2003	12/23/2003	2/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	B AND C	B AND C	B AND C			
10.	pH(Standard Units)	7.0	7.20	7.00			
11.	Total Acidity (mg/l $CaCO_3$)	28	17	3.7			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	200	120			
13.	Specific Conductivity (umhos/cm at 25 C)	570	480	260			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.01	0.05	BDL			
16.	Total Sulfates (mg/l)	91	93	36			
17.	Total Iron (mg/l)	0.04	0.11	0.05			
18.	Total Suspended Solids (mg/l)	1.0	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	270	260	130			
20.	Nitrates (mg/l)	1.5	2.9	6.3			
21.	Date Sampled for Analysis	10/25/2003	12/23/2003	2/16/2004			
22.	Date Last Precipitation Event Occurred	10/23/2003	12/23/2003	2/6/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-97.00	W-97.00	W-97.00			
2.	Lab Identification Number	0312285	0402181	0310463			
3.	High (H)/Low (L) Designation (if applicable)	I	H	L			
4.	Surface Elevation for Sampling Station (msl)	1180	1180	1180			
5.	Depth of Well below Land Surface (msl)	86	86	86			
6.	Static Water Level of Well below Land Surface (feet)	28.	31.	41			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	12/23/2003	2/17/2004	10/25/2003			
9.	Aquifer/Zone Identification for Well/Spring	B AND C	B AND C	B AND C			
10.	pH(Standard Units)	7.30	7.0	7.8			
11.	Total Acidity (mg/l $CaCO_3$)	10	10	6.9			
12.	Total Alkalinity (mg/l $CaCO_3$)	320	310	340			
13.	Specific Conductivity (umhos/cm at 25 C)	750	490	830			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	BDL	BDL	.03			
16.	Total Sulfates (mg/l)	120	110	110			
17.	Total Iron (mg/l)	0.09	0.17	.51			
18.	Total Suspended Solids (mg/l)	BDL	BDL	4.0			
19.	Total Hardness (mg/l $CACO_3$)	250	260	170			
20.	Nitrates (mg/l)	0.29	0.52	.12			
21.	Date Sampled for Analysis	12/23/2003	2/17/2004	10/25/2003			
22.	Date Last Precipitation Event Occurred	12/19/2003	2/6/2004	10/23/2003			

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OHIO DEPARTMENT OF NATURAL RESOURCES
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ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-112.01	W-112.01	W-112.01			
2.	Lab Identification Number		0404174	0405177			
3.	High (H)/Low (L) Designation (if applicable)	L	H	I			
4.	Surface Elevation for Sampling Station (msl)	1142	1142	1142			
5.	Depth of Well below Land Surface (msl)	39	39	39			
6.	Static Water Level of Well below Land Surface (feet)	DRY WELL	36.2	36.1			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	8/16/2004	4/20/2004	5/24/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)		7.4	6.7			
11.	Total Acidity (mg/l $CaCO_3$)		21	18			
12.	Total Alkalinity (mg/l $CaCO_3$)		190	92			
13.	Specific Conductivity (umhos/cm at 25 C)		480	220			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)		.10	.11			
16.	Total Sulfates (mg/l)		29	20			
17.	Total Iron (mg/l)		4.2	4.8			
18.	Total Suspended Solids (mg/l)		71	160			
19.	Total Hardness (mg/l $CACO_3$)		260	100			
20.	Nitrates (mg/l)		3.6	1.2			
21.	Date Sampled for Analysis		4/20/2004	5/24/2004			
22.	Date Last Precipitation Event Occurred		4/19/2004	5/23/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-113.00	W-113.00	W-113.00			
2.	Lab Identification Number	0404176	0405181	0408154			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1130	1130	1130			
5.	Depth of Well below Land Surface (msl)	88	88	88			
6.	Static Water Level of Well below Land Surface (feet)	17.4	16.2	16.5			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.6	7.4	7.9			
11.	Total Acidity (mg/l $CaCO_3$)	9.5	10	14			
12.	Total Alkalinity (mg/l $CaCO_3$)	120	140	160			
13.	Specific Conductivity (umhos/cm at 25 C)	300	320	360			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	.04	.024			
16.	Total Sulfates (mg/l)	15	14	16			
17.	Total Iron (mg/l)	.11	.13	.12			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	110	120	150			
20.	Nitrates (mg/l)	.45	.24	.11			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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Laboratory Name **Tra-Det Inc.**
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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-114.00	W-114.00	W-114.00			
2.	Lab Identification Number	0404177	0405187	0408160			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1090	1090	1090			
5.	Depth of Well below Land Surface (msl)	92	92	92			
6.	Static Water Level of Well below Land Surface (feet)	17.7	*	*			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.1	6.9	7.4			
11.	Total Acidity (mg/l $CaCO_3$)	28	22	27			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	210	210			
13.	Specific Conductivity (umhos/cm at 25 C)	770	730	710			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.15	.11	.068			
16.	Total Sulfates (mg/l)	120	120	100			
17.	Total Iron (mg/l)	BDL	.04	.04			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	320	350	310			
20.	Nitrates (mg/l)	7.0	5.6	5.6			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

BDL-Below detectable limit

* Field S.W.L. data inadvertently lost.

Laboratory Name **Tra-Det Inc.**
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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-114.01	W-114.01	W-114.01			
2.	Lab Identification Number	0404178	0405188	0408161			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1065	1065	1065			
5.	Depth of Well below Land Surface (msl)	125	125	125			
6.	Static Water Level of Well below Land Surface (feet)	13.4	14.5	16.1			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/20/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	E	E	E			
10.	pH(Standard Units)	7.2	7.5	7.6			
11.	Total Acidity (mg/l $CaCO_3$)	28	13	23			
12.	Total Alkalinity (mg/l $CaCO_3$)	190	220	230			
13.	Specific Conductivity (umhos/cm at 25 C)	850	460	910			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.01	.110			
16.	Total Sulfates (mg/l)	100	29	100			
17.	Total Iron (mg/l)	.32	1.0	.16			
18.	Total Suspended Solids (mg/l)	BDL	7.3	BDL			
19.	Total Hardness (mg/l $CACO_3$)	340	220	310			
20.	Nitrates (mg/l)	6.4	4.4	5.3			
21.	Date Sampled for Analysis	4/20/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/19/2004	5/23/2004	8/12/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map		W-116.00	W-116.00	W-116.00		
2.	Lab Identification Number		0405180	0404194	0408153		
3.	High (H)/Low (L) Designation (if applicable)		I	H	L		
4.	Surface Elevation for Sampling Station (msl)		1150	1150	1150		
5.	Depth of Well below Land Surface (msl)		103	103	103		
6.	Static Water Level of Well below Land Surface (feet)		37.1	38.9	40.5		
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made		5/24/2004	4/21/2004	8/16/2004		
9.	Aquifer/Zone Identification for Well/Spring		D	D	D		
10.	pH(Standard Units)		7.9	7.7	8.3		
11.	Total Acidity (mg/l $CaCO_3$)		12	16	14		
12.	Total Alkalinity (mg/l $CaCO_3$)		230	240	240		
13.	Specific Conductivity (umhos/cm at 25 C)		480	460	510		
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)		.01	0.02	.003		
16.	Total Sulfates (mg/l)		19	22	20		
17.	Total Iron (mg/l)		.13	BDL	.01		
18.	Total Suspended Solids (mg/l)		BDL	BDL	BDL		
19.	Total Hardness (mg/l $CACO_3$)		190	230	180		
20.	Nitrates (mg/l)		BDL	0.24	.04		
21.	Date Sampled for Analysis		5/24/2004	4/21/2004	8/16/2004		
22.	Date Last Precipitation Event Occurred		5/23/2004	4/20/2004	8/12/2004		

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
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State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-117.00	W-117.00	W-117.00			
2.	Lab Identification Number	0404195	0405182	0408155			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1105	1105	1105			
5.	Depth of Well below Land Surface (msl)	SEALED	SEALED	SEALED			
6.	Static Water Level of Well below Land Surface (feet)	sealed	sealed	sealed			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/21/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	UNKNOWN	UNKNOWN	UNKNOWN			
10.	pH(Standard Units)	8.1	8.0	8.7			
11.	Total Acidity (mg/l $CaCO_3$)	9.8	7.8	9.8			
12.	Total Alkalinity (mg/l $CaCO_3$)	200	220	300			
13.	Specific Conductivity (umhos/cm at 25 C)	530	460	570			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.01	.08	.270			
16.	Total Sulfates (mg/l)	12	11	16			
17.	Total Iron (mg/l)	BDL	.04	.03			
18.	Total Suspended Solids (mg/l)	BDL	BDL	BDL			
19.	Total Hardness (mg/l $CACO_3$)	110	100	80			
20.	Nitrates (mg/l)	.08	.22	.17			
21.	Date Sampled for Analysis	4/21/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/20/2004	5/23/2004	8/12/2004			

BDL-Below detectable limit

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State **West Virginia** Zip **26003-0219**

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-124.00	W-124.00	W-124.00			
2.	Lab Identification Number	0404277	0405193	0408166			
3.	High (H)/Low (L) Designation (if applicable)	H	I	L			
4.	Surface Elevation for Sampling Station (msl)	1075	1075	1075			
5.	Depth of Well below Land Surface (msl)	59.5	59.5	59.5			
6.	Static Water Level of Well below Land Surface (feet)	21.3	23.2	23.7			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	4/30/2004	5/24/2004	8/16/2004			
9.	Aquifer/Zone Identification for Well/Spring	D	D	D			
10.	pH(Standard Units)	7.6	7.5	7.7			
11.	Total Acidity (mg/l $CaCO_3$)	11	9.6	27			
12.	Total Alkalinity (mg/l $CaCO_3$)	140	150	220			
13.	Specific Conductivity (umhos/cm at 25 C)	270	340	440			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	.02	.14	0.360			
16.	Total Sulfates (mg/l)	29	27	7			
17.	Total Iron (mg/l)	.27	6.7	2.7			
18.	Total Suspended Solids (mg/l)	5.3	21	6.7			
19.	Total Hardness (mg/l $CACO_3$)	150	180	170			
20.	Nitrates (mg/l)	.65	.46	0.20			
21.	Date Sampled for Analysis	4/30/2004	5/24/2004	8/16/2004			
22.	Date Last Precipitation Event Occurred	4/26/2004	5/23/2004	8/12/2004			

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OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RECLAMATION
ATTACHMENT 14A
(HYDROLOGIC MEASUREMENTS AND ANALYSES)

Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	W-126.00					
2.	Lab Identification Number						
3.	High (H)/Low (L) Designation (if applicable)	L					
4.	Surface Elevation for Sampling Station (msl)	1235					
5.	Depth of Well below Land Surface (msl)	73					
6.	Static Water Level of Well below Land Surface (feet)	DRY WELL					
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	5/25/2004					
9.	Aquifer/Zone Identification for Well/Spring	D					
10.	pH(Standard Units)						
11.	Total Acidity (mg/l $CaCO_3$)						
12.	Total Alkalinity (mg/l $CaCO_3$)						
13.	Specific Conductivity (umhos/cm at 25 C)						
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)						
16.	Total Sulfates (mg/l)						
17.	Total Iron (mg/l)						
18.	Total Suspended Solids (mg/l)						
19.	Total Hardness (mg/l $CACO_3$)						
20.	Nitrates (mg/l)						
21.	Date Sampled for Analysis						
22.	Date Last Precipitation Event Occurred						

BDL-Below detectable limit

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OHIO DEPARTMENT OF NATURAL RESOURCES
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Applicant's Name AMERICAN ENERGY CORPORATION (D-0425-5)

1.	Identification No. of Sampling Station from Hydrology Map	DW-34.03	W-34.02	W-48.03			
2.	Lab Identification Number	505148	505147	505203			
3.	High (H)/Low (L) Designation (if applicable)	Supplemental	Supplemental	Supplemental			
4.	Surface Elevation for Sampling Station (msl)	1360	1360	1280			
5.	Depth of Well below Land Surface (msl)	23	63	61			
6.	Static Water Level of Well below Land Surface (feet)	4	44	37			
7.	Flow for Spring/Stream (GPM unless otherwise denoted)						
8.	Date Above Measurements Made	5/11/2005	5/11/2005	5/12/2005			
9.	Aquifer/Zone Identification for Well/Spring	A	A	B			
10.	pH(Standard Units)	6.4	7.5	7.5			
11.	Total Acidity (mg/l $CaCO_3$)	6.2	16	8.4			
12.	Total Alkalinity (mg/l $CaCO_3$)	4.3	260	100			
13.	Specific Conductivity (umhos/cm at 25 C)	52	510	360			
14.	Total Dissolved Solids (mg/l)						
15.	Total Manganese (mg/l)	0.021	0.24	0.24			
16.	Total Sulfates (mg/l)	8.3	20	32			
17.	Total Iron (mg/l)	0.16	0.13	2.3			
18.	Total Suspended Solids (mg/l)	BDL	BDL	32			
19.	Total Hardness (mg/l $CACO_3$)	20	290	190			
20.	Nitrates (mg/l)	1.60	0.04	6.40			
21.	Date Sampled for Analysis	5/11/2005	5/11/2005	5/12/2005			
22.	Date Last Precipitation Event Occurred	5/10/2005	5/10/2005	5/11/2005			

BDL-Below detectable limit

Laboratory Name **Tra-Det Inc.**
Address **P.O. Box 2019 Wheeling**
State **West Virginia** Zip **26003-0219**

Detection Limits for Tra-Det, Inc. Laboratory

Total Acidity	1.0
Total Alkalinity	0.11
Total Fe	0.04
Total Manganese	0.01
TSS	1.0
Total Hardness	5.0
Total Sulfate	0.46
Specific Conductance	1.5
Nitrate	0.03

ADDENDUM TO PART 2, PAGE 18, ITEM D(3)
AMERICAN ENERGY CORPORATION
D-0425-5

Perennial stream channel hydro sites were chosen for the hydrograph as they are the most representative example of flow rates influenced by excessive precipitation. Groundwater can be influenced by usage (especially domestic wells) as well as the magnitude of precipitation events, i.e. heavy rainfall resulting in more runoff and less percolation.

The perennial streams illustrated on the graph are all much smaller in nature than Captina Creek, where the USGS gaging station shown on the graph is located.

Stream sampling for the D-0425-5 application area began in early November, 2003 during the low and transitional period following low flow. Intermediate flow sampling in late December, 2003, and high flow sampling was conducted in mid to late February and early March, 2004. The only exception to these sampling dates include some additional sites that were added to the proposed application area at a later date. These sites were sampled in late April, 2004 for high flow, late May, 2004 for intermediate flow, and mid to late August for high flow.

According to the Monthly Water Inventory Reports for Ohio, a very, to extreme moist spell began in Sept, 2003 in southeastern Ohio. Stream flow was above normal to excessive, through the end of 2003 and into 2004. A presidential disaster declaration was issued for Belmont and Monroe counties in January, 2004. Stream flow remained above normal to excessive through August, 2004. Groundwater levels rose in response to precipitation events, declined slightly seasonably, however remained above normal for the entire water year. February, 2004 is the only month during this period that flows declined contra-seasonably from January, 2004 flows.

There appears to be some correlation between flow trends for the USGS gaging station on Captina Creek and flow rates obtained during sampling for D-0425-5, however, there is a deviation from the norm for all sampling conducted for this application due to the unusually high amounts of precipitation during traditionally "low and intermediate flow" periods, with the lowest precipitation amounts occurring during the traditional "high flow" period.

Addendum to Page 18, D(3)

Water Resources

Data Category: Surface Water | Geographic Area: United States | go

Daily Streamflow for the Nation

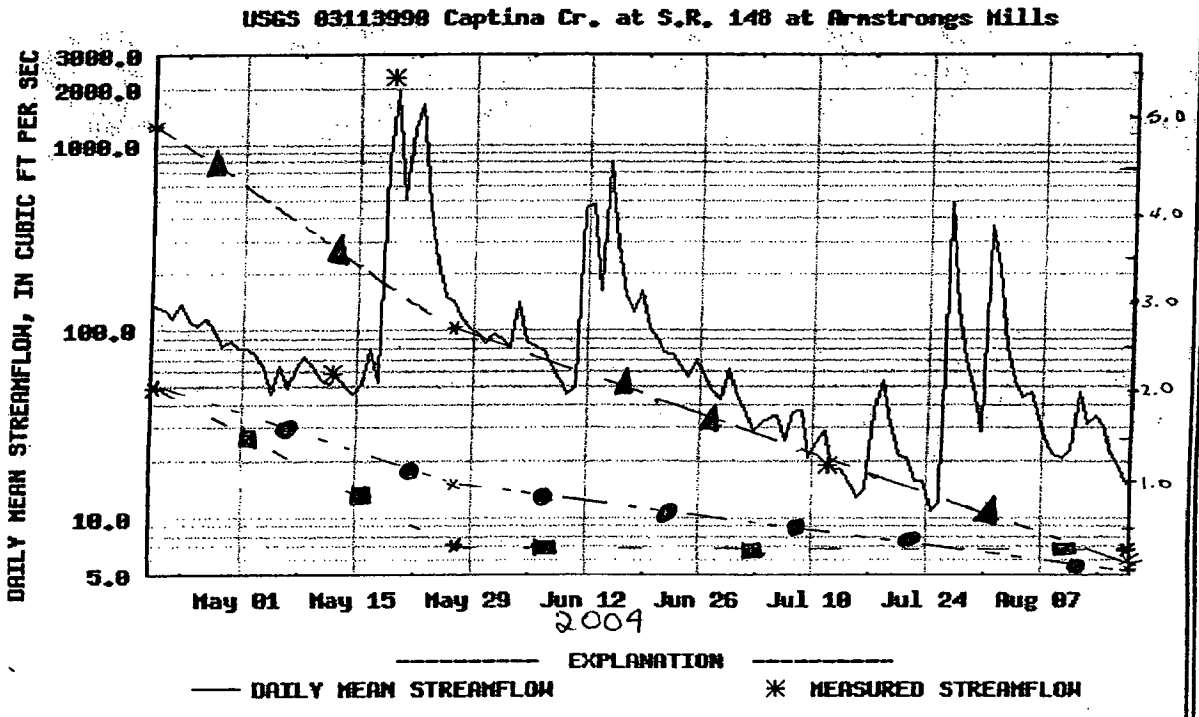
USGS 03113990 Captina Cr. at S.R. 148 at Armstrongs Mills 2004

Available data for this site Surface-water: Daily streamflow GO

Belmont County, Ohio
Hydrologic Unit Code 05030106
Latitude 39°54'24", Longitude 80°56'10" NAD27
Drainage area 127 square miles

Output formats

- Tab-separated data file
- Graph
- Reselect output format



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Top
Explanation of terms

Surface Water for USA: Daily Streamflow
http://waterdata.usgs.gov/nwis/discharge?

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Department of the Interior, U.S. Geological Survey

AEC 06522

Addendum to Page 18, D(3)

Water Resources

Data Category: Surface Water | Geographic Area: United States | go

Daily Streamflow for the Nation

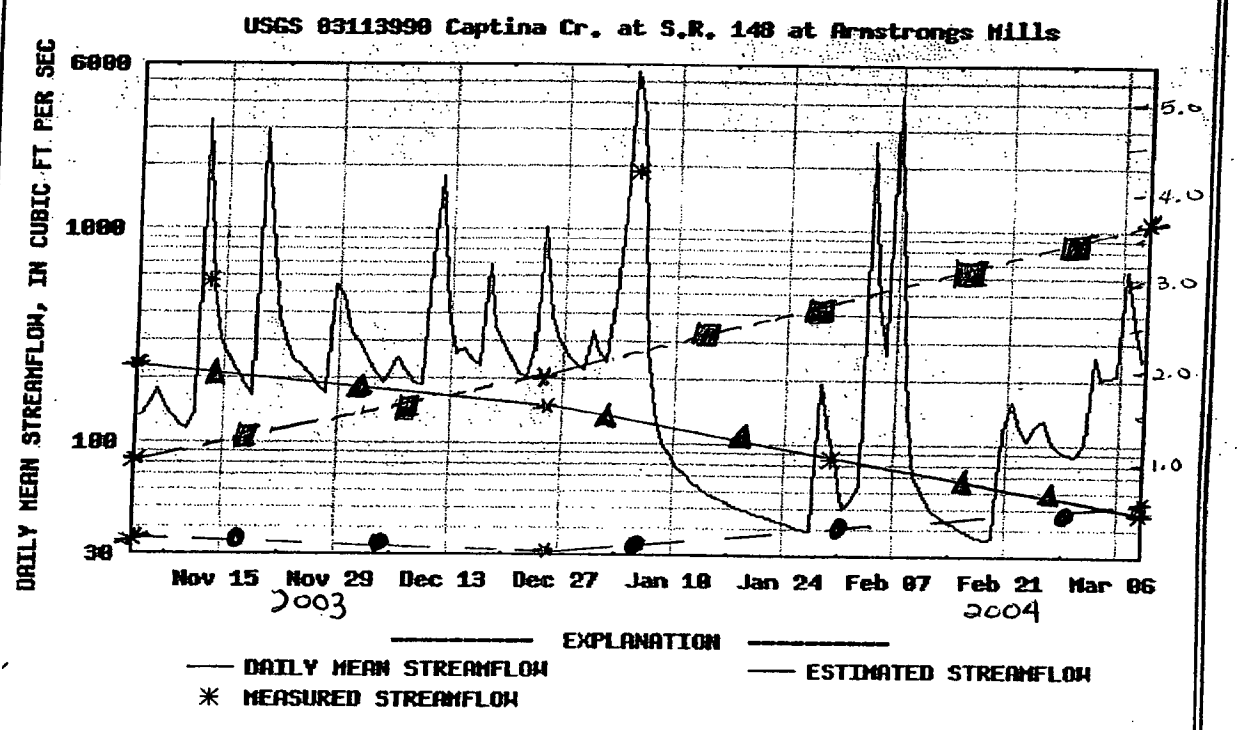
USGS 03113990 Captina Cr. at S.R. 148 at Armstrongs Mills 2003-2004

Available data for this site | Surface-water: Daily streamflow | GO

Belmont County, Ohio
Hydrologic Unit Code 05030106
Latitude 39°54'24", Longitude 80°56'10" NAD27
Drainage area 127 square miles

Output formats

- Tab-separated data file
- Graph
- Reselect output format



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Top
Explanation of terms

rface Water for USA: Daily Streamflow
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AEC 06523

ADDENDUM TO ATTACHMENT 14A AMERICAN ENERGY CORPORATION D-0425-5					
Low Flow Sample Dates	Precip. 30 days prior	Intermediate Sample Dates	Precip. 30 days prior	High Flow Sample Dates	Precip. 30 days prior
9-8-03	6.27"	7-24-03	7.86"	*2-2-04	3.06"
10-7-03	4.12"	7-28-03	7.85"	2-16-04	3.64"
10-8-03	4.12"	7-30-03	8.00"	2-17-04	3.64"
10-11-03	4.11"	7-37-03	8.00"	2-18-04	3.22"
10-13-03	4.11"	*8-6-03	9.14"	2-19-04	3.22"
10-16-03	3.70"	12-16-03	4.63"	2-20-04	3.22"
10-20-03	3.28"	12-22-03	3.52"	2-23-04	2.97"
10-25-03	2.52"	12-23-03	3.52"	2-24-04	3.17"
10-30-03	3.38"	12-24-03	3.52"	2-25-04	2.92"
*11-4-03	2.98"	12-26-03	3.85"	2-26-04	2.72"
*11-8-03	3.36"	12-29-03	3.72"	3-1-04	2.57"
~~*11-13-03~~	~~4.88"~~	~~12-30-03~~	~~3.43"~~	~~3-5-04~~	~~2.28"~~
*11-14-03	4.88"	1-5-04	7.57"	3-8-04	1.62"
		5-24-04	6.80"	3-17-04	1.86"
		5-25-04	6.81"	4-19-04	4.36"
				4-20-04	4.43"
				4-21-04	4.67"
				4-22-04	4.72"
				4-23-04	5.05"
				4-30-04	4.75"
Totals	51.71"		88.22"		68.09"
	Ave. **3.98"**		Ave. **5.88"**		Ave. **3.40"**
High/Low Ave.	**4.40"**	High/Low Ave.	**6.33"**	High/Low Ave.	**3.34"**

* Indicates sample dates within a transitional flow period. (Included in averages)

ADDENDUM TO ATTACHMENT 14A, AMERICAN ENERGY CORPORATION, D-0425-5

Precipitation amounts in inches, 30 days prior to all possible high flow sampling dates in 2004, including prior transitional (February 1 thru February 14), designated high flow period (February 15 thru April 30), and following transitional (May 1 thru May 15):

Month	/ Year	/ Day	Total precip.30 days prior inches
February	2004	1	3.06
		2	3.06
		3	3.35
		4	2.34
		5	2.32
		6	3.40
		7	3.67
		8	3.63
		9	3.63
		10	3.63
		11	3.64
		12	3.64
		13	3.64
		14	3.64
Prior Transitional		15	3.64
High Flow		16	3.64
		17	3.64
		18	3.22
		19	3.22
		20	3.22
		21	3.27
		22	3.28
		23	2.97
		24	3.17
		25	2.92
		26	2.72
		27	2.57
		28	2.57
March	2004	1	2.57
		2	2.89
		3	2.89
		4	3.07
		5	2.28
		6	2.63
		7	2.71
		8	1.62
		9	1.39
		10	1.39
		11	1.39
		12	1.41
		13	1.41
		14	1.41
		15	1.42
		16	1.49
		17	1.86
		18	1.86
		19	2.20
		20	2.20
		21	2.20
		22	2.20
		23	2.15
		24	2.14

Month	/ Year	/ Day	Total precip.30 days prior inches
March	2004	25	2.14
		26	1.94
		27	1.94
		28	2.04
		29	2.04
		30	2.10
		31	2.61
April	2004	1	2.81
		2	3.39
		3	3.25
		4	3.35
		5	3.35
		6	2.77
		7	2.76
		8	2.95
		9	2.95
		10	2.95
		11	2.93
		12	2.93
		13	3.91
		14	5.02
		15	5.04
		16	4.67
		17	4.67
		18	4.33
		19	4.36
		20	4.43
		21	4.67
		22	4.72
		23	5.05
		24	5.07
		25	5.08
		26	5.42
		27	5.32
		28	5.32
		29	5.26
High Flow		30	4.75
May	2004	1	4.38
(Following Transitional)		2	3.80
		3	3.93
		4	3.93
		5	3.85
		6	3.85
		7	3.85
		8	3.85
		9	3.80
		10	3.62
		11	3.62
		12	4.15
		13	3.18
		14	2.06
		15	2.04

GROUND WATER/SURFACE WATER SITE INDEX

SITE I.D.	LOCATION/SECTION	SITE I.D.	LOCATION/SECTION
W-10.00	NE 1/4 SEC. 30	WL-84.00	SE 1/4 SEC. 35
W-11.00	NW 1/4 SEC. 24	WL-86.00	SE 1/4 SEC. 35
WL-11.01	NW 1/4 SEC. 24	WL-88.00	SE 1/4 SEC. 35
W-12.00	NW 1/4 SEC. 24	WL-90.00	NE 1/4 SEC. 34
W-14.00	NW 1/4 SEC. 24	W-91.01	NE 1/4 SEC. 34
W-15.00	SW 1/4 SEC. 24	WL-92.00	SE 1/4 SEC. 35
WL-25.00	SW 1/4 SEC. 24	WL-94.00	SE 1/4 SEC. 35
W-26.00	SE 1/4 SEC. 24	W-97.00	NW 1/4 SEC. 29
W-28.03	SE 1/4 SEC. 30	WL-108.00	SW 1/4 SEC. 35
W-29.00	SE 1/4 SEC. 30	W -109.00	SE 1/4 SEC. 34
W-30.00	SE 1/4 SEC. 30	W-112.01	SE 1/4 SEC. 5
W-32.00	SE 1/4 SEC. 24	W-113.00	NE 1/4 SEC. 4
WL-33.00	SE 1/4 SEC. 30	W-114.00	SE 1/4 SEC. 4
WL-34.01	SE 1/4 SEC. 30	W-114.01	SE 1/4 SEC. 4
W-37.00	NE 1/4 SEC. 23	W-116.00	SE 1/4 SEC. 5
W-37.02	NE 1/4 SEC. 23	W-117.00	NE 1/4 SEC. 5
WL-49.00	SW 1/4 SEC. 23	WL-123.00	SE 1/4 SEC. 22
W-60.00	NW 1/4 SEC. 22	W-124.00	SW 1/4 SEC. 24
W-60.01	NW 1/4 SEC. 22	W-126.00	SE 1/4 SEC. 22
W-68.02	NW 1/4 SEC. 29	DW-26.01	SE 1/4 SEC. 24
W-83.00	NE 1/4 SEC. 35	DW-34.00	SE 1/4 SEC. 30

GROUND WATER/SURFACE WATER SITE INDEX

SITE I.D.	LOCATION/SECTION	SITE I.D.	LOCATION/SECTION
DW-38.00	NW 1/4 SEC. 23	DS-26.04	SW 1/4 SEC. 24
DW-48.02	SW 1/4 SEC. 23	DS-28.00	SE 1/4 SEC. 30
DW-53.01	NW 1/4 SEC. 23	DS-28.01	SE 1/4 SEC. 30
DW-58.00	NE 1/4 SEC. 28	DS-28.02	SE 1/4 SEC. 30
DW-60.02	NW 1/4 SEC. 22	DS-34.01	SE 1/4 SEC. 30
DW-61.00	NW 1/4 SEC. 22	DS-36.00	NE 1/4 SEC. 23
DW-91.00	NE 1/4 SEC. 34	DS-37.01	NE 1/4 SEC. 23
DW-94.01	SE 1/4 SEC. 35	DS-38.01	NW 1/4 SEC. 23
DW-95.00	SE 1/4 SEC. 35	DS-48.00	SW 1/4 SEC. 23
DW-96.03	NE 1/4 SEC. 35	DS-5.00	NW 1/4 SEC. 24
DW-97.01	NW 1/4 SEC. 29	DS-53.00	NE 1/4 SEC. 29
DW-98.01	SW 1/4 SEC. 30	DS-58.01	NE 1/4 SEC. 28
DW-112.02	SE 1/4 SEC. 5	DS-6.00	NE 1/4 SEC. 30
DW-115.00	SE 1/4 SEC. 5	DS-60.03	NW 1/4 SEC. 22
DW-119.01	SE 1/4 SEC. 34	DS-68.00	NE 1/4 SEC. 34
DW-120.00	SW 1/4 SEC. 28	DS-68.01	NW 1/4 SEC. 29
DW-121.00	NE 1/4 SEC. 34	DS-68.03	NW 1/4 SEC. 29
DW-123.01	SE 1/4 SEC. 22	DS-68.04	NW 1/4 SEC. 29
DW-126.01	SE 1/4 SEC. 22	DS-68.06	SW 1/4 SEC. 29
DS-18.00	SE 1/4 SEC. 30	DS-68.07	SW 1/4 SEC. 29
DS-26.02	SE 1/4 SEC. 24	DS-70.00	SW 1/4 SEC. 29

GROUND WATER/SURFACE WATER SITE INDEX

SITE I.D.	LOCATION/SECTION	SITE I.D.	LOCATION/SECTION
DS-72.00	SE 1/4 SEC. 23	DS-110.00	SW 1/4 SEC. 28
DS-91.02	NE 1/4 SEC. 34	DS-111.00	NE 1/4 SEC. 28
DS-91.03	NE 1/4 SEC. 34	DS-112.00	SE 1/4 SEC. 5
DS-91.04	NE 1/4 SEC. 34	DS-114.02	SE 1/4 SEC. 4
DS-91.05	NE 1/4 SEC. 34	DS-114.03	SE 1/4 SEC. 4
DS-91.06	NW 1/4 SEC. 28	DS-114.04	SE 1/4 SEC. 4
DS-91.07	NE 1/4 SEC. 34	DS-117.01	NE 1/4 SEC. 4
DS-96.00	NE 1/4 SEC. 35	DS-118.00	SW 1/4 SEC. 34
DS-96.02	NE 1/4 SEC. 35	DS-119.00	SW 1/4 SEC. 34
DS-96.04	NE 1/4 SEC. 35	DS-119.02	NW 1/4 SEC. 34
DS-96.05	NE 1/4 SEC. 35	DS-119.03	SE 1/4 SEC. 34
DS-96.06	NW 1/4 SEC. 29	DS-119.04	SE 1/4 SEC. 34
DS-96.08	NW 1/4 SEC. 29	DS-119.05	SE 1/4 SEC. 34
DS-96.10	NW 1/4 SEC. 30	DS-119.06	SE 1/4 SEC. 34
DS-96.11	NW 1/4 SEC. 30	DS-119.07	SE 1/4 SEC. 34
DS-96.12	NE 1/4 SEC. 35	DS-122.00	NW 1/4 SEC. 22
DS-96.13	NE 1/4 SEC. 36	D5-1	NE 1/4 SEC. 28
DS-104.00	NW 1/4 SEC. 34	D5-2	NE 1/4 SEC. 28
DS-104.01	NW 1/4 SEC. 34	D5-3	NW 1/4 SEC. 22
DS-109.01	SE 1/4 SEC. 34	D5-5	NE 1/4 SEC. 22

GROUND WATER/SURFACE WATER SITE INDEX

SITE I.D.	LOCATION/SECTION	SITE I.D.	LOCATION/SECTION
D5-6	SW 1/4 SEC. 17	U5-10	NE 1/4 SEC. 35
D5-7	NW 1/4 SEC. 18	U5-11	SE 1/4 SEC. 35
D5-8	NW 1/4 SEC. 34	U5-12	NE 1/4 SEC. 34
D5-9	SW 1/4 SEC. 35	U5-13	NW 1/4 SEC. 28
D5-10	SW 1/4 SEC. 35	U5-14	NW 1/4 SEC. 28
D5-11	SW 1/4 SEC. 25	U5-15	SE 1/4 SEC. 35
D5-12	SE 1/4 SEC. 25	U5-16	SE 1/4 SEC. 35
D5-13	SE 1/4 SEC. 4	U5-17	SE 1/4 SEC. 36
D5-14	SW 1/4 SEC. 28	U5-21	SW 1/4 SEC. 30
D5-15	NW 1/4 SEC. 16	U5-22	SW 1/4 SEC. 30
D5-0	SE 1/4 SEC. 28	U5-23	SE 1/4 SEC. 30
U5-1	SE 1/4 SEC. 6	U5-24	SE 1/4 SEC. 30
U5-2	SW 1/4 SEC. 17	U5-25	NW 1/4 SEC. 23
U5-3	NW 1/4 SEC. 17	U5-26	NW 1/4 SEC. 23
U5-4	NE 1/4 SEC. 23	U5-27	NW 1/4 SEC. 23
U5-5	SE 1/4 SEC. 24	U5-28	NW 1/4 SEC. 23
U5-6	SE 1/4 SEC. 18	U5-29	SW 1/4 SEC. 23
U5-7	SW 1/4 SEC. 19	U5-30	NW 1/4 SEC. 22
U5-8	SW 1/4 SEC. 19	U5-31	NE 1/4 SEC. 22
U5-9	NW 1/4 SEC. 30	U5-32	SW 1/4 SEC. 23

GROUND WATER/SURFACE WATER SITE INDEX

SITE I.D.	LOCATION/SECTION	SITE I.D.	LOCATION/SECTION
U5-33	SW 1/4 SEC. 23	P-48.01	SW 1/4 SEC. 23
U5-34	SW 1/4 SEC. 23	P-5.01	NW 1/4 SEC. 24
U5-35	NW 1/4 SEC. 23	P-68.05	NW 1/4 SEC. 29
U5-36	SW 1/4 SEC. 24	P-96.01	NE 1/4 SEC. 35
U5-37	SW 1/4 SEC. 24	P-96.07	NW 1/4 SEC. 29
U5-38	SE 1/4 SEC. 24	P-96.09	NW 1/4 SEC. 29
U5-39	SE 1/4 SEC. 19	P-97.02	NW 1/4 SEC. 29
U5-40	SE 1/4 SEC. 24	P-97.03	NE 1/4 SEC. 35
U5-41	SW 1/4 SEC. 19	P-98.00	SW 1/4 SEC. 30
U5-42	NW 1/4 SEC. 24	P-108.01	SW 1/4 SEC. 35
U5-43	NW 1/4 SEC. 24	W-34.02	SE 1/4 SEC. 30
U5-44	NW 1/4 SEC. 24	W-48.03	SW 1/4 SEC. 23
U5-45	NE 1/4 SEC. 30	DW-34.03	SE 1/4 SEC. 30
U5-46	NE 1/4 SEC. 30	DS-95.01	SE 1/4 SEC. 35
U5-47	NE 1/4 SEC. 30	Survey 5-103 Stream	NW 1/4 Sec. 34
U5-48	SE 1/4 SEC. 25	Survey 5-91 Streams	NW 1/4 Sec. 28
U5-49	NE 1/4 SEC. 22	Survey 5-67 Stream	NW 1/4 Sec. 28
U5-50	NE 1/4 SEC. 4	Survey 5-120 Stream	SW 1/4 Sec. 28
U5-51	SE 1/4 SEC. 5	Survey 5-96 Streams	NW 1/4 Sec. 29
U5-52	NE 1/4 SEC. 5	Survey 5-105 Stream	NE 1/4 Sec. 30

GROUND WATER/SURFACE WATER SITE INDEX
FOR SITES NOT LISTED IN D-0425-3

DS-27B	**SE 1/4 Sec. 25**
DS-27C	**SE 1/4 Sec. 25**
DS-132A	**NW 1/4 Sec. 30**
DS-135A	**SW 1/4 Sec. 30**
DS-146B	**SW 1/4 Sec. 36**
DS-146D	**SW 1/4 Sec. 36**
DS-146E	**SW 1/4 Sec. 36**
DS-184A	**SW 1/4 Sec. 30**
DS-184B	**SW 1/4 Sec. 30**
DW-140A	**SE 1/4 Sec. 36**
W-142A	**SE 1/4 Sec. 36**
W-148A	**SW 1/4 Sec. 36**
DW-184A	**SW 1/4 Sec. 30**
DW-259	**NW 1/4 Sec. 35**

ADDENDUM TO PART 2, ATTACHMENTS 14A, 14C, 14D
AMERICAN ENERGY CORPORATION

SAMPLE SITE	STATE PLANE COORDINATES X	Y	SAMPLE SITE	STATE PLANE COORDINATES X	Y
W-10.00	2,426,305	677,251	DS-34.01	2,425,737	676,693
W-11.00	2,427,177	677,346	DS-36.00	2,430,076	673,285
WL-11.01	2,427,100	677,401	DS-37.01	2,429,003	672,704
W-12.00	2,427,408	677,311	DS-38.01	2,427,933	673,914
W-14.00	2,428,205	677,260	DS-48.00	2,427,019	670,749
W-15.00	2,428,858	676,658	DS-5.00	2,428,280	677,931
WL-25.00	2,427,783	677,056	DS-53.00	2,426,065	673,688
W-26.00	2,430,391	676,413	DS-58.01	2,424,840	667,432
W-28.03	2,426,070	675,039	DS-6.00	2,424,744	678,806
W-29.00	2,426,113	676,050	DS-60.03	2,428,252	668,474
W-30.00	2,425,757	675,327	DS-68.00	2,423,077	671,671
W-32.00	2,429,559	676,426	DS-68.01	2,423,451	672,243
WL-33.00	2,425,680	675,910	DS-68.03	2,422,365	672,563
WL-34.01	2,426,152	676,951	DS-68.04	2,422,233	672,740
W-37.00	2,430,102	672,755	DS-68.06	2,422,806	672,058
W-37.02	2,429,579	672,979	DS-68.07	2,422,285	671,854
WL-49.00	2,428,389	669,687	DS-70.00	2,422,237	670,119
W-60.00	2,428,323	668,998	DS-72.00	2,429,586	669,440
W-60.01	2,428,474	668,586	DS-91.02	2,420,121	668,517
W-68.02	2,422,393	672,378	DS-91.03	2,419,963	668,431
W-83.00	2,419,560	672,301	DS-91.04	2,419,915	668,051
WL-84.00	2,419,610	671,994	DS-91.05	2,418,937	668,634
WL-86.00	2,419,486	671,460	DS-91.06	2,421,030	668,526
WL-88.00	2,419,627	672,165	DS-91.07	2,419,484	669,485
WL-90.00	2,419,782	669,451	DS-96.00	2,419,892	672,460
W-91.01	2,419,748	668,552	DS-96.02	2,420,580	672,488
WL-92.00	2,419,828	672,001	DS-96.04	2,419,809	672,727
WL-94.00	2,419,118	670,247	DS-96.05	2,419,953	673,014
W-97.00	2,420 947	673,304	DS-96.06	2,421,849	672,446
WL-108.00	2,417,182	671,835	DS-96.08	2,422,129	673,087
WL-109.00	2,420,187	666,387	DS-96.10	2,421,388	674,059
W-112.01	2,415,177	671,250	DS-96.11	2,421,486	673,767
W-113.00	2,414,911	670,020	DS-96.12	2,420,483	673,475
W-114.00	2,415,379	666,999	DS-96.13	2,419,963	674,822
W-114.01	2,415,565	666,746	DS-104.00	2,416,988	668,989
W-116.00	2,415,704	670,528	DS-104.01	2,417,128	668,860
W-117.00	2,415,623	669,291	DS-109.01	2,419,698	666,708
WL-123.00	2,428,794	666,006	DS-110.00	2,420,436	666,544
W-124.00	2,415,993	666,923	DS-111.00	2,420,776	667,567
W-126.00	2,431,023	666,163	DS-112.00	2,415,452	671,695
DW-26.01	2,429,313	676,185	DS-114.02	2,414,256	667,162
DW-34.00	2,426,277	677,061	DS-114.03	2,415,347	666,761
DW-38.00	2,428,025	673,662	DS-114.04	2,415,491	667,444
DW-48.02	2,428,097	670,250	DS-117.01	2,415,711	669,440
DW-53.01	2,426,398	673,829	DS-118.00	2,416,175	666,381
DW-58.00	2,424,886	667,157	DS-119.00	2,417,860	667,371
DW-60.02	2,428,391	668,714	DS-119.02	2,417,205	668,147
DW-61.00	2,428,624	668,601	DS-119.03	2,418,390	666,766
DW-91.00	2,419,868	668,497	DS-119.04	2,418,604	666,420
DW-94.01	2,418,953	670,378	DS-119.05	2,418,718	666,500
DW-95.00	2,419,481	670,555	DS-119.06	2,418,587	666,282
DW-96.03	2,420,094	672,630	DS-119.07	2,418,782	666,598
DW-97.01	2,420,877	673,190	DS-122.00	2,428,601	667,130
DW-98.01	2,421,617	675,589	D5-1	2,425,137	667,123
DW-112.02	2,415,144	671,357	D5-2	2,424,305	667,215
DW-115.00	2,414,490	671,038	D5-3	2,426,596	667,112
DW-119.01	2,418,819	666,243	D5-5	2,429,986	668,801
DW-120.00	2,421,895	666,518	D5-6	2,431,828	669,507
DW-121.00	2,418,286	666,961	D5-7	2,431,905	679,141
DW-123.01	2,428,727	666,322	D5-8	2,417,914	667,964
DW-126.01	2,431,159	666,259	D5-9	2,416,883	669,859
DS-18.00	2,423,889	676,602	D5-10	2,415,888	671,745
DS-26.02	2,429,336	676,099	D5-11	2,423,465	680,953
DS-26.04	2,427,856	676,458	D5-12	2,423,914	680,938
DS-28.00	2,426,099	675,829	D5-13	2,415,224	665,732
DS-28.01	2,425,788	675,113	D5-14	2,422,706	665,783
DS-28.02	2,425,444	675,100	D5-15	2,432,082	666,674

ADDENDUM TO PART 2, ATTACHMENTS 14A, 14C, 14D
AMERICAN ENERGY CORPORATION

SAMPLE SITE	STATE PLANE COORDINATES X	Y
D5-0	2,425,806	665,803
U5-1	2,415,829	676,616
U5-2	2,432,459	670,872
U5-3	2,432,370	672,311
U5-4	2,431,597	674,223
U5-5	2,431,302	675,379
U5-6	2,430,128	680,846
U5-7	2,429,229	680,900
U5-8	2,427,433	680,856
U5-9	2,422,767	679,323
U5-10	2,418,951	672,260
U5-11	2,419,109	670,030
U5-12	2,420,590	669,186
U5-13	2,422,252	669,335
U5-14	2,423,128	669,015
U5-15	2,419,900	670,393
U5-16	2,419,918	671,511
U5-17	2,420,667	674,940
U5-21	2,423,550	676,354
U5-22	2,423,015	676,023
U5-23	2,425,135	676,383
U5-24	2,425,035	675,194
U5-25	2,426,644	673,401
U5-26	2,426,324	672,237
U5-27	2,426,817	671,943
U5-28	2,427,539	672,190
U5-29	2,427,910	669,645
U5-30	2,427,901	668,705
U5-31	2,428,874	668,221
U5-32	2,428,447	669,447
U5-33	2,428,654	670,205
U5-34	2,428,325	671,095
U5-35	2,427,881	673,162
U5-36	2,426,613	675,244
U5-37	2,427,671	676,595
U5-38	2,431,132	676,530
U5-39	2,431,289	680,410
U5-40	2,429,478	676,468
U5-41	2,428,767	680,222
U5-42	2,427,165	679,510
U5-43	2,426,624	678,235
U5-44	2,427,533	677,789
U5-45	2,425,448	677,362
U5-46	2,424,320	677,257
U5-47	2,423,632	677,812
U5-48	2,425,712	680,374
U5-49	2,429,658	667,463
U5-50	2,413,952	668,278
U5-51	2,413,879	672,891
U5-52	2,414,049	674,571
P-48.01	2,427,645	670,190
P-5.01	2,427,872	677,964

SAMPLE SITE	STATE PLANE COORDINATES X	Y
P-68.05	2,422,304	673,016
P-96.01	2,420,154	672,507
P-96.07	2,421,508	673,035
P-96.09	2,421,426	673,865
P-97.02	2,420,960	673,414
P-97.03	2,420,611	673,343
P-98.00	2,422,312	675,390
P-108.01	2,417,482	671,165
DW-34.03	2,426,309	676,885
W-34.02	2,426,314	676,839
W-48.03	2,427,075	670,373
DS-95.01	2,419,915	670,510
W-142A	2,417,949	675,256
W-185	2,424,852	676,752

Note: X-Y coordinates for water impoundments were taken at the triangle sampling symbol as shown on the Application/Hydrology Map.

THE OHIO VALLEY COAL COMPANY
POWHATAN NO. 6 MINE - ALLEDONIA STATION
RAINFALL - 2004

RAINFALL AS OF: 01/01/05

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	0.40	0.00	0.32	0.58	0.00	0.00	0.00	0.00	0.01	T	0.00	0.01	
2	1.01	0.79	0.00	0.04	0.17	0.45	0.00	0.02	0.00	T	0.31	0.00	
3	0.50	0.15	0.18	0.00	0.00	0.01	0.00	T	0.00	0.00	0.13	0.00	
4	1.16	0.00	T	0.10	0.02	0.02	0.43	0.02	0.00	0.00	0.10	0.00	
5	0.02	1.10	0.50	0.00	0.00	0.00	0.02	0.00	0.00	0.10	0.00	0.05	
6	T	0.27	0.08	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	
7	0.00	0.00	0.01	0.05	0.00	0.00	0.07	0.00	0.64	0.00	0.00	0.00	
8	0.04	0.00	0.04	0.18	0.00	0.00	0.00	0.00	5.26	0.00	0.00	0.00	
9	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	
10	0.00	0.00	0.00	0.00	0.00	1.20	0.05	0.76	0.00	0.00	0.00	0.10	
11	0.00	0.00	0.02	0.00	0.53	0.00	0.50	0.27	0.00	0.00	0.36	0.05	
12	0.01	0.00	0.00	0.98	0.01	0.00	0.00	0.16	0.00	0.00	0.03	0.03	
13	0.00	0.00	0.00	1.12	0.00	1.40	0.08	0.00	0.00	0.24	0.00	0.01	
14	T	0.00	0.01	0.09	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	
15	0.00	0.00	0.07	0.00	0.20	T	0.00	0.00	0.00	0.20	0.02	0.00	
16	0.00	0.00	0.37	0.00	0.00	0.01	0.00	0.00	0.37	0.01	0.23	0.00	
17	0.00	0.00	T	0.00	1.60	0.29	0.33	0.00	5.73	0.00	0.45	0.00	
18	0.42	0.00	0.34	0.03	1.86	0.00	0.62	0.00	0.00	1.24	0.15	0.00	
19	T	0.00	0.00	0.07	0.85	0.00	0.02	0.21	0.00	0.02	0.00	0.13	
20	0.00	0.05	0.00	0.24	0.00	0.09	0.00	0.50	0.00	0.02	0.00	0.00	
21	0.00	0.01	0.00	0.05	0.94	0.00	0.00	0.05	0.00	0.00	0.00	0.02	
22	T	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.78	
23	0.31	0.20	0.00	0.02	0.05	0.00	T	0.00	0.00	0.27	0.16	0.10	
24	0.00	T	0.00	0.00	0.01	0.00	0.50	0.02	0.00	0.00	0.37	0.00	
25	0.25	0.00	0.00	0.34	0.28	0.00	1.05	T	0.00	0.00	0.00	0.00	
26	0.20	0.00	0.00	0.01	0.02	0.00	0.58	0.16	0.00	0.00	0.00	0.01	
27	0.15	0.00	0.10	0.00	0.00	0.00	T	0.33	0.00	0.14	0.00	0.00	
28	T	0.00	0.00	0.00	0.00	0.37	0.00	0.42	0.00	0.30	0.51	0.00	
29	0.00		0.06	0.00	0.00	0.00	0.00	0.41	0.00	0.06	0.01	0.00	
30	0.00		0.51	0.15	0.38	0.00	0.02	0.23	0.00	0.15	0.99	0.00	
31	0.00		0.52		0.03		1.11	0.00		0.00		T	
TOTAL	4.47	2.57	3.13	4.38	7.02	4.10	5.38	3.56	12.01	2.75	3.89	1.52	54.78
H/L	H	H	L	H	H	L	H	L	H	H	H	L	

Rain gauge is read at 7:00 am for the prior day. H/L compares the monthly rainfall with the 50 year average for this area
Alledonia station is located approximately 5.5 miles northeast of the application area.

AEC 06534

THE OHIO VALLEY COAL COMPANY
POWHATAN NO. 6 MINE - ALLEDONIA STATION
RAINFALL - 2003

RAINFALL AS OF: 06/17/04

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.10	0.02	0.00	0.00	T	0.00	0.00	T	0.57	T	0.00	0.00
2	0.18	0.00	0.03	0.00	0.00	0.23	0.00	0.29	0.07	0.00	0.05	0.00
3	0.07	0.65	0.00	0.00	0.00	0.89	0.00	0.89	0.01	0.00	0.00	0.00
4	0.03	0.03	0.02	0.64	0.67	0.02	0.00	0.05	0.00	0.21	0.00	0.21
5	0.20	0.00	0.32	0.04	0.14	0.00	0.40	0.00	0.00	0.00	0.35	0.40
6	0.12	0.10	0.02	0.20	0.00	0.64	0.14	0.01	0.00	0.00	0.03	0.00
7	0.00	0.00	0.00	0.37	0.35	0.10	0.40	0.59	0.00	0.00	0.00	0.00
8	T	0.00	0.00	T	T	0.41	0.29	0.12	0.00	0.00	0.00	0.00
9	0.00	0.07	0.03	0.00	1.51	0.00	0.37	0.65	0.01	0.01	0.00	T
10	0.02	0.07	0.00	0.47	0.20	T	0.73	0.01	0.00	0.00	0.00	0.87
11	0.00	0.05	0.00	0.07	0.22	0.24	0.78	T	0.00	0.00	1.53	T
12	0.00	0.00	0.00	0.00	0.17	0.01	1.36	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.13	0.00	0.00	0.10	0.00	0.00	0.01	0.00	0.00	T
14	0.01	0.20	0.00	0.00	0.52	0.00	0.00	0.00	0.11	1.19	0.00	0.56
15	0.00	0.00	0.00	0.00	0.30	0.18	0.58	0.37	0.38	0.00	T	0.00
16	0.11	1.30	0.00	0.07	0.00	0.36	0.00	0.70	0.00	0.26	T	0.34
17	T	0.05	0.00	0.06	0.18	0.49	0.01	0.00	0.00	0.12	0.00	0.02
18	0.01	0.02	0.00	0.00	0.00	0.00	0.12	0.00	2.06	0.00	0.85	0.02
19	0.05	0.07	T	0.00	0.00	0.01	0.00	0.00	0.15	0.00	0.68	0.04
20	0.05	T	0.14	0.54	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.35	0.03	0.02	0.00	0.00	0.19	T	0.00	T	0.00	0.00
22	0.00	0.40	0.00	0.01	0.01	0.00	1.42	0.00	0.80	0.04	0.00	0.00
23	0.07	0.16	0.00	0.00	0.00	0.00	1.06	0.00	0.00	T	0.00	0.49
24	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.09
25	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.25	0.00
26	0.16	0.00	0.03	0.00	0.00	0.01	0.00	0.74	0.04	1.15	0.00	0.00
27	0.00	0.00	0.00	0.00	0.14	0.00	0.12	0.59	0.27	0.03	0.52	0.00
28	0.16	0.00	0.00	0.27	T	0.00	0.02	0.01	0.04	0.13	0.00	0.00
29	0.16		0.00	T	0.10	0.00	0.00	0.79	0.04	0.00	0.00	0.39
30	0.00		0.23	0.04	0.00	0.00	0.00	0.85	0.24	0.00	0.29	0.00
31	0.07		0.06		0.50		0.46	0.91		T		0.00
TOTAL	1.57	3.54	1.04	2.80	6.00	3.69	8.46	7.57	4.86	3.14	4.55	3.43
H/L	L	H	L	L	H	L	H	H	H	H	H	H

Rain gauge is read at 7:00 am for the prior d H/L compares the monthly rainfall with the 50 year average for this area

AEC 06535

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT
ATTACHMENT 14D
(SURFACE WATER BODIES/PUBLIC WATER SUPPLIES)

Applicant's Name American Energy Corporation (D-0425-5)

Surface Water/ Public Supply Identification #	Type of Surface Water/Public Supply	Name of Owner of Surface Water/ Public Supply	Known Uses of Surface Water/ Public Supply
U5-45, U5-46, U5-47, U5-48, D5-12, U5-9, to D5-11 (tributaries to Crabapple Creek)	Intermittent Streams	See Map	None
U5-6, U5-7, U5-8, U5-39, U5-41 (Northern tributaries to Pea Vine Creek)	Intermittent Streams	See Map	None
U5-38, U5-40, U5-42, U5-43, U5-44, D5-7 (Southern tributaries to Pea Vine Creek)	Intermittent Streams	See Map	None
U5-2, U5-3, U5-4, U5-5 (Eastern tributaries to Paine Run	Intermittent Streams	See Map	None
U5-31, U5-49, U5-32, U5-33, D5-5, U5-34, U5-35, (Western tributaries to Paine Run)	Intermittent Streams	See Map	None
U5-36, U5-37 to D5-6 and D5-15 (Paine Run)	Intermittent/Perennial Streams	See Map	None
U5-17, U5-21, U5-22, U5-23, U5-24, U5-25, U5-26, U5-27, U5-28, U5-29, U5-30, DS-68.00, DS-68-01, DS-68.06, D5-1, D5-3 (Eastern tributaries to Ackerson Run)	Intermittent/Perennial Streams	See Map	None
U5-12, D5-2, U5-13, U5-14, U5-15, U5-16, (west tributaries to Ackerson Run) to D5-0 (Ackerson Run)	Intermittent/Perennial Streams	See Map	None
U5-52, U5-1, D5-10, U5-10, D5-9, U5-11, D5-8 (eastern tributaries to East Fork)	Intermittent/Perennial Streams	See Map	None
U5-50, U5-51, (western tributaries), to D5-13 (East Fork)	Intermittent/Perennial Streams	See Map	None
D5-14	Intermittent Stream	See Map	None
P48.01, P-5.01	Impoundments	See Map	Livestock
P-68.05, P-96.01, P-96.07	Impoundments	See Map	Livestock
P-96.09, 97.02, P-97.03, P-98.00	Impoundments	See Map	None
P-108.01	Impoundment	See Map	Recreational
Surveys: 5-103 Stm., 5-91 (2) Strms., 5-67 Stm.	Unnamed Tributaries to Unnamed Tributaries	See Map	None
Surveys: 5-120 Stm., 5-96 Strms., 5-105 Stm.	Unnamed Tributaries to Unnamed Tributaries	See Map	None

ATTACHMENT 14D
PERMIT D-0425-3
AMERICAN ENERGY CORPORATION
D-0425-3

Surface Water/ Public Supply Identification	Type of Surface Water/Public Supply	Name of Owner of Surface Water/ Public Supply	Known Uses of Surface Water/ Public Supply	WATERSHED	DRAINAGE BASIN
P-1	Pond	R. Thomas	Recreation		
P-4	Pond	Raven Rocks	Recreational		
P-5	Pond	Raven Rocks	Recreational		
P-26	Pond	R&T Jarrett	Unused		
P-27	Pond	R&M Inherst	Livestock		
P-30	Pond	H&B Mellott	Livestock		
P-39	Pond	T. Ledney And	Unused		
P-40	Pond	C&B Datkuliak	Livestock		
P-45	Pond	R. Kindelberger	Livestock		
P-46	Pond	W. Reed	Recreation		
P-47	Pond	N. Hamilton	Livestock		
P-50	Pond	R. Heller	Livestock		
P-51	Pond	T. Ledney	Livestock		
P-52	Pond	W. Reed	Recreation		
P-53	Pond	W. Reed	Livestock		
P-54	Pond	W. Reed	Recreation		
P-55	Pond	W. Reed	Recreation		
P-56	Pond		Unused		
P-57	Pond	J and M Ward	Recreation		
P-58	Pond	J and M Ward	Recreation		
P-59	Pond	G Louden	Recreation		
P-61	Pond	J. Riley	Livestock		
P-63	Pond	N. Moore	Livestock		
U2-02/D2-01	Perennial, PINEY CREEK	See Application Map	Unused	PINEY CREEK	CAPTINA CREEK
U-22/D-22/U-21/D-21/U2-07	INTERMITTENT TRIBUTARIES TO PINEY CREEK	See Application Map	Livestock	PINEY CREEK	CAPTINA CREEK
D-20	PERENNIAL TRIBUTARIES TO PINEY CREEK	See Application Map	Livestock	PINEY CREEK	CAPTINA CREEK
U-1/U1-01/U1-06/U1-04/U1-05/U1-08/U1-09/U1-10/U1-11/U1-12/U1-13/U1-02/U1-03/U1-07	Perennial, Crabapple Creek	See Application Map	Livestock	CRABAPPLE CREEK	CAPTINA CREEK

6-24-05;10:11AM; Hamilton ;1 # 7/ 14
AEC 06537

ATTACHMENT 14D
PERMIT D-0425-3
AMERICAN ENERGY CORPORATION

U1A-05/U1A-02/U1A-01/U1A-08/U1A-07/U1-01A/U1-01B/U1A-10/U1A 07/U-11B/D1-1A	INTERMITTENT, TRIBUTARIES TO U-1A	See Application Map	Livestock	CRABAPPLE CREEK	CAPTINA CREEK
U-1A/D-11	Perennial TRIBUTARIES TO U-1A	See Application Map	Livestock	CRABAPPLE CREEK	CAPTINA CREEK
U-8/D-8/u1-19/U-100/U1-18/U1-09/U1-11	Intermittent, TRIBUTARIES TO CRABAPPLE	See Application Map	Unused	CRABAPPLE CREEK	CAPTINA CREEK
U1-02A/U1-02B/U1-02C/U1-02D/U1-12/U1-13/U1-14	INTERMITTENT TRIBUTARIES TO U1-02	See Application Map	Livestock	CRABAPPLE CREEK	CAPTINA CREEK
U1-02/U1-10/U1-08/U1-01/U1-04	PERENNIAL TRIBUTARIES TO CRABAPPLE CREEK	See Application Map	Livestock	CRABAPPLE CREEK	CAPTINA CREEK
D1-01/U1-07	PERENNIAL CRABAPPLE CREEK	See Application Map	Livestock	CRABAPPLE CREEK	CAPTINA CREEK
U1-16/U1-17/U1-05/U1-06/U1-15	INTERMITTENT TRIBUTARIES TO U1-04	See Application Map	Livestock	CRABAPPLE CREEK	CAPTINA CREEK
U40-01/U40-02A/U40-03A/U40-04/U43-01/U43 06/U43-03/U43-04/U43-02	INTERMITTENT TRIBUTARIES TO PEA VINE	See Application Map	Livestock	PEA VINE	CAPTINA CREEK
D43-05	PERENNIAL TRIBUTARIES TO PEA VINE	See Application Map	Livestock	PEA VINE	CAPTINA CREEK
U-40/D-40/D-43	Perennial, Pea Vine	See Application Map	Livestock	PEA VINE	CAPTINA CREEK
U41/U41-01/U41-02	Perennial	See Application Map	Livestock	ACKERSON RUN	SUNFISH CREEK
U41-04	Intermittent	See Application Map	Livestock	ACKERSON RUN	SUNFISH CREEK
U42/U42-01/U42-02/U42 03/U42-04	Perennial	See Application Map	Unused	EAST FORK	SUNFISH CREEK

6-24-05;10:11AM; Hamilton ;1 # 8/ 14
AEC 06538

ADDENDUM TO PAGE 18, PART 2, D
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

SEASONAL VARIATIONS OF WATER QUALITY AND QUANTITY

Surface and groundwater data contained in the Attachment 14 forms included with this application indicate the seasonal variances of quality and quantity of the water in this area.

The water wells existing in the area give a fairly representative indication of the near surface water bearing zones that can be found in this region. The Probable Hydrologic Consequences of mining gives a detailed description of these characteristics.

Precipitation is one of the principal factors influencing water systems. Infiltration of precipitation increases soil moisture and influences groundwater chemical composition. The time required for infiltrating precipitation to reach lower water bearing zones increases with increasing depth. Depending on the morphological structure, character of surface vegetation, and intensity of precipitation, the amounts of infiltration also vary greatly. Amounts of infiltration subsequently influence the dissolved solids contents of groundwater, which, in most cases, become more dilute during periods of prolonged precipitation. Rainfall data collected near the mine has been included in this application.

ADDENDUM TO PART 2, PAGE 18, ITEM E(1, 2, & 3)
AMERICAN ENERGY CORPORATION
CENTURY MINE, PERMIT D-0425-5

HYDROLOGIC DETERMINATION

(1) The proposed longwall mining operation should have no impacts on the contents of total suspended and dissolved solids, acidity, or pH. Some wells may exhibit increases in iron and manganese during the post-mining phase. Some springs may exhibit increases in iron, manganese, and hardness during the post-mining phase. These increases are typically temporary and do not persist for more than one year. The quality of the surface and ground water in the application area is not expected to be changed in the long term as a result of the proposed mining activities. Specifically, the levels of pH, iron, manganese, total suspended solids, and total dissolved solids are not expected to vary from their original levels. However, these parameters may be temporarily changed.

(2) Aquifers in these strata normally have low yields and are less susceptible to mine subsidence fracturing. If fracturing occurs, they tend to close in response to lithostatic pressures or plug with fine-grained sediment and may contain clays that swell when wetted. Additionally, there are horizontal and vertical variability in the rock strata. Rapid facies and hydrologic property changes limit the horizontal continuity of individual rock units. With the exception of persistent coal seams, few lithologic units are continuous across the proposed D-0425-5 area. All of these factors tend to enhance the importance of localized flow systems. Most available ground water in this region is limited to the first 100 feet of the surface where enhanced permeability associated with rock fracturing is present. The depth of drilled wells within the D-0425-5 area ranges from 160 feet (as measured, log reports 199') to 39 feet, dug wells from 59.9 feet to 11 feet. Ground water recharge in the upper ridge and ridge top areas results in downward migration within this shallow saturated zone. Because topographic relief between ridge tops generally exceeds 100 feet, there are localized flow systems under the ridge tops that are not hydrologically connected with adjacent ridge tops. Ground water under any given ridge top can be considered continuous, however, continuity does not generally extend to adjacent ridgetops. Although the overall hydrologic regime will not be affected, individual sources of ground and surface water may be temporarily disrupted. Supplies that are affected permanently will be replaced by AEC at its own expense by connecting the water user to another supply. The cost of domestic water will be the responsibility of the water user unless otherwise agreed upon by AEC and the water user.

Based on core hole data presented in the approved test hole variance request, "soft" rocks make up an average of 66% of the strata within the D-0425-5 area. Soft rocks are defined here as shale, claystone, sandy shale and clay. The high percentage of soft rocks is significant as they have limited permeability, tend to deform in a more plastic manner, and are more prone to self-healing after fracturing. This process limits the amount of water that would tend to migrate downward. A readjustment of the subsurface flow system does not occur in areas of high cover (>200 feet).

ADDENDUM TO PART 2, PAGE 18, ITEM E(2), continued;

Some changes in ground water levels and repositioning of some hillside springs will result. Changes to the hydrologic balance in these areas, however, are minimized. The water that infiltrates from the surface remains in the flow system and is not expected to enter the mine. The lowering of static water levels will result in inconvenience (generally temporary) to ground water users in the D-0425-5 area. Based on water bearing zones identified in test holes, as well as field information collected during sampling of developed water supplies, five aquifers have been identified within the D-0425-5 area. These aquifer zones are identified on Attachment 14B contained in this application.

(3)(a) The proposed underground longwall mining operation will have no impact on sediment yield.

(b) The proposed underground longwall mining operation will have no impact on flooding. Surface drainage within D-0425-5 is divided into four drainage areas. State Route 556 roughly follows the drainage divide between the northern and southern portions of the permit. The area north of St. Rt. 556 is drained by unnamed tributaries to Crabapple Creek and Pea Vine Creek. Crabapple Creek and Pea Vine Creek are tributaries of Captina Creek. The area east of County Road 38 is drained by unnamed tributaries of Paine Run. The area west of Co. Rd. 38 and east of Co. Rd. 31 is drained by unnamed tributaries to Ackerson Run. The area west of Co. Rd. 31 is drained by unnamed tributaries to East Fork, which flows to Piney Fork. Paine Run, Ackerson Run, East Fork, and Piney Fork are tributaries of Sunfish Creek. It is expected that water flow in streams, where overburden exceeds 200 feet, may be temporarily reduced over relatively short stream segments. Due to the high percentage of soft rocks in the overburden, the overburden thickness (minimum 350 feet), and the minimal amount of water that is expected to enter the mine, any stream water loss should not drain into the proposed mine workings. Also see the PHC prepared by Moody & Associates for permit D-0425-1, beginning in the 5th paragraph on Page 10 and continuing on Page 11, for analysis of stream monitoring information from the Powhatan No. 6 mine.

(c) The majority of the developed water supplies in the D-0425-5 area are located along public roads. A total of 163 developed water supplies, 79 wells and 84 springs, were identified and inventoried within the hydrologic boundary for D-0425-5. See attachment 14C for a list of these supplies. Of the 163 developed supplies, 68 springs and 42 wells (total 110 supplies) are legitimately used. Of these legitimately-used supplies, 13 springs and 11 wells are located outside of the shadow area of the proposed mine, but within the hydrologic boundary. Descriptive information for each legitimately-used developed supply, as its position relates to the coal seam to be mined, and the anticipated impact and magnitude of impact is listed on Table A, Wells and Springs, labeled as an addendum to Part 2, Page 18, Item F(1). Only potential impacts on the legitimately-used water supplies have been addressed.

There are 37 ground water supplies inventoried in D-0425-3 outside the shadow area in that application. 23 of these supplies have a legitimate use. Their position in relation to the D-0425-5 mining area has changed their status of impact from mining. For this reason, the 23 legitimately-used supplies have been added to Table A to address their revised impact from mining. The 23 legitimately-used supplies are included in the tally on Table A, page 7 of 7. For ease of review, copies of the Attachment 14C from D-0425-3 have been included with this application, with the 37 ground water sites highlighted in yellow.

Table A presents a summary of the pertinent data for legitimately-used ground water supplies within the D-0425-5 area. The average well depth in the area is ***68*** feet. The average overburden thickness, from well bottoms to the coal, and from the spring surface elevations to the coal, is 536 feet. A summary of the location of legitimately-used supplies in relation to the longwall panels is included at the end of Table A. Springs are generally more significantly impacted than wells. Approximately ***65%*** of the legitimately-used developed springs, and approximately 66% of the legitimately-used wells are in danger of being ***severely*** impacted by mining on the D-0425-5 area.

In accordance with literature; Carver, Leslie and Rauch, Henry, 1994, "Hydrogeologic Effects of Subsidence at a longwall mine in the Pittsburgh Coal Seam," Proceedings of the 13 th International Conference of Ground Control in Mining, West Virginia University, Morgantown, West Virginia, pp. 298 - 307: A review of the literature indicates that the vast majority of ground water impacts occur in an area defined by the angle of less than 40 degrees from a vertical line drawn at the panel's edge; this angle has been called the angle of dewatering (Cifelli and Rauch, 1986; Tieman and Rauch, 1986; Rauch, 1989; and Carver and Rauch, 1994). Calculations based on this angle of dewatering, given a maximum overburden of 600 feet result in a distance of approximately 500 feet from the panel edge (600 x tan 40° = 503, as tan 40° = 0.839). Carver and Rauch found that 90 percent of affected supplies adjacent to panels were within a 27-degree angle of dewatering, which supports the OVCC finding (600 feet x 27° = 305 feet, as tan 27° = 0.510. The remaining 10 percent that exceeded the 27-degree angle of dewatering consisted of a single supply.

Using the 40-degree angle for hydrologic impact from the panel edge gives a distance of 643 feet for the proposed D-0425-5 application, based on the following calculation: 766 feet (max overburden thickness) x tangent 40-degrees (.0839) = 643 feet. The actual distance of impact from a longwall panel is a function of overburden thickness, and the fixed value is the 40-degree angle measured from a line that extends vertically from the panel edge.

Table B presents a summary of the pertinent data for the streams and ponds. Eight (8) ponds have been identified as having an agricultural livestock, and/or recreational use. ***Five (5) additional ponds and two (2) upstream sample sites from permit D-0425-3 are now located over the shadow area of D-0425-5. To address additional impacts on legitimately-used sources, they have been addressed on Table B. For ease of review, copies of the Attachment 14D from D-0425-3 have been included with this application, with the legitimately-used sources highlighted in yellow.***

Also see the approved PHC prepared by Moody & Associates in permit D-0425-1, "Evaluation of Hydrologic Impacts from Longwall Mining" beginning on Page 7 and continuing through Page 12.

The Powhatan No. 6 Mine is located approximately four miles north of the proposed Century Mine D-0425-5 area. The Powhatan No. 1 Mine (Bt-270) is located east of the D-0425-5 area, however, is no closer than 250 of the proposed mine gate areas, and no closer than 500 feet of a proposed longwall panels. The proposed mining on D-0425-5 will have no affect on the abandoned Bt-270 mine.

Some temporary changes to individual ground water and surface water source availability are anticipated. Wells and springs may go dry, streams may flow less, ponds may de-water. However, the effect on sediment yield, acidity, total suspended and dissolved solids, and flooding are expected to be minimal, if any. No long-term changes of this sort have been observed at the adjacent Powhatan No. 6 mine.

The effects are expected to stabilize within about two years as the localized water table reaches equilibrium again. Ponds and streams with visible cracks that are draining water will be repaired. Permanent replacement supply systems will be provided ***if*** an individual source is permanently affected.

TABLE A

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
American Energy Corporation, Application Area D-0425-5

Well/Spring Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Total Well Depth	Well Bottom Elev.	Coal Elev. (ft)	Overburden (ft) Well Bottom to coal	Anticipated Impact	*Magnitude	Panel Position	Distance to Nearest Panel
W-14.00	1310	51.4	1258.6	654	604.6	Dewatering	Severe / Likely	Center	N/A
W-28.03	1320	Unknown	Unknown	643	Unknown	Dewatering	Severe / Likely	Center	N/A
W-29.00	1340	67'	1273	653	620	Water Level Decline	Severe / Likely	Quarter	N/A
W-30.00	1338	66.3'	1271.7	646	625.7	Water Level Decline	Severe / Likely	Quarter	N/A
WL-33.00	1355	90'	1265	651	614	Water Level Decline	Severe / Likely	Quarter	N/A
WL-34.01	1360	62'	1298	658	640	Water Level Decline	Severe / Likely	Quarter	N/A
W-37.00	1210	82'	1128	626	502	Water Level Decline	Minimal / Possible	Outside	655'
W-37.02	1215	51'	1164	627	537	Water Level Decline	Moderate / Probable	Over Gate	120'
WL-49.00	1280	90'	1190	616	547	Water Level Decline	Severe / Likely	Edge, Panel/Gate	N/A
W-83.00	1240	75'	1165	650	515	Dewatering	Severe / Likely	Center	N/A
WL-84.00	1242	120'	1122	649	473	Water Level Decline	Severe / Likely	Quarter	N/A
WL-86.00	1265	110'	1155	647	508	Water Level Decline	Severe / Likely	Quarter	N/A
WL-88.00	1250	70'	1180	649	531	Water Level Decline	Severe / Likely	Quarter	N/A
WL-90.00	1305	110'	1195	641	554	Water Level Decline	Severe / Likely	Quarter	N/A
W-91.01	1250	Unknown	Unknown	640	Unknown	Water Level Decline	Moderate / Probable	Over Gate	30'
WL-92.00	1260	100'	1160	647	513	Water Level Decline	Severe / Likely	Quarter	N/A
WL-94.00	1240	120'	1120	646	474	Dewatering	Severe / Likely	Center	N/A
W-97.00	1180	86'	1094	646	448	Water Level Decline	Severe / Likely	Quarter	N/A

*Minimal: Water levels for wells or flow for springs either did not decline during mining, or return to pre-mining conditions within 2 months of undermining.
*Moderate: Water levels for wells or flow for springs declined during mining, return to pre-mining ranges within 2 to 6 months after undermining.
*Severe: Water levels for wells or flow for springs declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06544

TABLE A

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
American Energy Corporation, Application Area D-0425-5

Well/Spring Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Total Well Depth	Well Bottom Elev.	Coal Elev. (feet)	Overburden (ft) Well Bot./Spr. Elev. to coal	Anticipated Impact	*Magnitude	Panel Position	Distance to Nearest Panel
WL-109.00	1300	90'	1210	637	573	Water Level Decline	Minimal / Possible	Outside	1100'
W-113.00	1130	88'	1042	666	376	Water Level Decline	Minimal / Possible	Outside	1180'
W-114.00	1090	92'	998	671	327	Water Level Decline	Minimal / Possible	Outside	850'
W-114.01	1065	125'	940	671	269	Water Level Decline	Minimal / Possible	Outside	860'
W-116.00	1150	103'	1047	661	386	Water Level Decline	Moderate / Probable	Outside	375'
W-117.00	1105	Unknown	Unknown	666	Unknown	Water Level Decline	Moderate / Probable	Outside	480'
WL-123.00	1300	160'	1140	613	527	Water Level Decline	Minimal / Possible	Outside	1630'
DW-53.01	1305	32'	1273	636	637	Water Level Decline	Severe / Likely	Quarter	N/A
DW-60.02	1285	16'	1269	613	656	Water Level Decline	Moderate / Probable	Over Gate	20'
DW-94.01	1240	22'	1218	647	571	Water Level Decline	Severe / Likely	Quarter	N/A
DW-96.03	1175	27'	1148	648	500	Water Level Decline	Severe / Likely	Quarter	N/A
DW-115.00	1140	16'	1124	667	457	Water Level Decline	Minimal / Possible	Outside	1575'
DW-119.01	1260	40'	1220	645	575	Water Level Decline	Minimal / Possible	Outside	1180'
DW-120.00	1285	28'	1257	627	630	Water Level Decline	Minimal / Possible	Outside	980'
DS-18.00	1240	N/A	N/A	660	580	Reduced Flow	Moderate / Probable	Over Gate	130'
DS-28.00	1295	N/A	N/A	650	645	Dewatering	Severe / Likely	Center	N/A
DS-28.01	1300	N/A	N/A	644	656	Reduced Flow	Severe / Likely	Quarter	N/A
DS-28.02	1265	N/A	N/A	644	621	Reduced Flow	Severe / Likely	Quarter	N/A

*Minimal: Water levels for wells or flow for springs either did not decline during mining, or return to pre-mining conditions within 2 months of undermining.
*Moderate: Water levels for wells or flow for springs declined during mining, return to pre-mining ranges within 2 to 6 months after undermining.
*Severe: Water levels for wells or flow for springs declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06545

TABLE A

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
American Energy Corporation, Application Area D-0425-5

Well/Spring Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Coal Elev. (feet)	Overburden (feet)	Anticipated Impact	*Magnitude	Panel Position	Distance to Nearest Panel
DS-34.01	1285	657	628	Reduced Flow	Moderate / Probable	Over Gate	75'
DS-36.00	1125	628	497	Reduced Flow	Moderate / Probable	Outside	640'
DS-37.01	1140	627	513	Reduced Flow	Severe / Likely	Quarter	N/A
DS-38.01	1250	634	616	Reduced Flow	Severe / Likely	Quarter	N/A
DS-48.00	1180	618	562	Reduced Flow	Severe / Likely	Quarter	N/A
DS-5.00	1270	656	614	Reduced Flow	Severe / Likely	Edge, Panel/Gate	N/A
DS-53.00	1275	635	640	Dewatered	Severe / Likely	Center	N/A
DS-6.00	1098	671	427	Reduced Flow	Severe / Likely	Edge, Panel/Gate	N/A
DS-60.03	1240	612	628	Reduced Flow	Severe / Likely	Quarter	N/A
DS-68.00	1195	632	563	Reduced Flow	Severe / Likely	Quarter	N/A
DS-68.01	1180	633	547	Reduced Flow	Severe / Likely	Quarter	N/A
DS-68.03	1170	637	533	Reduced Flow	Severe / Likely	Quarter	N/A
DS-68.04	1135	638	497	Reduced Flow	Severe / Likely	Quarter	N/A
DS-68.06	1220	634	586	Reduced Flow	Severe / Likely	Quarter	N/A
DS-68.07	1157	635	522	Reduced Flow	Moderate / Probable	Over Gate	75'
DS-70.00	1157	631	526	Reduced Flow	Severe / Likely	Quarter	N/A
DS-91.03	1240	638	602	Reduced Flow	Severe / Likely	Edge, Panel/Gate	N/A
DS-91.04	1195	639	556	Reduced Flow	Severe / Likely	Quarter	N/A

*Minimal: Water flow for springs either did not decline during mining, or returned to pre-mining conditions within 2 months of undermining.
*Moderate: Water flow for springs declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
*Severe: Water flow for springs declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06546

TABLE A

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
American Energy Corporation, Application Area D-0425-5

Well/Spring Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Coal Elev. (feet)	Overburden (feet)	Anticipated Impact	*Magnitude	Panel Position	Distance to Nearest Panel
DS-91.05	1170	646	524	Reduced Flow	Severe / Likely	Quarter	N/A
DS-91.06	1190	633	557	Reduced Flow	Moderate / Probable	Over Gate	75'
DS-96.00	1200	648	552	Dewatered	Severe / Likely	Center	N/A
DS-96.02	1155	645	510	Dewatered	Severe / Likely	Center	N/A
DS-96.04	1180	649	531	Reduced Flow	Severe / Likely	Quarter	N/A
DS-96.05	1152	650	502	Reduced Flow	Severe / Likely	Edge, Panel/Gate	N/A
DS-96.06	1135	639	496	Dewatered	Severe / Likely	Center	N/A
DS-96.08	1175	641	534	Reduced Flow	Severe / Likely	Quarter	N/A
DS-96.10	1225	647	578	Reduced Flow	Moderate / Probable	Over Gate	75'
DS-96.13	1210	657	553	Reduced Flow	Severe / Likely	Quarter	N/A
DS-104.00	1135	658	477	Dewatered	Severe / Likely	Center	N/A
DS-104.01	1170	657	513	Reduced Flow	Severe / Likely	Quarter	N/A
DS-109.01	1220	640	580	Reduced Flow	Minimal / Possible	Outside	780'
DS-110.00	1230	635	595	Reduced Flow	Minimal / Possible	Outside	1000'
DS-111.00	1220	633	587	Reduced Flow	Severe / Likely	Quarter	N/A
DS-112.00	1140	666	474	Reduced Flow	Moderate / Probable	Over Mains	600'
DS-114.02	1110	674	436	Reduced Flow	Minimal / Possible	Outside	1890'

*Minimal: Water flow for springs either did not decline during mining, or returned to pre-mining conditions within 2 months of undermining.
*Moderate: Water flow for springs declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
*Severe: Water flow for springs declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06547

TABLE A

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
American Energy Corporation
Application Area D-0425-5

Well/Spring Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Total Well Depth	Well Bottom Elev.	Coal Elev. (feet)	Overburden (feet) (Well bottom to coal)	Anticipated Impact	*Magnitude	Panel Position	Distance to Nearest Panel
DS-114.03	1077	N/A	N/A	672	405	Reduced Flow	Minimal / Possible	Outside	1020'
DS-114.04	1055	N/A	N/A	671	384	Reduced Flow	Minimal / Possible	Outside	840'
DS-117.01	1105	N/A	N/A	665	440	Reduced Flow	Moderate / Probable	Over Gate	390'
DS-118.00	1100	N/A	N/A	665	435	Reduced Flow	Minimal / Possible	Outside	1050'
DS-119.02	1167	N/A	N/A	657	510	Reduced Flow	Severe / Likely	Quarter	N/A
DS-119.03	1140	N/A	N/A	647	493	Reduced Flow	Minimal / Possible	Outside	650'
DS-119.04	1200	N/A	N/A	646	554	Reduced Flow	Minimal / Possible	Outside	1040'
DS-119.05	1200	N/A	N/A	646	554	Reduced Flow	Minimal / Possible	Outside	970'
DS-119.06	1240	N/A	N/A	646	594	Reduced Flow	Minimal / Possible	Outside	1175'
DS-119.07	1198	N/A	N/A	646	552	Reduced Flow	Minimal / Possible	Outside	875'
DS-122.00	1265	N/A	N/A	612	653	Reduced Flow	Moderate / Probable	Outside	515'
DW-34.03	1360	23'	1337	658	679	Water Level Decline	Severe / Likely	Quarter	N/A
DS-58.01	1060	N/A	N/A	619	441	Reduced Flow	Moderate / Probable	Outside	140'
WL-108.00	1210	65'	1145	682	463	Water Level Decline	Severe / Likely	Edge, Panel/Gate	N/A
DS-92	1240	N/A	N/A	673	567	Reduced Flow	Severe / Likely	Quarter	N/A

*Minimal: Water flow for springs either did not decline during mining, or returned to pre-mining conditions within 2 months of undermining.
*Moderate: Water flow for springs declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
*Severe: Water flow for springs declined during mining, did not return to pre-mining ranges within 6 months of undermining.

TABLE A

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
American Energy Corporation
Application Area D-0425-5

Well/Spring Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Total Well Depth	Well bottom Elev.	Coal Elev. (feet)	Overburden (feet) (Well bottom to coal)	Anticipated Impact	*Magnitude	Panel Position	Distance to Nearest Panel
DS-93	1160	N/A	N/A	673	487	Reduced Flow	Severe / Likely	Quarter	N/A
DS-132A	1185	N/A	N/A	673	512	Dewatered	Severe / Likely	Center	N/A
DS-151	1160	N/A	N/A	677	483	Reduced Flow	Severe / Likely	Quarter	N/A
DS-206	1240	N/A	N/A	652	577	Reduced Flow	Severe / Likely	Edge, Panel/Gate	N/A
DS-210	1200	N/A	N/A	650	550	Reduced Flow	Severe / Likely	Quarter	N/A
DS-251	1220	N/A	N/A	681	539	Dewatered	Severe / Likely	Center	N/A
DS-252	1170	N/A	N/A	678	492	Reduced Flow	Moderate / Probable	Over Mains	520'
DS-256	1200	N/A	N/A	672	528	Dewatered	Severe / Likely	Center	N/A
DS-258	1200	N/A	N/A	668	532	Dewatered	Severe / Likely	Center	N/A
DS-260	1180	N/A	N/A	665	515	Reduced Flow	Severe / Likely	Quarter	N/A
DS-269	1200	N/A	N/A	680	520	Reduced Flow	Severe / Likely	Quarter	N/A
DS-309	1240	N/A	N/A	658	582	Reduced Flow	Moderate / Probable	Over Gate	210'
DS-427	1240	N/A	N/A	665	575	Dewatered	Severe / Likely	Center	N/A
DS-450	1220	N/A	N/A	657	563	Reduced Flow	Moderate / Probable	Over Gate	45'
W-142A	1275	Unknown	Unknown	677	Unknown	Dewatered	Severe / Likely	Center	N/A

*Minimal: Water flow for springs either did not decline during mining, or returned to pre-mining conditions within 2 months of undermining.
*Moderate: Water flow for springs declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
*Severe: Water flow for springs declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06549

TABLE A

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
American Energy Corporation
Application Area D-0425-5

Well/Spring Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Total Well Depth	Well Bottom Elev.	Coal Elev. (feet)	Overburden (feet)	Anticipated Impact	Magnitude	Panel Position	Distance to Nearest Panel
W-148A	1210	80'	1130	680	450	Reduced Water Level	Severe / Likely	Edge, Panel/Gate	N/A
WL-180	1260	60'	1200	672	528	Dewatered	Severe / Likely	Center	N/A
W-184	1260	65'	1195	662	533	Reduced Water Level	Severe / Likely	Edge, Panel/Gate	N/A
DW-184A	1270	21'	1249	663	586	Dewatered	Severe / Likely	Center	N/A
DW-268	1260	32'	1228	681	547	Reduced Water Level	Severe / Likely	Quarter	N/A
DW-425	1300	25'	1275	667	608	Reduced Water Level	Severe / Likely	Quarter	N/A
DW-426	1250	39'	1211	672	539	Reduced Water Level	Severe / Likely	Quarter	N/A
DS-27B	1100	N/A	N/A	678	422	Reduced Flow	Severe / Likely	Quarter	N/A
DS-27C	1160	N/A	N/A	676	484	Reduced Flow	Severe / Likely	Quarter	N/A

	Surf. elev. Of wells.	Depth of Wells	Bottom Elev. Of Wells/ Surf. Elev. Of Spr=s.	Coal Elev.	Overburden Depth
Average	1212	68'	1153	651	536
Minimum	1055	16'	940	612	269
Maximum	1360	160'	1337	682	679

Minimal / Possible Impact (More than 643' from panel) 20 or 18%
Moderate / Probable Impact (Less than 643' from panel) 18 or 17%
Severe / Likely Impact (Above Shadow Area) 72 or 65%

Total Wells - 42
Total Dev. Springs - 68
Total - 110 Legitimately-used ground water supplies

AEC 06550

TABLE B

ADDENDUM TO PART 2, PAGE 18, ITEM F(1), American Energy Corporation
Application Area D-0425-5

Stream and Pond Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Coal Elev. (feet)	Overburden (feet)	Anticipated Max. Impact/ *Magnitude	Panel Position	Distance to Nearest Panel
U5-1	1190	686	504	Reduced flow, Severe / Likely	Quarter	N/A
U5-2	1055	618	437	Reduced Flow, Minimal / Possible	Outside	1750
U5-3	1075	625	450	Reduced Flow, Minimal / Possible	Outside	1725
U5-4	1090	634	456	Reduced Flow, Minimal / Possible	Outside	2180
U5-5	1140	664	476	Reduced Flow, Minimal / Possible	Outside	2270
U5-6	1120	664	456	Reduced flow, Severe / Likely	Quarter	N/A
U5-7	1120	665	455	Reduced flow, Severe / Likely	Quarter	N/A
U5-8	1155	672	483	Reduced flow, Severe / Likely	Quarter	N/A
U5-9	1095	678	417	Reduced flow, Severe / Likely	Center	N/A
U5-10	1200	653	547	Reduced flow, Severe / Likely	Quarter	N/A
U5-11	1220	646	574	Reduced flow, Severe / Likely	Quarter	N/A
U5-12	1190	636	554	Reduced flow, Severe / Likely	Quarter	N/A
U5-13	1210	629	581	Reduced flow, Severe / Likely	Quarter	N/A
U5-14	1120	624	496	Reduced flow, Severe / Likely	Center	N/A
U5-15	1205	643	562	Reduced flow, Severe / Likely	Quarter	N/A
U5-16	1205	646	559	Reduced flow, Severe / Likely	Quarter	N/A
U5-17	1170	653	517	Reduced flow, Severe / Likely	Quarter	N/A
U5-21	1180	657	523	Reduced flow, Moderate / Probable	Over Gate	20'
U5-22	1195	656	539	Reduced flow, Severe / Likely	Quarter	N/A

* Minimal: Water flow either will not decline during mining, or will return to pre-mining conditions within 2 months of undermining.
* Moderate: Water flow declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
* Severe: Water flow declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06551

TABLE B

ADDENDUM TO PART 2, PAGE 18, ITEM F(1), American Energy Corporation
Application Area D-0425-5

Stream and Pond Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Coal Elev. (feet)	Overburden (feet)	Anticipated Max. Impact / *Magnitude	Panel Position	Distance to Nearest Panel
U5-23	1205	656	549	Reduced flow, Moderate / Probable	Over Gate	20'
U5-24	1220	645	575	Reduced flow, Moderate / Probable	Over Gate	20'
U5-25	1230	634	596	Reduced flow, Severe / Likely	Quarter	N/A
U5-26	1210	629	581	Reduced flow, Severe / Likely	Quarter	N/A
U5-27	1175	626	549	Reduced flow, Moderate / Probable	Over Gate	75'
U5-28	1205	627	578	Reduced flow, Severe / Likely	Quarter	N/A
U5-29	1210	616	594	Reduced flow, Severe / Likely	Quarter	N/A
U5-30	1205	612	593	Reduced flow, Moderate / Probable	Over Gate	20'
U5-31	1210	613	597	Reduced flow, Severe / Likely	Quarter	N/A
U5-32	1220	616	604	Reduced flow, Severe / Likely	Quarter	N/A
U5-33	1205	618	587	Reduced flow, Severe / Likely	Quarter	N/A
U5-34	1205	622	583	Reduced flow, Severe / Likely	Quarter	N/A
U5-35	1205	630	575	Reduced flow, Severe / Likely	Quarter	N/A
U5-36	1190	645	545	Reduced flow, Moderate / Probable	Over Gate	65'
U5-37	1198	653	545	Reduced Flow, Moderate / Probable	Outside	210'
U5-38	1220	645	575	Reduced Flow, Minimal / Possible	Outside	1430'
U5-39	1100	661	439	Reduced flow, Severe / Likely	Quarter	N/A
U5-40	1225	663	562	Reduced flow, Severe / Likely	Quarter	N/A
U5-41	1105	664	441	Reduced flow, Severe / Likely	Quarter	N/A

* Minimal: Water flow either will not decline during mining, or will return to pre-mining conditions within 2 months of undermining.
* Moderate: Water flow declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
* Severe: Water flow declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06552

TABLE B

ADDENDUM TO PART 2, PAGE 18, ITEM F(1), American Energy Corporation
Application Area D-0425-5

Stream and Pond Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Coal Elev. (feet)	Overburden (feet)	Anticipated Max. Impact/ *Magnitude	Panel Position	Distance to Nearest Panel
U5-42	1210	667	543	Reduced Flow, Severe / Likely	Center	N/A
U5-43	1210	664	546	Reduced Flow, Severe / Likely	Quarter	N/A
U5-44	1220	658	562	Reduced Flow, Moderate / Probable	Over Gate	35'
U5-45	1210	661	549	Reduced Flow, Severe / Likely	Quarter	N/A
U5-46	1200	664	536	Reduced Flow, Severe / Likely	Quarter	N/A
U5-47	1230	668	562	Reduced Flow, Severe / Likely	Quarter	N/A
U5-48	1200	676	524	Reduced Flow, Severe / Likely	Center	N/A
U5-49	1110	611	499	Reduced Flow, Moderate / Probable	Outside	195'
U5-50	1090	672	418	Reduced Flow, Minimal / Possible	Outside	2175'
U5-51	1095	671	424	Reduced Flow, Minimal / Possible	Outside	2150'
U5-52	1178	681	497	Reduced Flow, Minimal / Possible	Outside	1000'
D5-1	980	619	361	Reduced Flow, Moderate / Probable	Outside	450'
D5-2	1000	622	378	Reduced Flow, Moderate / Probable	Outside	345'
D5-3	1040	615	425	Reduced Flow, Moderate / Probable	Outside	485'
D5-5	1085	613	472	Reduced Flow, Severe / Likely	Quarter	N/A
D5-6	985	616	369	Reduced Flow, Minimal / Possible	Outside	1100'
D5-7	1025	655	370	Reduced Flow, Minimal / Possible	Outside	1140'
D5-8	1110	652	458	Reduced Flow, Severe / Likely	Center	N/A
D5-9	1098	657	441	Reduced Flow, Severe / Likely	Quarter	N/A

* Minimal: Water flow either will not decline during mining, or will return to pre-mining conditions within 2 months of undermining.
* Moderate: Water flow declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
* Severe: Water flow declined during mining, did not return to pre-mining ranges within 6 months of undermining.

AEC 06553

TABLE B

ADDENDUM TO PART 2, PAGE 18, ITEM F(1), American Energy Corporation
Application Area D-0425-5
Stream and Pond Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Coal Elev. (feet)	Overburden (feet)	Anticipated Max. Impact/ *Magnitude	Panel Position	Distance to Nearest Panel
D5-10	1085	664	421	Reduced flow, Moderate / Probable	Over Gate	75'
D5-11	1015	677	338	Reduced flow, Severe / Likely	Quarter	N/A
D5-12	1035	676	359	Reduced flow, Severe / Likely	Quarter	N/A
D5-13	1038	671	367	Reduced flow, Minimal / Possible	Outside	1950'
D5-14	1121	628	493	Reduced flow, Minimal / Possible	Outside	1735'
D5-15	938	617	321	Reduced flow, Minimal / Possible	Outside	1625'
D5-0	975	617	358	Reduced flow, Minimal / Possible	Outside	1715'
**P-48.01	1230	617	613	Reduced flow, Severe / Likely	Quarter	N/A
**P-5.01	1270	659	611	Reduced Water Level, Severe / Likely	Quarter	N/A
**P-68.05	1175	639	536	Reduced Water Level, Severe / Likely	Edge Panel/Gate	N/A
**P-96.01	1158	647	511	Reduced Water Level, Severe / Likely	Quarter	N/A
**P-96.07	1150	643	507	Reduced Water Level, Severe / Likely	Quarter	N/A
P-96.09	1220	646	574	Reduced water level, Severe / Likely	Quarter	N/A
P-97.02	1175	647	528	Reduced water level, Severe / Likely	Quarter	N/A
P-97.03	1140	647	493	Reduced water level, Severe / Likely	Quarter	N/A
P-98.00	1215	651	564	Reduced water level, Severe / Likely	Quarter	N/A
**P-108.01	1170	655	515	Reduced water level, Severe / Likely	Center	N/A

* Minimal: Water flow/water level either will not decline during mining, or will return to pre-mining conditions within 2 months of undermining.
* Moderate: Water flow/water level declined during mining, returned to pre-mining ranges within 2 to 6 months after undermining.
* Severe: Water flow/water level declined during mining, did not return to pre-mining ranges within 6 months of undermining.

** Used surface water sites

AEC 06554

TABLE B

ADDENDUM TO PART 2, PAGE 18, ITEM F(1), American Energy Corporation
Application Area D-0425-5
Stream and Pond Data / Hydrologic Summary

Site I.D.	Surface Elev. (feet)	Coal Elev. (feet)	Overburden (feet)	Anticipated Max. Impact/ *Magnitude	Panel Position	Distance to Nearest Panel
**P-27	1200	674	526	Reduced Water Level, Severe / Likely	Center	N/A
**P-30	1200	662	538	Reduced Water Level, Severe / Likely	Quarter	N/A
**P-40	1205	672	533	Reduced Water Level, Severe / Likely	Edge, Panel/Gate	N/A
**P-50	1200	656	544	Reduced Water Level, Severe / Likely	Edge, Panel/Gate	N/A
**P-61	1121	628	493	Reduced Water Level, Severe / Likely	Edge, Panel/Gate	N/A
**U-41-01	1110	641	469	Reduced Water Level, Severe / Likely	Quarter	N/A
**U-41	1080	636	444	Reduced Water Level, Severe / Likely	Quarter	N/A
**P-45	1207	659	548	Reduced Water Level, Severe / Likely	Quarter	N/A
**P-51	1170	683	487	Reduced Water Level, Minimal / Possible	Outside	1540'

** Used Surface Water Sites

	Surf. Elev.	Coal Elev.	Overburden Depth
Average	1148	646	504
Minimum	938	611	338
Maximum	1270	686	613

Sites Outside	20
Edge panel/gate	4
Over Gate	8
Quarter	44
Center	7
	83 Total Sites

Minimal Impact Possible	15	or	18%
Moderate Impact Possible	13	or	16%
Severe Impact Likely	55	or	66%

AEC 06555

ADDENDUM TO PART 2, PAGE 18, ITEM F(1)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425-5

ALTERNATE WATER SUPPLY INFORMATION - EXTENT OF MINING IMPACTS

Of the supplies listed on Attachment 14C and 14D, the maximum anticipated (possible)impacts as a result of mining are discussed within the PHC and summarized on Tables A and B. Some sources may be impacted permanently or may have delayed or long-term recovery.

Table A represents all legitimately-used ground water sites with a summary of the impacts shown on page 7 of 7.

Table B represents all surface water sites, with those having a legitimate use marked with two asterisks (**). The summary of impacts for all streams and impoundments is shown on Table B, page 5 of 5, and is based on all surface water sites. The anticipated impact and magnitude of impact on stream sites was based on its individual position over a longwall panel, gate, or outside of the shadow area. Should impacts occur upstream of a downstream station, regardless of the downstream station position relative to the longwall panel, impact of mining on the downstream station may increase in terms of diminished flow.

G. LAND USE INFORMATION - **Permit Area**

(1) Describe the uses of the land within the proposed permit area exis at the time of the filing of this permit application and provide a which delineates the area of each land use.

N/A, NO PERMIT AREA

(2) Was the land use described in item G(1) above changed within five years before the anticipated date of beginning this proposed minin operation? Yes, No. If yes, submit an addendum describ the historic use of the land.

N/A, NO PERMIT AREA

(3) Analyze the capability of the land within the proposed permit area before any mining to support a variety of uses, giving consideratic to soil and foundation characteristics, topography, vegetative cove and hydrology of the proposed permit area.

N/A, NO PERMIT AREA

(4) Analyze the productivity of the land within the proposed permit are before any mining to include average yields obtained under high lev of management.

N/A, NO PERMIT AREA

(5) Is any land within the proposed permit area classified as prime farmland? ____ Yes, ____ No.

N/A, NO PERMIT AREA

(6) Submit an addendum describing the use of the land within the permit area, including the creation of permanent water impoundments, that proposed to be made of the land following reclamation, including information regarding the utility and capacity of the reclaimed lanc to support a variety of alternative uses.

N/A, NO PERMIT AREA

(7) Are there existing land use classifications under local law of the proposed permit area? ____ Yes, ____ No. If yes, describe the land use classification and submit as an addendum to the permit application, the comments of the governmental agency which would hav to initiate, implement, approve or authorize the proposed use of the land following reclamation. If □no,□ describe the sources of information on which the determination was made.

N/A, NO PERMIT AREA

G. (8) Submit as an addendum a copy of the comments from the legal or equitable owner of record of the surface of the proposed permit a concerning the proposed land use.

N/A, NO PERMIT AREA

(9) Describe the consideration which has been given to making all of proposed coal mining activities consistent with surface owner pla and applicable state and local land use plans and programs.

N/A, NO PERMIT AREA

(10) Describe how the proposed land use is to be achieved and the nece support activities that may be needed to achieve the proposed lan use.

N/A, NO PERMIT AREA

(11) Is the postmining land use to be different from the premining lanc use? _____ Yes, _____ No. If yes, submit as an addendum to the pe application, the plans and findings required by paragraph (D) of r 1501:13-9-7 of the Administrative Code.

N/A, NO PERMIT AREA

(12) Has the proposed permit area been previously mined?_____ Yes,_____ N If yes, provide the following information, if available.

(a) Type of mining method
(b) Coal seam mined
(c) Non coal mineral mined
(d) Extent of mining (acres)
(e) Approximate dates
(f) Land use preceding mining

N/A, NO PERMIT AREA

H. PRIME FARMLAND INVESTIGATION-**Permit Area**

(1) Does the proposed permit area include any land that is prime farmla taking into consideration the negative determinations listed in paragraph (L)(2) of rule 1501:13-4-13 of the Administrative Code?
Yes, No.

N/A, NO PERMIT AREA

(2) If the response to item H. (1) is yes, submit Attachment 15.

(3) If the response to item H. (1) is no, submit Attachment 16.

I. FISH AND WILDLIFE PLAN

Describe the fish and wildlife resources for this permit area and adjace area in accordance with paragraph (P)(1)(a-b) of rule 1501-4-05 of the Administrative Code.

N/A No permit Area

PART 3 RECLAMATION AND OPERATIONS PLAN

GENERAL REQUIREMENTS-**Permit Area** (Items A. (1) and A. (2) - **Permit and Underground Workings)**

Submit an addendum describing the type and method of coal mining proced for this application. Explain how these procedures will maximize the u and conservation of the coal resources.

SEE ADDENDUM TO PART 3, PAGE 21, ITEM A(1)

(2) Indicate the anticipated annual and total production of coal from t proposed operation.

Annual **5.6 MILLION TONS PER YEAR** Total **22.9 MILLION TONS**

(3) Will this operation be combined with surface coal mining activities the extent that contemporaneous reclamation of areas disturbed by surface mining will be delayed or such that the underground working will be within 500 feet of the surface mining activities? Yes No. If yes, submit Attachment 30.

N/A, NO PERMIT AREA

(4) Are experimental mining practices to be employed in the proposed mining operations? Yes, No. If yes, submit as an addend to the permit application, the description, maps, and plans require by paragraph (B) of rule 1501:13-4-12 of the Administrative Code.

N/A, NO PERMIT AREA

(5) Are mountaintop removal mining practices to be employed in the proposed mining operations? Yes, No. If yes, submit as a addendum to the permit application the information required by paragraph (C) of rule 1501:13-4-12 of the Administrative Code.

N/A, NO PERMIT AREA

(6) Are the natural pre-mining slopes within the permit area in excess o twenty (20) degrees? Yes, No. If yes, submit an addendum demonstrating compliance with the steep slope mining provisions of paragraph (D) of rule 1501:13-4-12 and 1501:13-13-05 of the Administrative Code.

N/A, NO PERMIT AREA

(7) Is augering proposed within the permit area? Yes, No If yes, submit Attachment 18.

N/A, NO PERMIT AREA

(8) Are variances from approximate original contour to be employed for t proposed underground mining surface operations? Yes, No. If yes, submit an addendum to the permit application demonstrating compliance with paragraph (E) and/or (K) of rule 1501:13-4-12 of the Administrative Code.

N/A, NO PERMIT AREA

ADDENDUM TO PART 3, PAGE 21, A(1)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

MINING METHODS

This application area will be mined by the longwall method of mining. Longwall mining is a method by which large panels of coal are surrounded by entries and are then extracted. The roof is temporarily supported by shields as the longwall machinery cuts the coal. The shields are then hydraulically moved forward, allowing the roof to collapse behind them. Subsidence of the surface occurs as the strata above the mine first collapses into the void left from the extracted coal, then the overlying strata deforms and comes to rest atop the rubble. Monitoring at a nearby longwall mine in the Pittsburgh No. 8 coal seam shows that the surface subsides approximately 60 to 65 percent of the seam thickness of about 60 inches. This mining method maximizes the recovery of the reserve by leaving coal only in the development entries (main and gate entries) and barrier pillars to protect the main entries.

The mining will progress from existing travelways in the D-0425 mine areas to this application area through main entries that will carry the ventilation currents and contain the haulage entries. These main entries will branch down into the gate entries that will surround the longwall panels. While continuous miners are used for these development entries, they are not considered production sections. These mining units are considered part of the longwall mining to be conducted at the CENTURY MINE. Full coal recovery (longwall mining) methods are planned for the entire application area,

A. (9) Will access to the underground workings be gained through a drift entry _____ Yes, __X__ No. If yes, provide as an addendum suffici information to determine the location of the entry relative to the highest elevation of the coal reserve. Is the drift entry located as to eliminate the potential for a gravity discharge? _____ Yes, _____ No. If no, the applicant must demonstrate that the coal sear not acid or iron producing. Provide an analysis of the strata immediately above and below the coal, and the coal seam itself, sufficient to demonstrate that the water quality from the entry wil meet effluent limitations without treatment.

(10) For entries to underground workings other than drift entries, provi as an addendum sufficient information to determine the location of entry relative to the coal reserve. Are the entries located so as eliminate the potential for a gravity discharge?
__X__ Yes, _____ No. If no, provide the following demonstration:

(a) the gravity discharge will meet effluent limitations without treatment, or

(b) the water will be treated to meet effluent limitations and provisions will be made for consistent limitations of the treatment facility throughout the anticipated period of gravity discharge.

(11) Will the permanent entry seals be designed to withstand the maximum anticipated hydraulic head when the operations are abandoned? _____ Yes, _____ No. If yes, submit the appropriate information demonstrating that this will be accomplished. If no, provide a typical plan for the seals to be used to close the mine entries pursuant to applicable state and federal regulations.

N/A, NO PERMIT AREA

(12) Submit an addendum describing the construction, modification, maintenance, and removal (unless to be retained for postmining land use), including the proposed engineering techniques and major equipment to be used, of the following facilities:

(a) dams, embankments, and other impoundments. Do any of the plans for water, sediment or slurry impoundments meet the requirements of 30 CFR 77.216? _____ Yes, ____ No. If yes, submit as an addendum a plan that addresses each of the requirements in 30 CF 77.216-2.

N/A, NO PERMIT AREA

(b) overburden and topsoil handling and storage areas and structures

N/A, NO PERMIT AREA

ADDENDUM TO PART 2, PAGE 22, ITEM A(10)
AMERICAN ENERGY CORPORATION

The Pittsburgh #8 coal dips southeast at about 0.5%. The #8 coal ranges in elevation from 682 (base of coal) to 610 (base of coal) within the proposed shadow area. The lowest surface elevation within the proposed permit and shadow area is 980. Gravity discharge cannot and will not occur at this site.

A. (12) (c) coal removal, handling, storage, cleaning, and transportatic
areas and structures; including, but not limited to, prepara
plants, beltlines, tipples, rail sidings, and primary roads.
roads, conveyors and rail systems, submit an addendum descri
the information required pursuant to paragraph (L) of rule
1501:13-4-14 and 1501:13-10-01 of the Administrative Code.

N/A, NO PERMIT AREA

(d) spoil removal, handling, storage, transportation, and dispos
areas and structures, including underground development waste
exces vast
exces ibir
the i
1501:
The r **the**
0425- **spos**
at cu

(e) mine s,
gas h
facil
N

(f) water
N

(13) Provide an are
N

(14) Will the p
N/A, N

(a) dispos othe
source B ar
if app f ru
1501:1

(b) dispos
ress
the di nt t
paragr ode.

(c) return
abandc yes
comply
1501:1
Admini A
approv

B. EXISTING STRUCTUR

(1) Are any exi ith
to facilita Yes,
___ No. If a
descriptior ne
informatior th
Administrat
N/A, N

B. (2) Are any existing structures proposed to be modified or reconstru for use in connection with or to facilitate the coal mining and reclamation operation? _____ Yes, _____ No. If □yes□, submit a addendum to the permit application, a compliance plan for each structure. The plan shall include the information required by paragraph (B)(2) of rule 1501:13-4-14 of the Administrative Code.

N/A, NO PERMIT AREA

C. BLASTING-**Permit Area**

Will blasting occur within 25 feet of the surface during shaft and por development or other on-site development?

_____ Yes, _____ No. If yes, submit Attachment 29.

N/A, NO PERMIT AREA

D. RECLAMATION PLAN - GENERAL REQUIREMENTS-**Permit Area** (Item D.12) -**Permit, Shadow, and Adjacent Area**)

(1) Provide a detailed timetable for the completion of backfilling anc grading for each mining year.

N/A

(2) Provide a detailed timetable for completion of resoiling for each year.

N/A

(3) Provide a detailed timetable for completion of planting for each mining year.

N/A

(4) Describe the plan for backfilling, compacting and grading of the disturbed permit area, including the disposal of all mine generatec debris.

N/A

(5) Submit an addendum describing the plan for the removal, storage, redistribution and stabilization of topsoil, subsoil, or approved alternative resoiling material to meet the requirements of rule 1501:13-9-03 of the Administrative Code. If an alternative resoili material is to be used, submit Attachment 19.

N/A

(6) Provide the following information for the revegetation plan:

(a) Schedule for revegetation to include planting of temporary vegetation.

N/A

D. (6) (b) List the species and amounts per acre of seeds and seedlings be used.

N/A, NO PERMIT AREA

(c) Describe the methods to be used in planting and seeding.

N/A, NO PERMIT AREA

(d) Describe the mulching techniques.

N/A, NO PERMIT AREA

(7) Describe the soil testing plan for evaluation of the results of topsoil handling and reclamation procedures related to revegetati

N/A, NO PERMIT AREA

(8) Submit an addendum describing the measures to be employed to handl and place acid or toxic-forming materials in accordance with parag (J) of rule 1501:13-9-04 and paragraph (J) of rule 1501:13-9-14 of Administrative Code.

N/A, NO PERMIT AREA

(9) Describe the measures, including appropriate cross sections and ma to be used to plug, case or manage mine openings or bore holes oth than those entries utilized to gain access to the underground workings, pursuant to rule 1501:13-9-02 of the Administrative Code

N/A, NO PERMIT AREA

(10) Is the reclamation plan consistent with local physical, environment and climatological conditions?

_____ Yes, _____ No.

N/A, NO PERMIT AREA

(11) Identify any other applicable air and water quality laws and regulations and health and safety standards and describe the steps be taken to comply with each.

N/A, NO PERMIT AREA

(12) Submit an addendum describing the plan for minimizing to the extent possible and using the best technology currently available, disturbances and adverse impacts of the operation on fish and wildl and related environmental values, including compliance with the endangered species act, and achieving enhancement of such resources where practical for the permit, shadow, and adjacent areas.

SEE ADDENDUM TO PART 3, PAGE 25, D(12)

ADDENDUM TO PART 3, PAGE 25, D(12)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

RECLAMATION PLAN - FISH, WILDLIFE, ENVIRONMENTAL VALUES

The proposed longwall mining operation is not expected to impact fish, wildlife, and other related environmental values. Minnows have been found in some of the larger stream segments within the application area. However, the normal annual cycle shows that during the summer and fall months, when the stream flow is minimal, the minnows swim downstream, only to return again. Observations show that stream segments that go dry following subsidence have returned to near their normal flow, and will again support minnows. The larger streams will return to normal flow faster than smaller streams because more sediment is carried in larger streams and help fill any residual cracks that may be found. There are several ponds overlying the application area, and larger fish live in them. Our experience at the CENTURY MINE is that ponds are not greatly influenced by subsidence due to the amount of cover. Wildlife has never been shown to be affected by longwall mining. If surface slips are caused by mining activities, over the mining area, AMERICAN ENERGY CORPORATION will restore the land to a condition equal to its original value and reasonably foreseeable use. Undeveloped springs that are found above the application area may be dewatered and usually reposition themselves downstream. AEC will replace undeveloped springs if they are legitimately used according to our water replacement plan.

E. RECLAMATION PLAN PROTECTION OF HYDROLOGIC BALANCE-**Permit and Adjacent Ar**

Submit an addendum describing the measures to be taken during and after proposed mining operations to:

(1) minimize disturbance to the hydrologic balance, including quality quantity, within the permit and adjacent areas and to prevent mate damage outside the permit area;

(2) protect the rights of present users of surface and ground water;

(3) avoid acid or toxic drainage.

SEE ADDENDUM TO PART 3, PAGE 26, E(1-3)

F. GROUND WATER AND SURFACE WATER MONITORING PLAN-**Permit and Shadow Area**

Based upon the probable hydrologic consequences determination and analys of all baseline hydrologic, geologic, and other information submitted in this application, address the following items in accordance with paragra (F) of rule 1501:13-4-14 and paragraph (N) of rule 1501:13-9-04 of the Administrative Code.

(1) In addition to the quality and quantity parameters required for quarterly monitoring and NPDES monitoring, will any other parameter be monitored? _____Yes, __X__ No. If yes, indicate the parameter(s)and the site(s) where such monitoring will occur.

(2) Do you propose or anticipate the need for a variation in the require monitoring frequency for ground and surface water sites and monthly sites to be affected?_____Yes, __X__ No. If yes, describe the variation in frequency and the monitoring sites to be affected.

(3) Describe the plan for collection, recording, and reporting of all surface and ground water quality and quantity monitoring data, including data collected for the NPDES program.

SEE ADDENDUM TO PART 3, PAGE 26, F(3) IN D-0425-3

Monitoring will continue until an adversely impacted well is plugged, as evidence by the submittal of a plugging repo via ARP

ADDENDUM TO PART 3, PAGE 26, ITEM E(1-3)
AMERICAN ENERGY CORPORATION
CENTURY MINE
D-0425-5

RECLAMATION PLAN - PROTECTION OF HYDROLOGIC BALANCE

The hydrologic balance is expected to change moderately as a result of the proposed longwall mining operation in the long term, see Addenda to Part 2, Page 18, Item F(1), and Table A and Table B summarys. Aquifers identified on the Attachment 14B are not related to the post-subsidence zones with the exception of Zone A. Zone A is comparable to the "near surface zone". All aquifers identified on the Attachment 14B are above the caved zone and zone of fracturing. After mining, new wells will be drilled, or existing wells may be re-drilled. The success of re-drilling existing wells has not been documented. Groundwater still is available after subsidence. At that time, ground water will be available in quantity at least as great as before mining. Because of increased porosity due to the cracking caused by longwall mining, the quantity of ground water that is available to users will probably increase. Minor surface cracking over longwall areas will eventually heal or be repaired, causing the ground to capture approximately the same percentage of rainfall as before mining. It is anticipated that stream flow in selected sections of first order streams where overburden thickness exceeds 200 feet may be temporarily reduced over relatively short stream segments. This impact is anticipated due to the fact that the headwaters of streams occasionally relocate to lower elevations following subsidence that results in the dewatering of hillside/hilltop springs. The monitoring data obtained for ground and surface water sources over the longwall areas at the nearby Powhatan No. 6 Mine indicate there have been no lasting deleterious effects of the longwall mining on water quality, and no lasting effects are anticipated at the Century Mine. Therefore, the hydrologic balance outside the application area will be protected.

The rights of present users of surface and ground water will be maintained through the water replacement plan found in the Addendum to Part 2, Page 18, F(2). It is anticipated that within 2 years, ground water will re-establish itself so that wells and springs can be replaced. Surface water drainage is not expected to be impacted seriously by longwall mining.

Acid or toxic drainage are not expected to be a problem at the Century Mine. The No. 8 seam is entirely below drainage, and the openings to the surface are located high enough above the seam that they will not experience hydraulic pressure from the seam. The major watershed of the D-0425-5 area is Sunfish Creek. Surface drainage from the proposed shadow area will reach Sunfish Creek to the south at elevations ranging from approximately 778 to 684 feet. The coal seam within the proposed shadow area has elevations ranging from approximately 682 to 610, and is therefore below the elevation of Sunfish Creek. Sunfish Creek is located at a distance of approximately 4.1 miles south of the southernmost limits of the proposed mining area. A small portion of the proposed shadow area, the northernmost portion, north of S.R. 556, is within the Captina Creek watershed. We do not anticipate any mining impacts on Captina Creek from the proposed mining. Acid or toxic drainage is not expected to enter the waters of the State.

American Energy Corporation will research the potential of oil/gas wells prior to mining. This will be done through the use of both Ohio Department of Natural Resources records, as well as fieldwork. We will then plug the wells in the active mining areas with cement, prior to mining through them. Gas well P#3413 on the Ward property will be plugged prior to its interception by mining. The plugging report will be submitted via A.R.P.

ADDENDUM TO PART 3, PAGE 26, F
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

GROUND WATER AND SURFACE WATER MONITORING PLANS

1. Ground Water Monitoring Plan

All legitimately developed, used ground water supplies will be monitored quarterly for quality and monthly for quantity for at least one year prior to full recovery mining, and at least one year subsequent to mining unless access is denied by the land owner. This monitoring will include wells and springs used for domestic purposes. Weekly quantity monitoring will be conducted whenever the longwall face is within three weeks of undermining the supply and no less than three weekly pre-mining and post-mining measurements will be made. Ground water supplies located within 500 feet (measured horizontally) of the perimeter of the active longwall panel will be monitored as if they were located on the panel. Monitoring will be continued for at least one year subsequent to full recovery mining contingent upon review by the Division of Mines and Reclamation. Daily precipitation data will be submitted quarterly to evaluate spring flow.

2. Surface Water Monitoring Plan

Various surface water locations depicted on the application/hydrology map will be sampled monthly for flow and quarterly for quality. The quality requirements of OAC 1501:13-3-14(F)(2) and the other QMR parameters as stated on the QMR report sheets will apply to the surface water analysis. Each surface monitoring station will be monitored for at least one year prior to full coal recovery mining. Monitoring will be continued for at least one year subsequent to full recovery mining contingent upon review by the Division of Mines and Reclamation. Daily precipitation data will be submitted quarterly to evaluate stream flow.

With each quarterly monitoring report of ground and surface water, a map depicting the progression of the longwall face will be attached to indicate the sampling points in the full recovery areas. Notes will be submitted indicating the position relative to the longwall face, with "+" indicating the station is in advance of the face and a "-" indicating a position behind the face. An attempt will be made to monitor and sample as outlined above, however, some sources may not be accessible. These locations, if encountered, will be documented in the quarterly reports. All samples will be taken as outlined to the extent that existing well construction allows. Any samples that are unobtainable will be documented as such in the quarterly report. Quarterly sampling will include analysis for nitrates.

AMERICAN ENERGY CORPORATION will monitor all ground and surface locations in accordance with the quarterly monitoring plan outlined above regardless of the saturated zones that they access. All developed supplies have been identified and have been indicated on the application/hydrology map.

In most cases, surface cracks are expected to open and close relatively rapidly, however, some surface cracks may take weeks to close. For this reason, most cracks will not be repaired until AEC determines that the cracks are not going to close themselves. If the surface cracks are in an area that is commonly traveled by man or livestock, the cracks will be repaired immediately. Surface cracking that is found in areas not commonly traveled, may be marked by brightly colored tape. This tape alerts anyone in the area of the depression or opening. If the cracks do not close within the period of time AEC determines is adequate, a contractor will repair the cracks.

Monitoring of these areas will continue for up to six months after mining, and if the cracks reopen, they will once again be repaired. Monitoring of panel areas before mining consists of visual inspection or aerial photo review. AEC's subsidence control program will adequately assure that the value and reasonably foreseeable use of the surface land is maintained.

3. Prior to the introduction of farm equipment into fields that have been undermined, AEC will inspect the field for cracks or slips if requested by the landowner. Repairs needed (to maintain access into the fields) will be made at appropriate times. Crop lands damaged by subsidence will be repaired at appropriate times to permit harvest or cultivation without damage to personnel or equipment. Note: "appropriate times" indicates that the repairs will be made (1) at a time when access is needed and (2) when damage to adjacent plants will be minimized.

Damage Repairs – Water Resources

Generally, streams are temporarily affected by subsidence, decreasing in flow as cracks open in the stream bed. However, because the streams contain a high concentration of sediment during rains, the cracks fill quickly and the effect is short lived. The water re-establishes itself within several years.

The effect of temporary water loss in streams on wildlife is not a mystery. A large percentage of the streams in the area are intermittent, meaning that there is no detectable flow during the dry seasons of the year. In it's adaptation to the climate in the area, the local wildlife tends to migrate as these streams experience changes in flow throughout the year.

AEC will monitor all streams as outlined in the addendum to page 26, part 3, F(3). In the event that a stream's flow is reduced or diminished due to longwall subsidence, AEC will monitor the stream bed over a five-year period. *If normal flow is not re-established within twenty-four months, and it is determined by ODNR and AEC that the stream will not resume normal flow naturally*, AEC will, at it's expense, fully grout or line the stream bed to mitigate the subsidence damage and restore normal flow to the stream.

ADDENDUM TO PAGE 30, PART 3, K(5)(c)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425
PAGE THREE

In the event that other water resources such as springs and wells are diminished due to longwall subsidence, AEC will take measures to restore the water supply as outlined in the Addendum to Page 18, Part 2, F.

ANTICIPATED EFFECTS - SURFACE STRUCTURES

Structures situated over a panel or within the angle of draw may be damaged due to subsidence. When the longwall passes directly under a structure, the structure experiences first moderate tensile stress, then moderate compressive stress. As the structure subsides, the end that was undermined first subsides first, causing some tilting away from the advancing face. As the surface over the panel subsides, it takes on the shape of a trough, with the edges remaining in tension and the center in compression. Because the mining face moves quickly, damage to structures from this type of movement is minimized.

The damage that may be expected may involve cracking of plaster, cracking of concrete block or brick, cracking of dirt and cement floors, cracking along mortar joints, and separation of existing cracks. Cracks may close partially or completely after subsidence is complete. Additions to houses may separate away from the original structure. Cracks that occur during separation may close partially or completely after subsidence is complete.

Utility Installations

AEC anticipates minimal impact on the utility installations over the proposed application area. Utility lines (water, electric, etc.), undergo minimal damage due to subsidence over the underground mining area. The utility lines that are typically damaged are county water lines made of asbestos concrete. No such construction is found in the application area. Other construction materials withstand subsidence well.

Communication and Cellular Phone Towers

AEC will notify the Communication Company a minimum of six months prior to mining, and advise where necessary. AEC advises the Communication Company to monitor the tower for damage, which will be addressed when reported to AEC. *Minimal damage to the towers is anticipated due to the small concrete base on which the tower is located. The structure may become out of plumb, and require readjusting, and the tension in the guyed wires adjusted.*

Public Water Tower

AEC will notify the Switzer Water Authority a minimum of six months prior to mining, and advise where necessary. AEC advises the Water District to reduce the quantity of water in the storage tank, and monitor for damage, which will be addressed when

reported to AEC. *AEC also plans to place bands around the concrete base of the structure to minimize damage. The impacts on the water tower would be the same impacts as those listed above for structures in general.* Minimal damage to the towers is anticipated. *Emergency repairs will be performed as soon as practicable in order to minimize any disruption in water service, which is not anticipated.*

Gas Pipelines

AEC will notify the gas company a minimum of six months prior to mining, and advise where necessary. Gas pipelines have been undermined by the neighboring Ohio Valley Coal Company with minimal damage. AEC advises the gas company to uncover the pipeline prior to undermining and monitor for damage during subsidence.

High Voltage Power Lines

AEC will notify the AEP a minimum of six months prior to mining, and advise where necessary. Notification at least six months prior to undermining the lines to allow the utility to take measures that they deem necessary and proper to protect their property and the public health and safety. High Voltage Power lines have been undermined D-0425-1 permit area with minimal damage. AEC advises AEP to monitor for damage during subsidence.

ADDENDUM TO PAGE 30, PART 3, K(5)(e)

ABSTRACT

This paper compares the results of the observed subsidence caused by longwall mining to that of predicted subsidence using the Surface Deformation Prediction System (SDPS) model. The SDPS model has been developed recently by the Virginia Polytechnic Institute and State University for the Office of Surface Mining Reclamation and Enforcement (OSM) and demonstrated good correlation. The model also predicts the potential damages to gas lines, highways, railroad, streams, and hazardous waste fills, which can be minimized or prevented by taking necessary measures.

Topics of Presentation

- **Background**
- **Surface Deformation Prediction System**
- **Discussion of Results**
- **Acknowledgments**

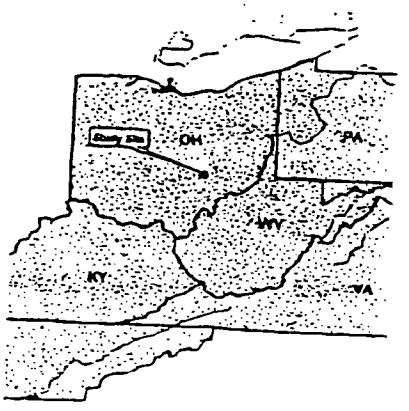

Figure 1 - Study Site Location

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Background

The study site is located near Athens, Ohio as shown on the map (Fig.1) A 250,000 - gallon water tank (Fig. 2) was undermined by the longwall operations.

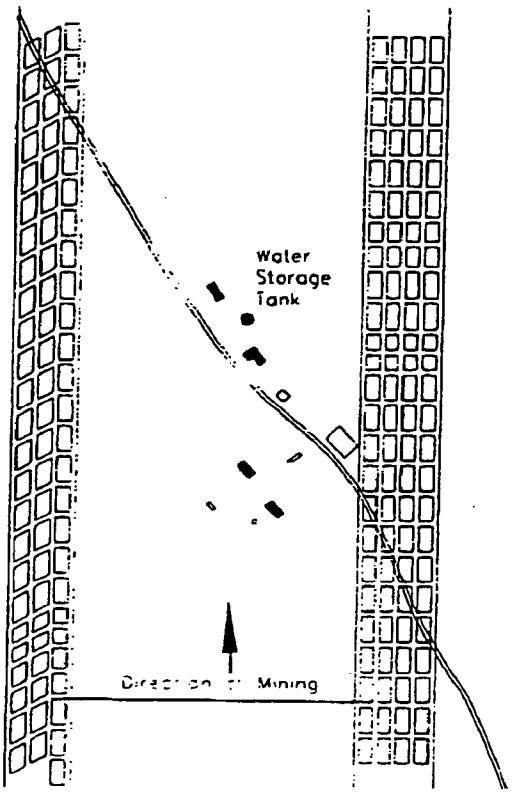

Figure 2 Location of Water Tank and Mine Panel Layout

The water tank is located near the center of the panel. Mining depth varies from 500 to 550 feet mining height is 6 feet and the panel width is 1050 feet. A geotechnical firm was retained by the mining company to monitor the subsidence and take necessary measures to prevent damage to the water tank. The water tank is supported by five columns (Fig. 3).

The tank subsided 4.11 ft and the maximum differential movement between the columns was 0.46 ft. The water tank did not experience any damage.

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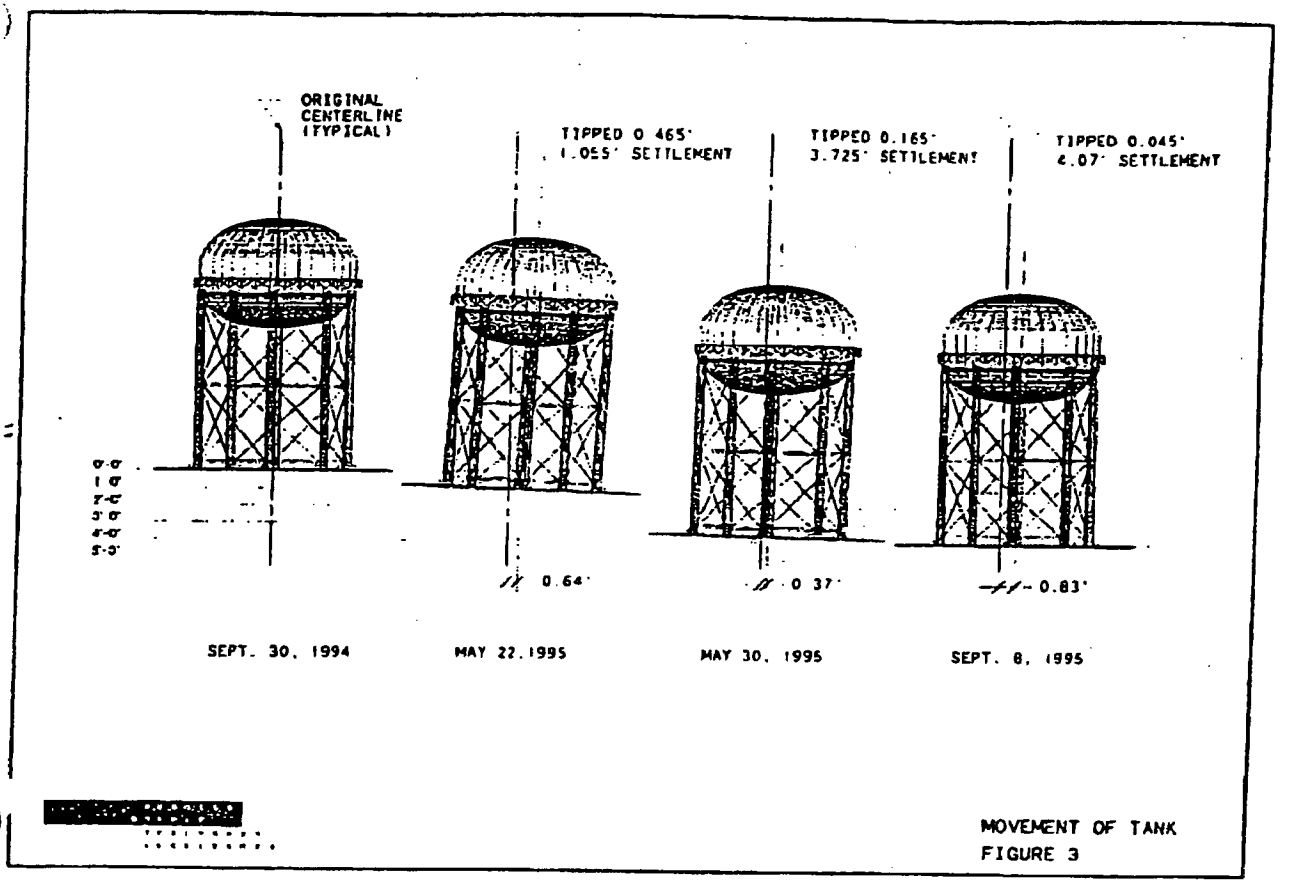


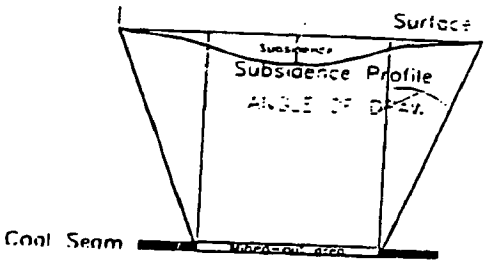
MOVEMENT OF TANK
FIGURE 3

Surface Deformation Prediction System

The Surface Deformation Prediction System (SDPS) developed by VPI & SU for OSM is applied to predict the amount of subsidence and construct the profile using the calculations. Two popular methods of SDPS namely 1) Profile Function, 2) Influence Function for predicting subsidence are explained here .The predicting technique is based on several empirical relationships, developed through the statistical analysis of data from many case studies. Input parameters for these methods are mining depth, panel width, mining height, percent of hard rock in the overburden and the excavation boundaries. Initially these methods were developed for longwall mining and later applied to room-and-pillar mining with success.

The Profile Function Method (Figure 4) : The Profile Function Method predicts;

- the amount of subsidence at the defined points along a profile line,
- the subsidence profile, and
- the angle of draw.



DEFINITION OF SUBSIDENCE PARAMETERS

Subsidence is surface movement in the vertical direction that has been caused by underground mining

The angle of Draw is the angle between the vertical line from the edge of the mined-out area and a line connecting to a point of zero subsidence on the surface

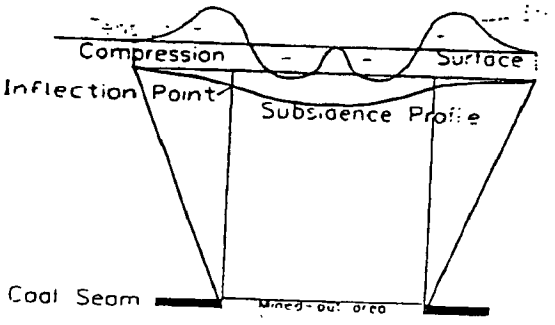
Figure 4 - Subsidence parameters using Profiles Function Method

The empirical parameters required are already built into the profile function equation. Input parameters are;

- Percent of hardrock in the overburden,
- Mining height, and
- Depth and width of opening.

The Influence Function Method (Figure 5) : This method can model complex mine layouts and predicts;

- the amount of subsidence at any point on the surface,
- the subsidence profile,
- the horizontal displacement,
- the angle of draw,
- the slope,
- the strains, and
- the curvature at any point on the surface.



DEFINITION OF SUBSIDENCE PARAMETERS:
Strain is the horizontal displacement between two points divided by the distance between the points. A positive sign denotes tensile strain and negative sign denotes compressive strain.

Inflection point is the point dividing the concave and convex portions of the subsidence profile. Subsidence here is equal to half of the maximum subsidence.

Figure 5 - Subsidence parameters using Inference Function Method

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DISCUSSION OF RESULTS

Figure 6 shows the predicted and observed subsidence profiles at the water tank along the transverse line which is parallel to the direction of the longwall.

- The predicted and the observed maximum subsidence are 4.0 ft. and 4.1 ft respectively, which is good.
- The correlation between the predicted and observed subsidence profiles and the angle of draw is also good.
- The objective of this study was to minimize the damage to water tank during mining. Therefore, minimum monitoring stations were installed. The information obtained is not sufficient to compare other parameters.
- The percent of hardrock in the overburden is sometimes adjusted to fit the results because the driller's hardrock interpretation may vary from the geologist's.

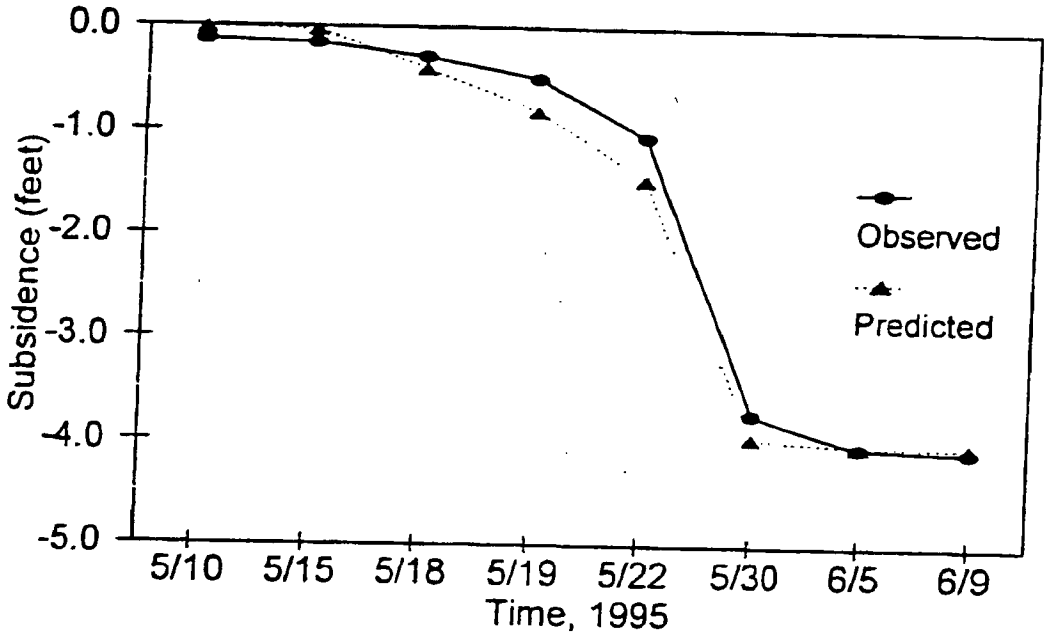

Figure 6. Predicted and Observed Subsidence

ACKNOWLEDGMENTS

I thank;

- Southern Ohio Coal Company for providing mine maps, overburden lithology, and the longwall face progress when the water tank was undermined,
- Terry Breckenridge of Burgess and Nipple, Columbus, Ohio for providing the subsidence data and the water tank pictures before, during and after mining,
- My colleagues Lois Uranowski and Jesse Craft for assisting me to make drawings and for giving suggestions writing this paper.

REFERENCES

Karmis, M and Z. Agioutantis, "The Prediction of Ground Movements Caused by Mining," Proceedings 3rd Workshop on Surface Subsidence due to Underground Mining, Morgantown, WV, June 1992, pp. 1-9.

For Presentation at the SME Annual Meeting in Salt Lake City, Utah on Feb. 28 - March 2, 2000

AEC 06579

ADDENDUM TO PAGE 30, PART 3, K(5)(e)

22nd International Conference on Ground Control in Mining

Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study

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ABSTRACT

The potential influences of mining subsidence on structural stability, integrity and functionality of guyed tower structures have not been systematically studied before. This paper presents a case study where a guyed steel tower of a telecommunication company was mined under by a longwall operation. Prior to mining, every aspect of the subsidence influences to this structure was studied. The pre-mining assessment indicated that the structure could experience vibration problem in the second half of the dynamic subsidence process. Based on the study, a simple mitigation measure was recommended and implemented and the structure was successfully protected.

INTRODUCTION

Guyed tower structures have been frequently employed to elevate objects (e.g., radio or TV transmitters, wind turbines, etc.) high above ground surface because of their low construction cost and great stability. A guyed steel tower is consisted of a tall and slim steel lattice structure restrained laterally by a number of steel guy wires from different directions.

Mining in a longwall panel with a fairly large overburden was conducted under a guyed steel tower used for wireless phone service. Assessment of the influences of the subsidence process on this structure has been performed using the methods developed in this study prior to the longwall mining operation. The assessment concluded that the stability, integrity and functionality of this tower structure would not be affected by the subsidence process. However, the lateral restraint to the steel tower by the guy wires would be reduced, possibly causing vibration of the structure under gusty wind conditions, in the second half of the dynamic subsidence process. The only mitigation measure for this tower was to monitor and to maintain proper tensions on the guy wires. The structure was successfully protected and its services had never been affected.

This paper presents the methods for assessing the subsidence influences on the guyed tower at various stages of the subsidence process.

LONGWALL PANEL AND TOWER STRUCTURE

The portion of the longwall panel over which the transmission tower is located is shown in Fig. 1. The longwall panel was 874 ft wide (rib-to-rib) and the mining height in the Pittsburgh coal seam is between 6.5 and 7.0 ft. The base of the tower is located near the central portion of the longwall panel. The tower sits in a flat area on the top of a steep hill. The overburden depth at the tower base is about 1,017 ft.

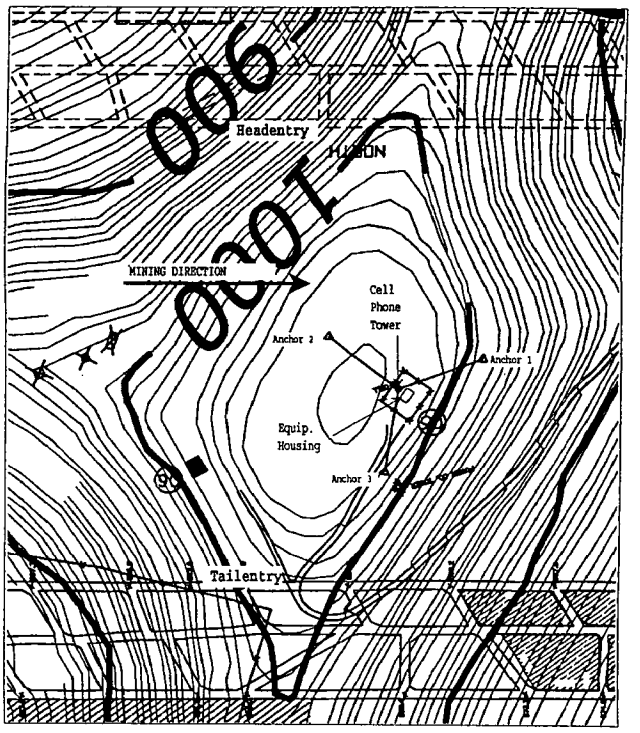

Fig. 1 Overview of the Site

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The tower (Fig. 2), belonging to one of largest wireless phone companies in the nation, serves as a relay station to transmit cellular phone signals between two similar towers located more than 20 miles away in the tri-city area in the northern West Virginia and southwestern Pennsylvania. The steel lattice tower is about 180 ft tall and laterally restrained by 12 steel guy wires. These guy wires are installed in three vertical planes that are separated from each other by about a 120° horizontal angle. Along each plane, the lower ends of the four wires are tied to a concrete anchor block (Fig. 3) and the upper ends are tied to the tower at three different levels. The turnbuckle on each guy wire makes it possible to make necessary adjustment for regular maintenance. The anchors were located about 160 ft away from the tower base. The concrete anchor blocks, 2' (H) x 3' (W) x 7'-6" (L), were buried about 6 ft below the ground surface.

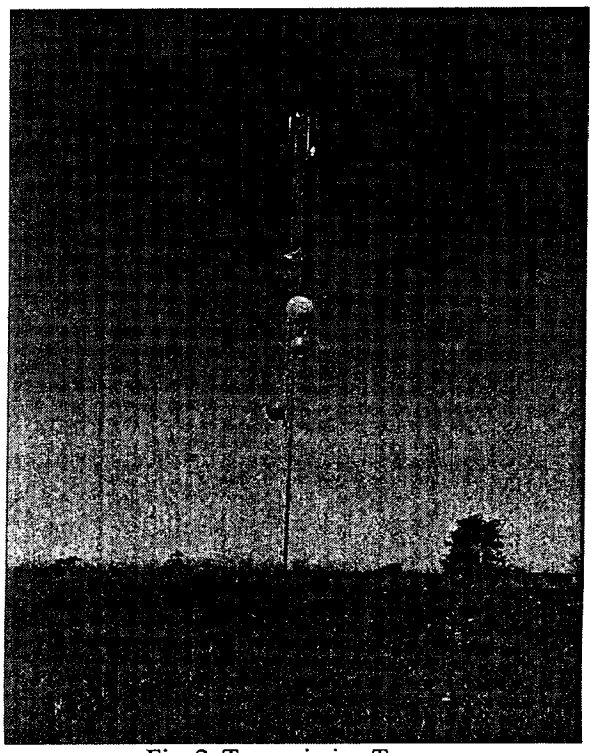

Fig. 2 Transmission Tower

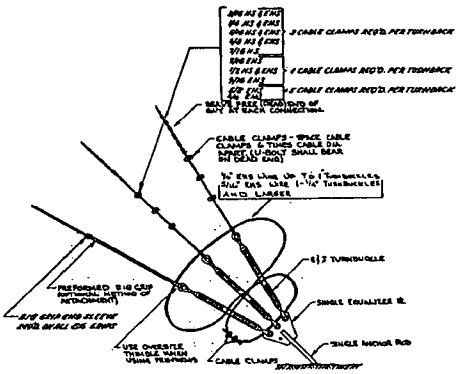

Fig. 3 Method to Tie the Guy Wires to the Anchor Block

Table 1 shows the pre-mining coordinates and elevations of the points of interest on the tower structure (i.e., base, anchors and ties). A local coordinate system is used for the structure. The datum of the elevation of the local coordinate system is set at the base of the tower ($z = 0$ ft at the base). It should be noted that the anchors are not on the same elevation as the tower base. The x-direction of the coordinate system follows the mining direction with $x = 0$ at the tower base. The y-axis points from the panel tailentry to the headentry with $y = 0$ at the panel tailentry.

Table 1 Local Coordinates of the Tower Base and Anchors

Point of Interest	x	y	z*
Base (0)	0	369	0
Anchor 1	149	427	-12
Anchor 2	-123	469	-6
Anchor 3	-23	215	-1
Tie 1	0	369	60
Tie 2	0	369	123
Tie 3	0	369	173

* elevations are expressed in relation to tower base

The tower super-structure is tied to its foundation with one steel bolt (ϕ =15/16"). The reinforced concrete foundation is constructed in two sections. The lower section is a square one with side length being 4'-6" and the thickness being 1'-6". The upper section is cylindrical with its diameter and height being 2 and 4 ft, respectively. The foundation is buried with only the top 6 inches being exposed above the ground surface.

In each of the three guy wire planes, one guy wire (ϕ = 3/8") is used at the lower level located about 60 ft above the tower base (referred as Tie 1). Two guy wires (ϕ = 7/16") are tied to the tower at the middle level (123 ft above the tower base) to resist the possible rotation of the tower structure (Tie 2). The top of the tower is tied with one guy wire (ϕ = 7/16") at the elevation of 173 ft above the tower base (Tie 3). At lower and top tie levels, breast type of ties are used to provide lateral restrain to the tower only while the middle tie is a torque type to provide both lateral and rotational restrains to the tower as shown in Fig. 4. The guy wires have been pre-tensioned with the tensions ranging from 1,250 lbs at the lower level to 1,975 lbs at the top level.

SUBSIDENCE PREDICTION

In order to assess the potential subsidence influence on the tower structures, dynamic subsidence prediction is performed at four surface points of interest, the tower base and the three anchors, using the subsidence prediction program CISPM version 2.01 (Peng and Luo, 1992). Mining height of 7.0 ft and an advance rate of 80 ft/day were used in the predictions.

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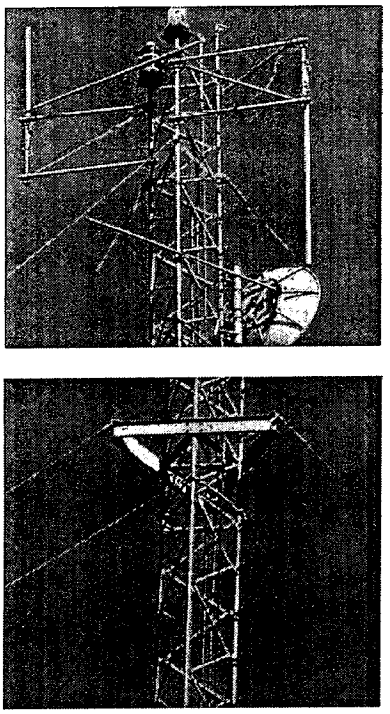


Fig. 4 Breast Type (Top) and Torque Type (Bottom) Ties

The predictions was performed at different time stages ranging from when the longwall face was from 300 ft inby to 1,700 ft outby the tower base. These time stages are chosen to cover the entire active dynamic subsidence process. The prediction for the last time stage (i.e., the face has passed the tower base for a distance of 1,700 ft) should be considered as the final subsidence. The predicted surface subsidence (S) and the two components of horizontal displacement (U_x and U_y along the x and y directions, respectively) at these specified time stages are plotted in Figs. 5, 6 and 7, respectively.

Figure 5 shows the predicted subsidence development curves at the tower base and anchors. Insignificant amount of subsidence would be experienced by the tower structures when the longwall face was directly under the tower base. The subsidence process would be most active when the face was between 300 and 400 ft passed the tower base. The ground begin to regain stability after the face has passed the tower base a distance of 1,000 ft. The final prediction shows that anchor 1 will subside the most (3.06 ft) while anchor 3 the least (1.62 ft). There is no significant differential subsidence among the base, anchors 1 and 2 after the subsidence process is over.

The predicted development curves of horizontal displacements along the mining direction are plotted in Fig. 6. The negative values shown in the figure indicate that the movements were against the mining direction. The maximum movements along the mining direction ranged from 0.43 to 0.54 ft when the longwall face was between 300 and 700 ft passed the tower base.

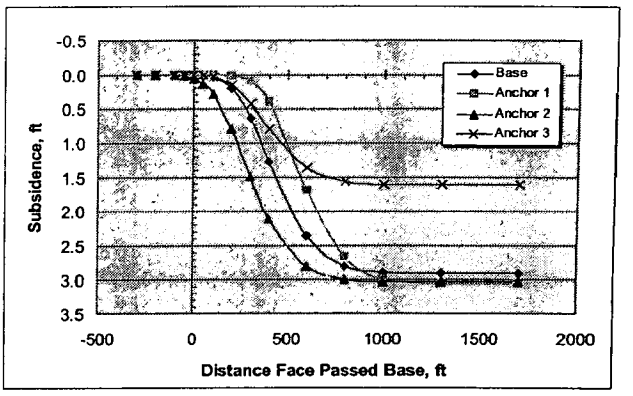


Fig. 5 Predicted Dynamic Subsidence

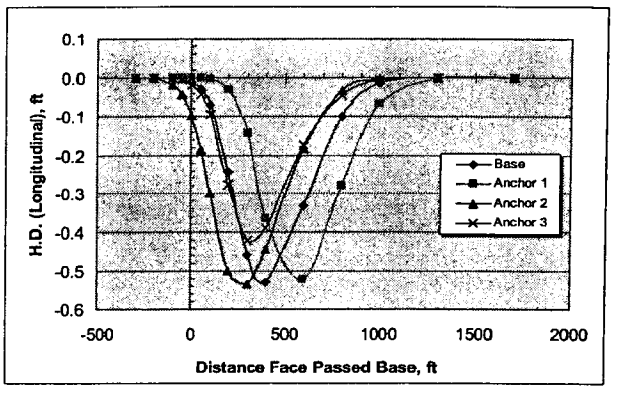


Fig. 6 Predicted Dynamic Horizontal Displacement Along Mining Direction

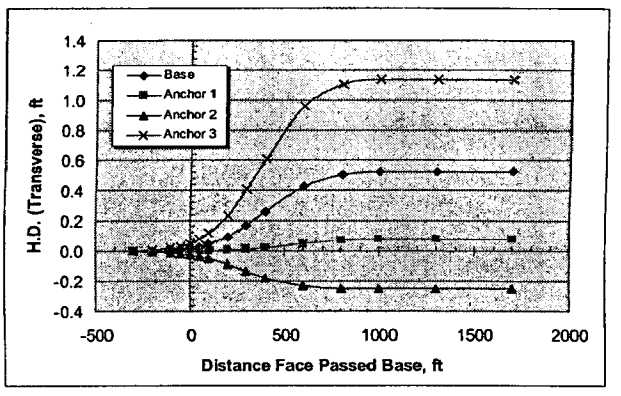


Fig. 7 Predicted Dynamic Horizontal Displacement Along Panel Transverse Direction

The predicted development curves of horizontal displacements along the panel transverse direction are plotted in Fig. 7. A positive value indicates movement from the panel tailentry to headentry. It shows that the base and anchors 1 and 3 would move toward the panel headentry side while anchor 2 would move toward the panel tailentry side. Among these four points, anchor 3 will have the largest movement (1.15 ft) while anchor 1 will have the least movement (0.07 ft) when the subsidence process is over.

AEC 06582

ASSESSMENT OF SUBSIDENCE INFLUENCES

Based on the predicted dynamic surface movements at the tower base and three anchors as well as the structural characteristics of the tower, the movements and deformations of the tower structure can be determined. Subsequently, the following three aspects of potential influences that the ground subsidence process could cause to the tower structures can be assessed.

- *Structural stability*: Since the tower structure is tall and sits on the hill top, its stability during and after the subsidence process was a concern.
- *Structural integrity*: The subsidence process could induce some additional forces on various parts of the tower structures. If strong enough, these forces could cause structural damages to some of the structural parts.
- *Functionality*: If the tilting and rotation of the transmission tower induced by the subsidence process exceed certain critical values, they could cause blockage and alignment problems to the paths of the signal transmission resulting in disruption or degradation of the cellular phone services.

Assessment of Structural Stability

Stability analysis is normally required for tall structure with small bases such as transmission tower to assess the potential for the structure to be toppled by external lateral forces. Because of their designs, the guyed towers are a type of very stable tower structures that can sustain high winds, earthquakes and extreme weather. The stability of the guyed tower could only be jeopardized when some of the guy wires, especially those tied to the upper levels of the towers, break under some extreme forces. The determination of the subsidence-induced forces in the guy wires to be induced for this case is presented in the next section. That analysis indicated that the subsidence-induced tensions in the guy wires were insignificant compared to pretensions in these wires and to their ultimate breaking loads of the steel cables. Therefore, the ground subsidence process associated with the longwall mining operation will not affect the stability of this particular transmission tower.

Assessment of Structural Integrity

As the ground subsides, the relative spatial locations of the tower base and the anchors, the ground-contacting points of the guyed tower structure, will change. Such changes in elevations and coordinates of these ground-contacting points could induce additional tensions or slacking condition in the guy wires and additional loads in the tower structure.

Determination of Tower Equilibrium State

In determining the subsidence-induced tensions and loads, the predicted dynamic surface movements at the tower base and the anchors at a time stage are imposed on their respective original coordinates and elevations listed in Table 1. The most important task is to determine the coordinates of the ties on the tower when a new equilibrium is developed in the tower structure for that time stage. Since the guy wires tied to each of the three ties on the tower are of the same size (3/8" for wires connected to tie 1, and 7/16" to ties 2 and 3), the following conditions should be satisfied when a new equilibrium at each tie position is reached.

$$\begin{cases} \sum_{i=1}^{3} \varepsilon_i \cos\beta_i \cos\alpha_i = 0 \\ \sum_{i=1}^{3} \varepsilon_i \sin\beta_i \cos\alpha_i = 0 \end{cases} \quad (1)$$

In Equation 1, ε_i is the subsidence-induced strain developed in the guy wire connected between anchor i and the tie of interest. The horizontal angle between this guy wire and the mining direction is β_i while the slope angle is expressed as α_i. The subsidence-induced strain in this guy wire is determined as:

$$\varepsilon_i = \frac{\sqrt{(x_i - x_o)^2 + (y_i - y_o)^2 + (z_i - z_o)^2} - L_o}{L_o} \quad (2)$$

In equation 2, x_i, y_i, and z_i are the coordinates and elevation of ground anchor i at a given time stage. The coordinates and elevation at a given tie on the tower are x_o, y_o, and z_o. The original length of the guy wire is L_o. In setting up equations 1 and 2, the following two reasonable assumptions are made:

- The vertical deformation of the tower structure is insignificant. Therefore, the new elevation at a tie position z_o is equal to the elevation of the subsiding tower base plus the original height of this tie.
- The ability for the tower structure itself at the tie levels to resist lateral displacement is insignificant.

By solving the two simultaneous nonlinear equations (Eq. 1), the coordinates, x_o and y_o, of each of the three ties can be determined when the new equilibrium of the tower structures is reached at a given time stage. A computer program was developed for solving the simultaneous nonlinear equations involved in this task. Using the program repeatedly, the coordinates for the three ties and the horizontal displacements (x-component, y-component and principal, Δx, Δy and ΔU) of these three ties relative to the tower base were determined and the results are shown in Figs. 6, 7 and 8, respectively. It is apparent that the upper part of the tower would displace with respect to its base more than the lower part.

Changes in Guy Wire Tensions

Using these determined coordinates of the ties and the anchors, the subsidence-induced strains in the guy wires on the tower base can be determined. In converting the subsidence-induced strain (Eq. 2) to the subsidence-induced tension, the stiffness (S) of each of the two types of the steel wire ropes should be determined based on the average value of 6-strand and 8-strand steel wire ropes as:

AEC 06583

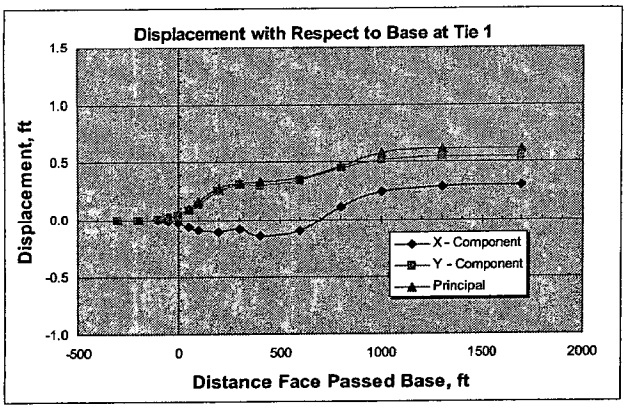


Fig. 6 Horizontal Displacements of Tie 1

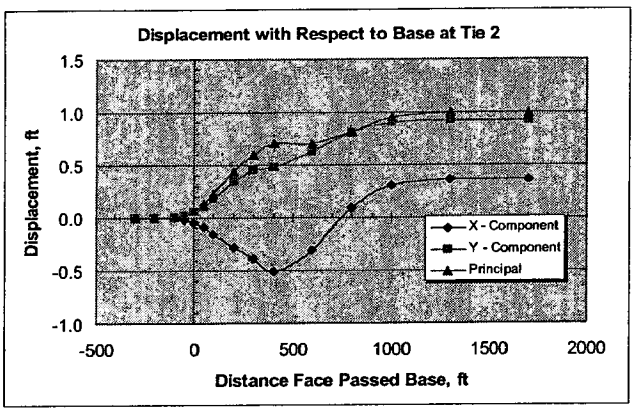


Fig. 7 Horizontal Displacements of Tie 2

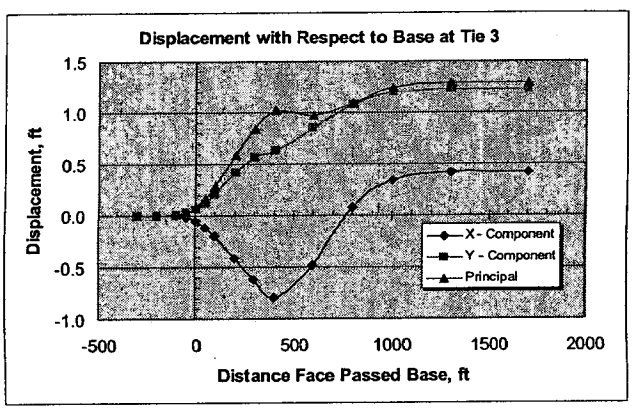


Fig. 8 Horizontal Displacements of Tie 3

$$S = 10x10^6 A \qquad \text{lbs} \qquad (3)$$

In Eq. 3, A is the cross-sectional area of the wire rope. The stiffness values used in the conversion are 1,104,466 and 1,503,301 lbs ft/ft for the 3/8" and 7/16" guy wires, respectively. The average tensions in the guy wires induced by the ground subsidence process associated with the longwall operation are plotted in Fig. 9. A positive value indicates that an additional tension has been induced in the guy wire by the subsidence process while a negative value shows that the existing tension in the guy wire observed before mining will be reduced. A negative force is only meaningful when its magnitude is smaller than the pre-mining tension in the guy wire. Figure 9 shows that tensions would develop in the guy wires when the longwall face is between 50 ft inby and 300 ft outby the tower base. The maximum subsidence-induced tension was about 780 lbs for guy wires tied to the level 3 of the tower when the longwall face is about 200 ft passed the tower base. Such additional tensions are smaller than the pre-mining tensions ranging from 1,250 to 1,975 lbs and are insignificant compared to the ultimate breaking strengths of the guy wires (10,600 lbs for 3/8" wire rope and 14,400 lbs for 7/16" wire rope). Therefore, the subsidence-induced tensions were incapable of causing breakage of the guy wires.

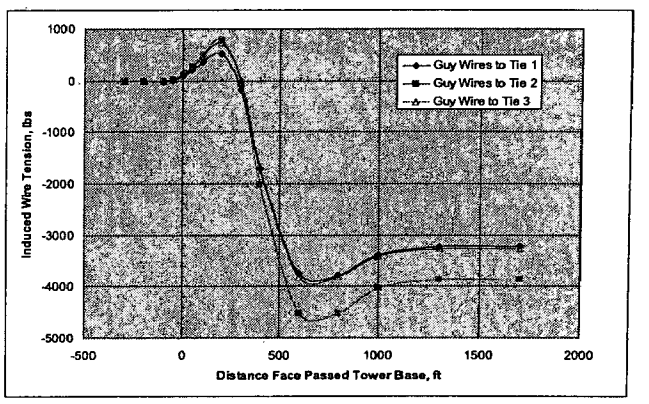


Fig. 9 Subsidence-Induced Tensions in the Guy Wires

However, after the longwall face has passed the tower base a distance 350 ft, the tensions in the guy wires become nonexistent (The magnitudes of the negative values are larger than the pre-mining wire tensions). Under such condition, the guy wires would slack and the tower would be no longer effectively restrained laterally by the guy wires within certain small range. The lack of effective lateral restraint makes it possible for the tower, especially its upper sections, to vibrate under strong gushing winds.

Additional Load to the Tower

The subsidence-induced tensions in the guy wires also induce additional loads to the tower structure, especially in the section near the tower base. The additional load in the lower section at a given time stage is the summation of the vertical components of the tensions in all of the guy wires. The calculations show that additional loads can be induced in the first half of the dynamic subsidence process until the longwall face has passed the tower base a distance of 350 ft. The maximum subsidence-induced load on the tower base would be 4,947 lbs when the face was 200 ft past the base. Such additional load was also insignificant compared to the weight of the steel tower structure and the load from the pre-mining wire tensions (about 12,000 lbs). Therefore, the subsidence-induced load to the tower base would not cause any structural integrity problems to the tower.

AEC 06584

Bending Curvature on the Tower

The differential lateral displacements between the base and the three ties would create a bending condition in the tow lattice structure. The calculation shows that the lower part of the tower was bent laterally more severely than the upper part. However, the maximum bending curvature, 5.5×10^{-5} 1/ft in the lower part when the longwall face was about 300 ft passed the tower base, was still insignificant for the tower steel lattice structure. Therefore, the bending developed on the tower structure would have no effect on its structural integrity.

Assessment of Structural Functionality

The assessment of subsidence influences on the functionality of the transmission tower is to assess whether the ground subsidence process is to disrupt or degrade the ability of the transmitters on the tower to relay phone signals to and from the transmission towers in the other two cities. Such ability could be potentially affected by: the blockage of the signal path, and (2) the incorrect alignment of the signal path. This section assesses the possibilities for such two potential problems to occur during and after the ground subsidence process.

Possibility of Signal Path Blockage

The cellular phone company was concerned with the vertical subsidence at the location of the tower base that would place the tower a few feet (2.9 ft as predicted and shown in Fig. 5) lower than its original elevation. It was thought that such lowering of tower elevation could make high obstacles (such as large trees) to intrude into the signal path between the transmission towers causing signal blockage.

However, it should be noted that the transmission tower was located on the top of one of the highest hills, if not the only highest hill, in a large area around and the transmitters were also located high above the ground on the tower. The ground subsidence process would not only lower the tower but also the surrounding surface area to certain extent. Therefore, the signal paths are impossible to be blocked by any local obstacles around this transmission tower.

Another fact was that the other two transmission towers were located about 23.5 miles (air distance) away from this transmission tower. The predicted 2.9 ft elevation lowering at this transmission tower would only change the signal path by a minor angle of 4.84 seconds. Such insignificant change in signal path would make it impossible for any obstacles located close to the other towers to intrude into the signal paths, either. Therefore, the possibility for the subsidence process to cause blockage of the signal paths was none.

Possibility of Misalignment of Signal Paths

During and after the subsidence process, some minor inclination and rotation will develop on the tower structure. Such inclination and rotation, if large enough, could affect the alignment of the signal paths between the transmitters. According to the cellular phone company, any inclination away from the vertical direction or rotation in the horizontal plane of the tower larger than one degree could affect the alignment of the signal paths.

Based on the determined coordinates and elevations of the tower base and the ties, the inclinations of the tower structures away from the vertical direction at each time stage were determined for each section and the entire height of the tower. The results include inclinations along x and y directions as well as the principal one. The principal inclination of the tower would increase as the dynamic subsidence process with the maximum being reached when the ground regains its stability. The maximum inclinations would be 0.59°, 0.36° and 0.35° for the lower, middle and top sections, respectively. The maximum inclination for the entire tower is about 0.43°.

The rotation of the tower structure is determined using the coordinates of the anchors and tie 2 because torque type tie at this level were designed to provide rotational restraint to the tower lattice structure. The maximum tower rotation, 0.56°, would occur when the dynamic subsidence process was over.

The analysis indicated that both the maximum inclination and the maximum rotation of the tower are smaller than their critical values. Therefore, the alignments of the signal paths would not be affected by the ground subsidence process associated with the longwall mining operation, either.

MITIGATION MEASURE AND RESULTS

Based on the analyses performed, it was concluded that the only possible problem is the vibration of the tower under strong gushing winds due to the lack of effective lateral restraint by the guy wires. Such condition would occur in the second half of the dynamic subsidence process starting at the time when the longwall face is 300 ft outby the tower base.

In order to prevent the condition for potential vibration from occurring, it was recommended that the tensions in the guy wires were to be monitored daily when the longwall face is between 0 and 1,000 ft past the tower base. Necessary adjustments should be made by loosening or tightening the turnbuckles (Fig. 3) on the guy wires near the anchor blocks to maintain the needed tension levels. During the time period when the face is between 300 and 750 ft passt the tower base, multiple adjustments should be made daily to compensate the anticipated large reduction of tensions in the guy wires. When making these adjustments, the plumbing of the lattice structure should be also checked to avoid over-adjustments.

Mining under the tower started in the early January, 2003. The recommended mitigation measure was implemented. The dynamic subsidence process in the area of the transmission tower was over by the end of that month. Despite severe winter weathers in the first two to three months of this year, the tower was successfully protected and no complaints about the phone services were made.

AEC 06585

CONCLUSIONS

This paper presents a case study where a telecommunication transmission tower was subsided by a longwall operation. The potential subsidence influences on the structure were carefully assessed based on the predicted surface movements in the dynamic subsidence process and the structural information of the tower using a systematic approach.

The assessment indicated that structural stability, integrity and functionality of this tower would not be significantly affected by the subsidence event. However, a vibration condition could develop in the second half of the dynamic subsidence process because of the slack of the guy wires.

Based on the assessment, a simple mitigation measure, monitoring and tension adjustment was recommended and implemented. The project was successful as evidenced by the continued quality service carried by this transmission tower.

REFERENCE

Peng, S.S. and Y. Luo, 1992, "Comprehensive and Integrated Subsidence Prediction Model - CISPM (V2.0)," *Proc. 3rd Workshop on Surface Subsidence Due to Underground Mining*, Ed. S.S. Peng, West Virginia University, Morgantown, WV, pp. 22-31.

AEC 06586

MITIGATING MEASURES – SURFACE STRUCTURES

Damage to Public Roads

AEC will notify the appropriate road authority at least six months prior to undermining the road. In the event that roadways are permanently damaged by subsidence, AEC, at the request of the road authority, will pay to repair the road surface to its pre-mining condition. Temporary repairs for all roads will be performed as needed and deemed necessary by a local road representative. *Permanent repairs will be performed as soon as practicable. Roads affected by multiple panel subsidence may have delayed permanent repairs. Signs will be posted prior to undermining the public roads, and an AEC representative will travel all subsided public roads to ensure there is no threat to public safety in the days during undermining and just after mining.*

Damage to Public Water Lines *and Water Storage Tank*

AEC will notify the owner of public water lines at least six months prior to undermining the lines. In the event that the pipelines are damaged by subsidence, AEC, at the request of the public water line authority, will pay to repair the pipeline to its pre-mining conditions. *AEC also plans to place excavate around the base to install tension cables around the concrete base of the water holding tank to minimize damage. The impacts on the water tank would be the same impacts as those listed above for structures in general. Minimal damage to the tank is anticipated. Emergency repairs will be performed as soon as practicable in order to minimize any disruption in water service, which is not anticipated. Switzer Water Authority currently has booster pumps in line, which will be turned on to provide water to residents at higher elevations in the event the tank is damaged and unable to supply water due to mining. In the event of a tank failure, Switzer Water Authority still has the capacity and facilities to provide water to all of its customers.*

Damage to Public Sewer Lines

AEC will notify the owner of public sewer lines at least six months prior to undermining the lines. In the event that the pipelines are damaged by subsidence, AEC, at the request of the public sewer line authority, will pay to repair the pipeline to its pre-mining conditions.

Damage to Other Utility Lines and Installations

AEC will notify the owner of other utility lines (electric lines and sub-stations) at least six months prior to beginning work at the proposed permit area and will take

measures to protect the lines that traverse the proposed permit area. Notification at least six months prior to undermining the lines to allow the utility to take measures that they deem necessary and proper to protect their property and the public health and safety. No interruption of service is anticipated. The high voltage power lines have been subsided in the past at both Ohio Valley Coal Company, and American Energy Corporation. AEC notified the power company of the timing of the mine. We have had no complaints or requests from the power company. See Addenda to Page 30, K(5)(d).

The effects due to subsidence are expected to be similar to those experienced at the water tower located near Athens, Ohio. A paper documenting the effects of which is attached.

Damage to Active oil and Gas wells

Active Oil and Gas wells within 25 feet of active underground workings will be plugged, and the well owner will be adequately compensated for his loss.

Houses that experience Subsidence effects of 2 panels

Houses that experience damages from more that one longwall panel will have emergency repairs completed as soon as practicable. After the house has endured damage from one longwall panel, emergency repairs will be made. After the passage of the second longwall panel, emergency repairs will be made again, and permanent repairs will occur a minimum of six months after all subsidence is complete.
Some of the residents that may experience multiple subsidence occurrences are: R. Reed, B. Palmer, S & B Brandon, R. Perkins, L. Neiswanger, and D. Carpenter.

AEC will ensure that all utilities will be kept operational and functional and there will be no threat to public health.

AEC will inspect structures daily to monitor for damage to utility installations. The structures will undergo a thorough physical examination, and any necessary emergency repairs will occur as soon as practicable.

ADDENDUM TO PAGE 30, PART 3, K(5)(h)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

Monitoring of Structures

A pre-subsidence inspection and photo documentation will occur prior to undermining any occupied or otherwise currently utilized structure.

After AMERICAN ENERGY CORPORATION has completed its pre-subsidence survey, AMERICAN ENERGY CORPORATION will notify the Division of Mineral Resource Management if a private agreement (pursuant to OAC 1501:13-12-03(E)) between AMERICAN ENERGY CORPORATION and the landowner exists. If no agreement exists, the Division of Mineral Resource Management, after discussions with AMERICAN ENERGY CORPORATION, will decide the need for any monitoring of the structure(s). If monitoring is required, AMERICAN ENERGY CORPORATION will submit a plan for the monitoring. If, prior to subsidence, a private agreement is reached, AMERICAN ENERGY CORPORATION shall be released from any and all monitoring requirements.

Subsequent to subsidence, a post-subsidence inspection will occur, and any immediate needs will be addressed as soon as practicable, with permanent repairs to follow.

ADDENDUM TO PAGE 30, PART 3, K(5)(f)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

NOTICE OF MINING, PRE-SUBSIDENCE SURVEY, MONITORING OF STRUCTURES

Notice of Mining

AEC will mail written notice to owners and occupants of surface property or structures of AEC's intent to mine under such property or structures at least six months prior to any mining by AEC under their property.

Pre-Subsidence Survey

A pre-subsidence survey of all structures to be undermined will be conducted by AEC personnel or by someone contracted to do this work and will be used to determine the condition of the structures and facilities prior to the mining unless a private agreement exists between AEC and the landowner. This survey may include, but not be limited to: still and video photography, land surveying, making various measurements, interviewing landowners, tenants, or other individuals, and making various drawings. This survey will be performed in accordance with Underground PPD 90-3. Refusal of the landowner to allow a pre-subsidence survey will result in the amount of damage caused by subsidence to be indeterminate. In such cases, AEC will enforce the terms of its deed language, which deeds represent valid agreements between the coal owner and the owner of the surface estates and address all damage that may occur due to the removal of all coal. Such agreements vary from tract to tract, but are shown in the Addendum to Part 1, Page 10, C.(8)(b).

ADDENDUM TO PAGE 30, PART 3, K(5)(g)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

REPAIRS TO STRUCTURES

After mining, structures will be repaired or replaced as required by law or the owner will be compensated for the diminution in value to the extent required by law. A private agreement may be used to satisfy the requirements of OAC 1501:13-12-03. If repaired, structures will be returned to their pre-mining condition.

Repair of and compensation for damage under the terms and conditions of OAC 1501:13-12-03(F) and (H) can be determined only after review and analysis of the damage in each particular situation. AEC will comply with all legal requirements if subsidence damage occurs.

As required by OAC 1501:13-12-03(l), all remedial, restorative and mitigatory actions required under this rule will be performed as soon as practicable.

ADDENDUM TO PAGE 30, PART 3, K(5)(h)
AMERICAN ENERGY CORPORATION
CENTURY MINE
PERMIT D-0425

Monitoring of Structures

A pre-subsidence inspection and photo documentation will occur prior to undermining any occupied or otherwise currently utilized structure.

After AMERICAN ENERGY CORPORATION has completed its pre-subsidence survey, AMERICAN ENERGY CORPORATION will notify the Division of Mineral Resource Management if a private agreement (pursuant to OAC 1501:13-12-03(E)) between AMERICAN ENERGY CORPORATION and the landowner exists. If no agreement exists, the Division of Mines and Reclamation, after discussions with AMERICAN ENERGY CORPORATION, will decide the need for any monitoring of the structure(s). If monitoring is required, AMERICAN ENERGY CORPORATION will submit a plan for the monitoring. If, prior to subsidence, a private agreement is reached, AMERICAN ENERGY CORPORATION shall be released from any and all monitoring requirements.

Subsequent to subsidence, a post-subsidence inspection will occur, and any immediate needs will be addressed as soon as practicable, with permanent repairs to follow.

PART 4 FORMAT AND CONTENT

LING OF ADDENDA

If an addendum is needed to present the information required by the items ir permit application, the addendum is to be submitted with the permit applicat and each page, map, plan or other document in the addendum should include th applicants name and indicate to what item the addendum applies. For example Addendum to Part 3, item K(2),Zebco Coal Company.

Provide the information requested below for all technical data submitted in application.

Identification of Technical Data (1)	Person/Organization that Collected Data and Date	Methodology for Collecting Data	Person/Organizati that Collected Da and Date
PART 2, C ATTACHMENT 27, 31, 14	FRED BLACKMAN, QUALITY ENVIRONMENTAL SERVICES	GRAB SAMPLES AND INTERVIEWS	FRED BLACKMAN, QUALITY ENVIRONMENTAL SERVICES
ATTACHMENT 13	KEROGEN RESOURCES, INC	CORE DRILL	KIM CECIL, KEROGEN RESOURCES, INC

(1) The technical data is to be identified by referencing the particular ite in the application for which the data was used in preparing the response (e.g Part 2, B(1); Attachment 14; Part 4, A).

_____ New Submittal
_____ Revised Submittal R-_____

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

APPLICATION TO REVISE A COAL MINING PERMIT

Note: Refer to the division's "General Guidelines for Processing ARPs" and "Requirements for Specific Types of Common ARPs" for guidance on submitting and processing ARPs.

1. Applicant's Name **American Energy Corporation**

   Address **43521 Mayhugh Hill Road**

   City **Beallsville** State **Ohio** Zip **43716**

   Telephone Number **740-926-1008**

2. Permit Number **D-0425**

3. Section of mining and reclamation to be revised:

   Part 3, Item K(4)

4. Describe in detail the proposed revision and submit any necessary drawings, plans, maps, etc:

   Revise the room and pillar mining plan

5. Describe in detail the reason for requesting the revision:

   The Murray Mining System will be implemented in this area.

6. Will this revision constitute a significant alteration from the mining and reclamation operations contemplated in the original permit? ☐ Yes, ☒ No.
   (**Note:** refer to paragraph (E)(2) of 1501:13-04-06 of the Ohio Administrative Code to determine if a revision is deemed significant.)

   If "yes," complete the following items 7 through 9.

7. In the space below, give the name and address of the newspaper in which the public notice is to be published.

8. In the space below, give the text of the public notice that is to be published. (Include the information required by paragraph (A)(1) of 1501:13-05-01 of the Ohio Administrative Code.)

9. In the space below, give the name and address of the public office where this application is to be filed for public viewing.

I, the undersigned, a responsible official of the applicant, do hereby verify the information contained in this revision request is true and correct to the best of my information and belief.

Print Name James R. Turner, Jr. Title Treasurer

Signature _____ Date 3/20/07

Sworn before me and subscribed in my presence this 20th day of March, 2007

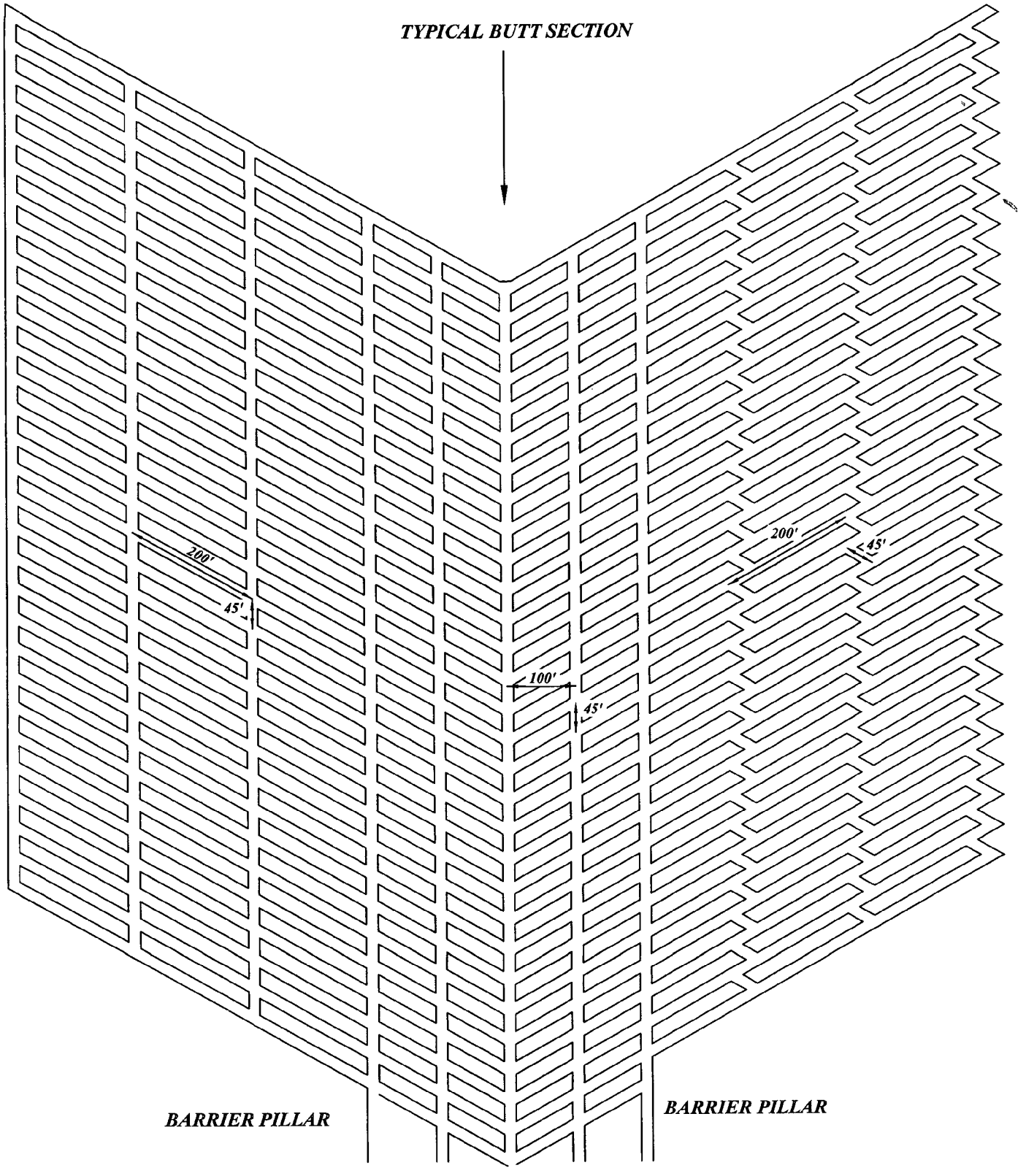
Ellen M. Green
Notary Public

My Commission Expires [illegible] 201

(For Division Use Only)

This application for renewal is hereby ☐ issued, ☐ disapproved.

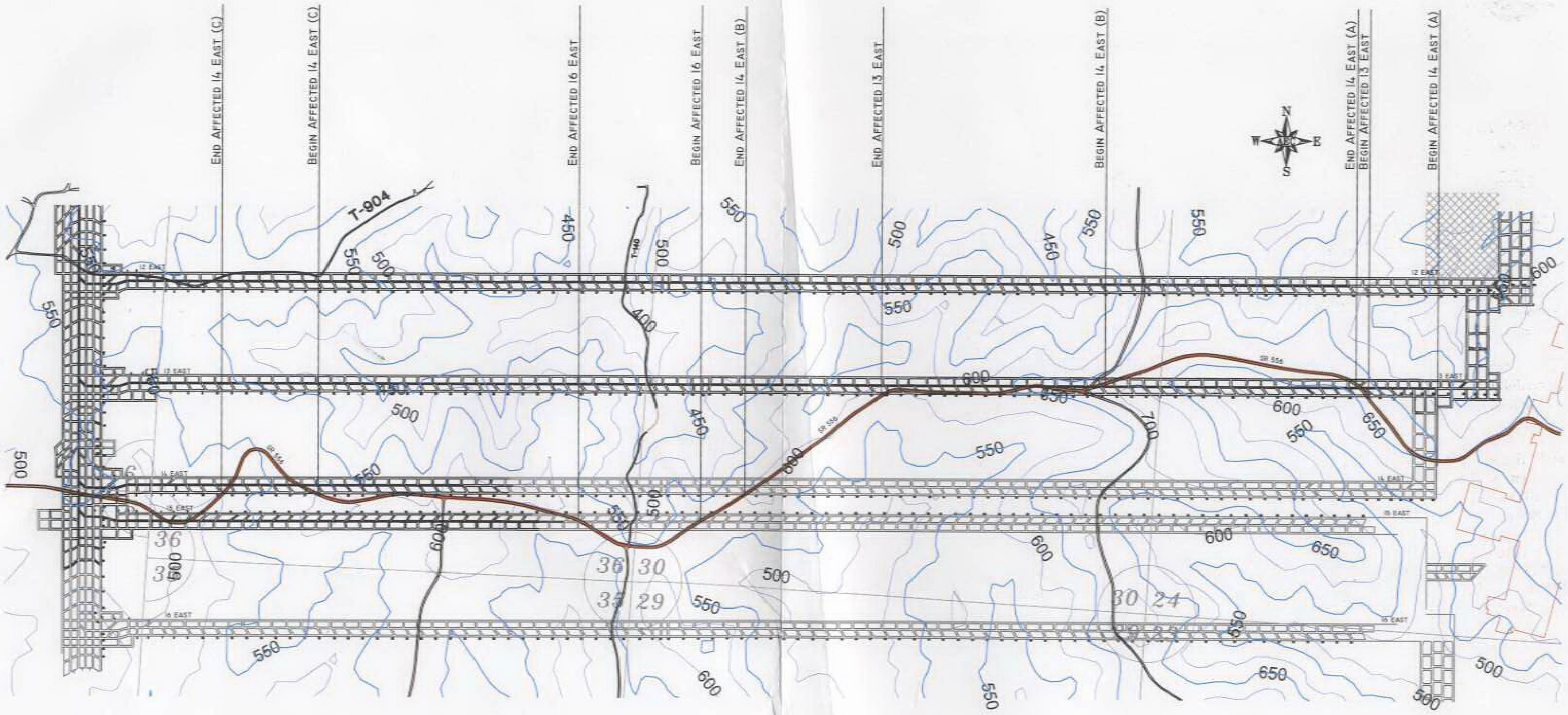
Chief, Division of Mineral Resources Management Date



ADDENDUM TO PART 3, PAGE 28, ITEM K (1)
TYPICAL BUTT SECTION
AMERICAN ENERGY CORPORATION

SCALE 1" = 200'

WAYNE TWP. , BELMONT CO.
SEC 1, 2, 7, & 8 T6 R5



ROAD AFFECTED PER PANEL:

SENT TO ODOT
NOV. 1 2006
PER THEIR REQUEST

STATE ROUTE 556

COUNTY AND TOWNSHIP ROADS

AMERICAN ENERGY CORP.
CENTURY MINE

LONGWALL MINING
UNDER S.R. 556

SCALE 1" : 1000'

T:\Freddy\Fred Map Revised.dwg, 10/31/2006 8:58:58 AM, 1:1000

AEC 06597

[PILLAR PARAMETERS]

PILLAR	ENTRY CENTER (ft)	MINIMUM DIMENSION (ft)	MAXIMUM DIMENSION (ft)
1	86.67	28.03	80.44
2	86.67	28.03	80.44
3	86.67	28.03	80.44
4	86.67	28.03	80.44

PILLAR	AREA (ft)*(ft)	STRENGTH (psi)	LOAD-BEARING CAPACITY (tons)
1	2.26E+03	2.43E+03	3.94E+05
2	2.26E+03	2.43E+03	3.94E+05
3	2.26E+03	2.43E+03	3.94E+05
4	2.26E+03	2.43E+03	3.94E+05

TOTAL LOAD-BEARING CAPACITY OF PILLARS WITHIN AMZ: 3.49E+06 (tons)

To view the distribution of Pillar Load Bearing Capacity
select 'View Plots->Settings->Pillar Load Bearing Capacity'

[BARRIER PILLAR PARAMETERS]
none

[STRESS ON INDIVIDUAL PILLARS WITHIN THE AMZ]

DEVELOPMENT STRESSES.....1192 (psi)

Provide the name, address, and position of officials of each private or aca research organization or governmental agency contacted in the preparation o [illegible]ation for information on land uses, soils, geology, vegetation, fish and wildlife, water quantity and quality, air quality, and archeological, cultural, and historic features.

Name and Address of Official	Position of Official	Name of Agency/ Organization	Type of Information (e.g. Geology)
BILL HAIKER 1855 FOUNTAIN SQUARE COURT, COLUMBUS, OHIO 43224	HYDROGEOLOGIST	ODNR, DIVISION OF WATER	Groundwater Inventory
RICHARD WHITT P. O. BOX 2019 WHEELNG, WV 26003	ANALYSIST	TRA-DET, INC	Water Sample Analysis

APPLICATION FOR ABANDONED MINED LAND DIRECT NEGOTIATED CONTRACT (IF APPLICABLE)

N/A

In accordance with Section 1513.27 of the Ohio Revised Code, the chief of t Division of Reclamation has been granted the authority to enter into contra with licensed operators for reclamation of abandoned mined lands affected b coal mining prior to April 10, 1972 and located adjacent to a permit area. be eligible for reclamation funding, the abandoned mined land must be causi offsite environmental problems, will not be affected by the operator during normal course of mining, and is not likely to be mined in the foreseeable future. If such lands exist adjacent to your permit area and you are inter in contracting for reclamation of the lands, complete this application , det and send directly to:

Robert S. Baker, Manager
Mined Land Reclamation
Division of Reclamation
Fountain Square, H-2
Columbus, Ohio 43224

Upon receipt, a representative from the Mined Land Reclamation section will contact you.

Applicant:

Address:

ty: _____ State: _____ Zip:

Business Telephone:

Contact Person:

Description of Abandoned Mined Land:

County:
Township:
Section/Lot:
Approximate Acreage:

Environmental Problems Associated with Site:

ROCKWOOD CASUALTY INSURANCE COMPANY

ISB-2553

654 Main Street
Rockwood, PA 15557

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ROCKWOOD CASUALTY INSURANCE COMPANY, a Corporation duly organized and existing under the laws of the Commonwealth of Pennsylvania and having its principal office in the Borough of Rockwood, PA does hereby nominate, constitute and appoint:

John P. Yediny

its true and lawful agent and attorney-in-fact, to make, execute, seal and deliver for and on its behalf as surety, and as its act and deed any and all bonds, contracts, agreements of indemnity and other undertakings in suretyship (NOT INCLUDING bonds without a fixed penalty or financial guarantee) provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

Five hundred thousand and 00/100 ----------($500,000.00)

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolution adopted by the Board of Directors of ROCKWOOD CASUALTY INSURANCE COMPANY:

"RESOLVED, That the President, Senior Vice President, Vice President, Assistant Vice President, Secretary, Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the Company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the ROCKWOOD CASUALTY INSURANCE COMPANY, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, ROCKWOOD CASUALTY INSURANCE COMPANY has caused its official seal to be hereunto affixed and these presents to be signed by its duly authorized officer the 6th day of March, 2003.

ROCKWOOD CASUALTY INSURANCE COMPANY

By Philip S. Kift, Vice President

STATE OF PENNSYLVANIA
COUNTY OF SOMERSET SS:

On this 6th day of March A.D. 2003, before me, a Notary Public of the Commonwealth of Pennsylvania, in and for the County of Somerset, duly commissioned and qualified, came THE ABOVE OFFICER OF THE COMPANY, to me personally known to be the individual and officer described in, and who executed the preceding instrument, and he acknowledged the execution of same, and being by me duly sworn, deposed and said that he is the officer of the said Company aforesaid, and that the seal affixed to the preceding instrument is the Corporate Seal of said Company, and the said Corporate Seal and his signature as officer were duly affixed and subscribed to the said instrument by the authority and direction of the said corporation, and that Resolution adopted by the Board of Directors of said Company, referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the Borough of Rockwood, the day and year first above written.

Notarial Seal
Kelly J. Geary, Notary Public
Rockwood Boro, Somerset County
My Commission Expires Mar. 6, 2007
Member, Pennsylvania Association of Notaries

(Notary Public)

I, the undersigned Officer of the ROCKWOOD CASUALTY INSURANCE COMPANY, a Pennsylvania Corporation of Rockwood, PA, do hereby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, I have hereunto set my hand, and affixed the Seal of said Company, on the 2nd day of February, 20 07.

Kurt D. Tipton, Sr. Vice President

AEC 06601

MR 505

Application No: _____

State of Ohio
Department of Transportation
Permit Application

See Reverse Side For Additional Requirements

District Permit Office Use Only

County: _____
Route: _____
Log Pt: _____
Access Category: _____
Classification: _____

[1] This form must be completed by the property owner or agents working for a utility company (if applicable). *Application by contractor is unacceptable.*

Name AMERICAN ENERGY CORPORATION
Address 42521 MAYHUGH HILL RD. TWP. HWY. 88 City BEALLSVILLE State OH
Zip 43716 Phone (740) 926-9152 Other (Fax, E-mail) FAX: 740-926-9198

[2] Type of Permit requested: ____ Commercial (*See other side.*) ____ Residential ____ Field ____ Utility ____ Drainage
____ Beautification (*See other side.*) ____ Spraying, trimming, tree removal ✓ Other

[3] Briefly describe work to be performed. (*Attach plans and see instructions.*)
S.R. 556 WILL BE UNDER MINED BY THREE SEPERATE LONG-WALL PANELS
1- 3700' OF S.R. 556, BEGIN MARCH 07 AND END APPROXIMATELY 45 DAYS
2- 2500' OF S.R. 556, BEGIN SEPTEMBER 07 AND END " 45 DAYS
3- 1200' OF S.R. 556. BEGIN APRIL 08 AND END " 15 DAYS
TRAFFIC PLAN AEC WILL MONITOR S.R. 556 CONTINUOUSLY DURING MINING.

[4] Location where work is to be performed. Give sufficient detail to locate the site accurately, such as the distance in miles or feet from a mile post or from some geographical feature such as an intersecting highway.
In MONROE County (along, across) State Route 556, 2 miles or — feet
North___ East___ West___ South✓ of SR 145 on the North✓ East___ West___ South✓ side of the road.
*Work to commence on MARCH 07, SEPT. 07, APRIL 08 and will require 105 days to complete.

[5] Does the property owner own or have any interests in any adjacent property? ____ Yes ✓ No
If yes, please describe. _____

[6] Prior to any excavation in the highway right-of-way, the Ohio Utilities Protection Service (OUPS) must be contacted in accordance with ORC Section 3781.25 to 3781.32. OUPS can be reached at 1-800-362-2764. A call must be made to OGPUPS at 1-800-925-0988

[7] Open cutting of pavement shall not be permitted unless no reasonable alternate method is available. Written approval of the Ohio Department of Transportation District Office must be obtained.

[8] All work requiring men or vehicles within ODOT right of way shall comply with all applicable requirements of the Ohio Manual of Traffic Control Devices and Item 614 (Maintaining Traffic) of the Construction and Material Specifications, latest editions. Failure to comply with these requirements will be cause for immediate revocation or suspension of the permit until the proper traffic control devices have been provided.

[9] I have received a copy of the policies and regulations pertaining to the permit for which I have applied. If a permit is subsequently issued to me by the Ohio Department of Transportation, I understand that the permit will state the terms and conditions for its use, and I agree to comply with all conditions and regulations stipulated on or attached to the permit. I also understand and agree that failure to comply fully with all conditions and regulations of the permit or any change in the use of the permit inconsistent with its terms and conditions will be considered a violation and cause for suspension, revocation, or annulment of the permit thereby rendering the permit illegal and subject to appropriate Department action, up to an including removal of the installation at the permittee's expense.

SIGN HERE ➜ Ry M Murray
Signature of Property Owner or Agent for Owner

Date 10/12/06 Daytime Phone 740-926-9152

Reviewers Comments:

ODOT Use Only

Date Received At ODOT: _____
By: _____

Date Reviewed: _____
By: _____

Date Permit Issued _____
By: _____

Rev 7/01/05

(See Other Side)

AEC 06602

AMERICAN ENERGY CORPORATION

43521 Mayhugh Hill Road • Twp. Hwy. 88 • Beallsville, OH 43716

PHONE: (740) 926-9152
FAX: (740) 926-9138

October 13, 2006

Mr. Jeff Schenrlein
District 10
338 Muskingum Drive
P.O. Box 351
Marietta, OH.45750

RE: Permit Application to Mine under S.R.556
Monroe County, Sunsbury Township

Dear Mr. Schenrlein:

American Energy Corporation wishes to conduct mining under sections of State Route 556 located in Monroe County, Ohio. The longwall mining method will be used in the recovery area that passes under proximately 1.5 miles of State Route 556.

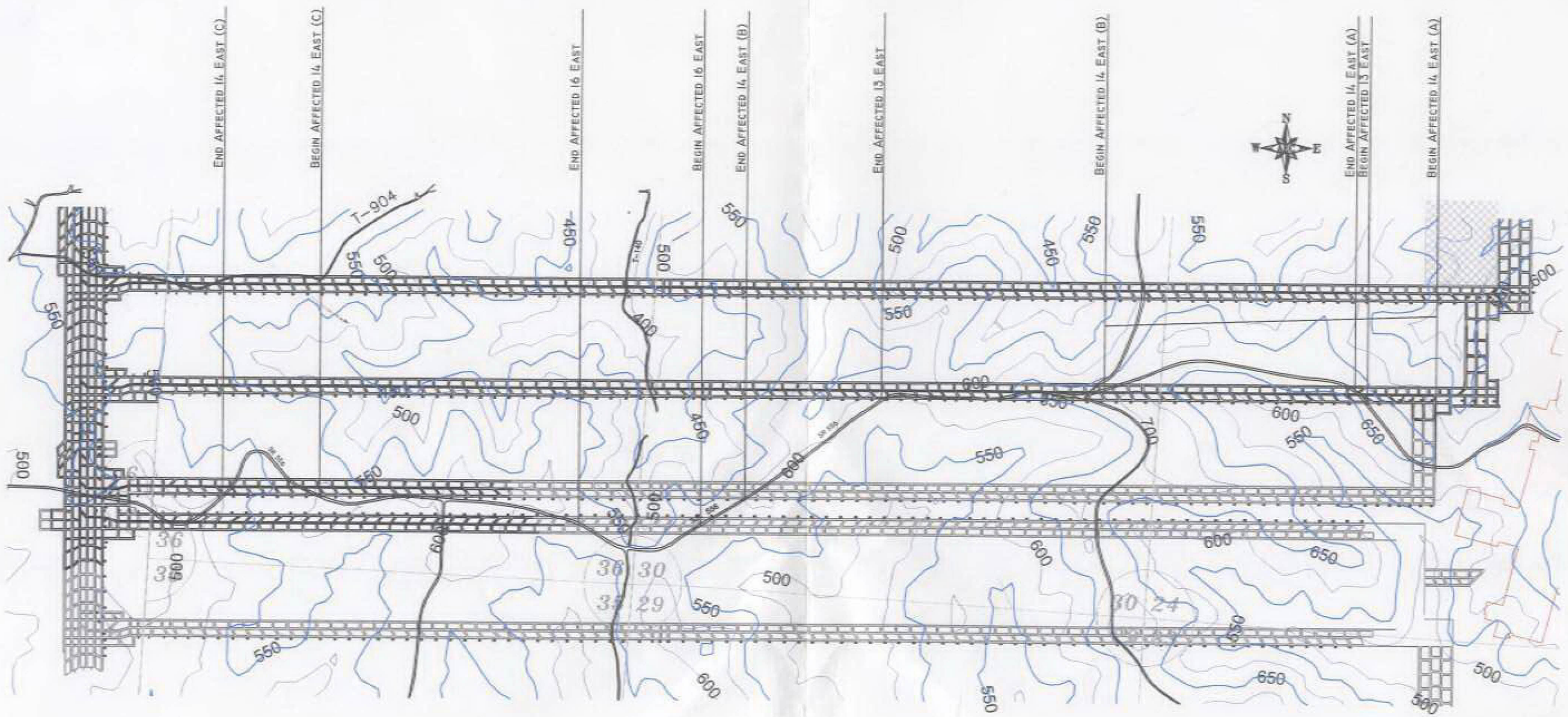
I have attached a map showing the length of the road and the approximate starting and ending locations. Also the map indicates the amount of cover above the coal seam.

In the past we have mined under sections of state highways in district 11. We were required to submit a $10.000.00 bond. Our current mining permit D-0425 -5 requires American Energy Corporation to make repairs to damages relating to subsidence.

If you have any questions or need additional information please feel free to contact me at your convenience.

Sincerely,

Fred M. Blumling
Environmental Engineer



Road Affected Per Panel:

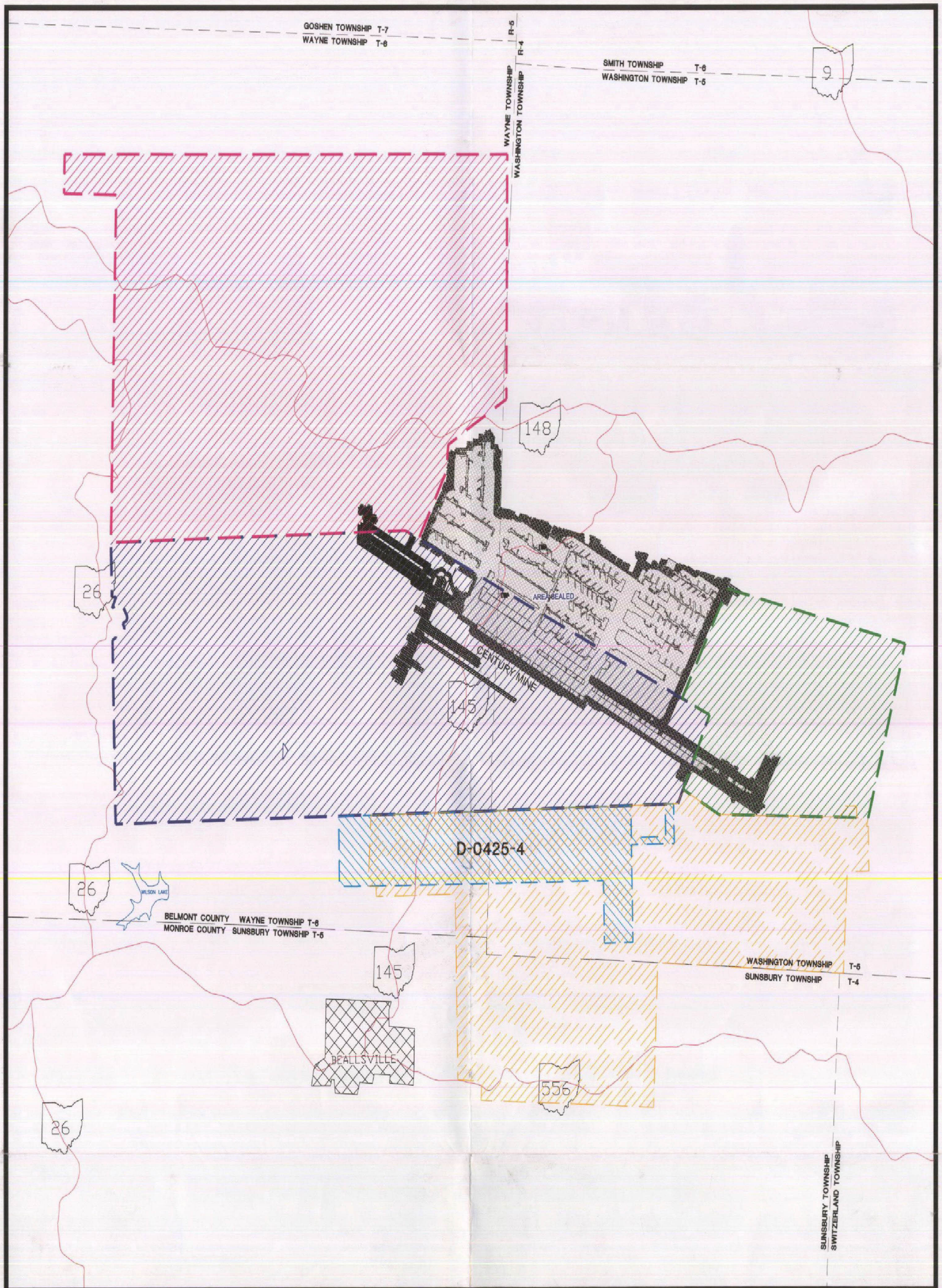
13 East: 3700 Feet
14 East: 2500 Feet
16 East: 1200 Feet

American Energy Corp.
Century Mine

Longwall Mining
Under S.R. 556

Scale 1" : 1000'

AEC 06604



MAP LEGEND

- AREA CURRENTLY PERMITTED
- AREA CURRENTLY BEING APPLIED FOR
- AREA CURRENTLY BEING APPLIED FOR
- FUTURE AREA 1
- FUTURE AREA 2

NOTE: FUTURE PROJECTIONS SHOWN HEREON ARE ESTIMATED AND ARE SUBJECT TO CHANGE BASED ON NUMEROUS UNKNOWN VARIABLES

N
W E
S

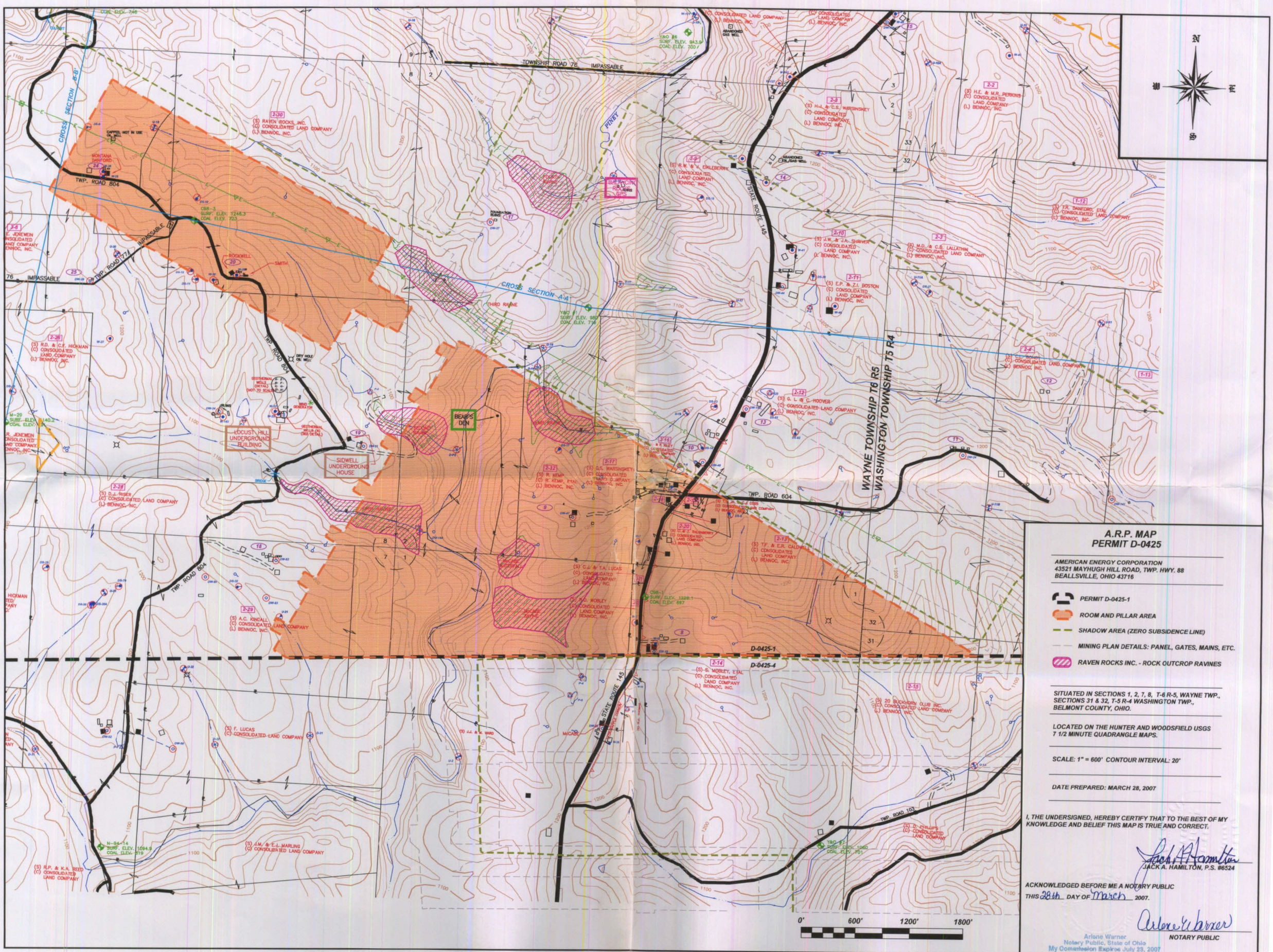
(SCALE: 1"=2000')

AMERICAN ENERGY CORPORATION
CENTURY MINE

ADDENDUM TO PART 1, PAGE 8, ITEM C(7)
FUTURE APPLICATION AREAS AND SEQUENCE

FUTURE PERMIT AREAS.DWG

DATE: 3-21-02
REVISED: 11-20-02
05-07-03



A.R.P. MAP
PERMIT D-0425

AMERICAN ENERGY CORPORATION
43521 MAYHUGH HILL ROAD, TWP. HWY. 88
BEALLSVILLE, OHIO 43716

PERMIT D-0425-1

ROOM AND PILLAR AREA

SHADOW AREA (ZERO SUBSIDENCE LINE)

MINING PLAN DETAILS: PANEL, GATES, MAINS, ETC.

RAVEN ROCKS INC. - ROCK OUTCROP RAVINES

SITUATED IN SECTIONS 1, 2, 7, 8, T-6 R-5, WAYNE TWP., SECTIONS 31 & 32, T-5 R-4 WASHINGTON TWP., BELMONT COUNTY, OHIO.

LOCATED ON THE HUNTER AND WOODSFIELD USGS 7 1/2 MINUTE QUADRANGLE MAPS.

SCALE: 1" = 600' CONTOUR INTERVAL: 20'

DATE PREPARED: MARCH 28, 2007

I, THE UNDERSIGNED, HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF THIS MAP IS TRUE AND CORRECT.

Jack A. Hamilton
JACK A. HAMILTON, P.S. #6524

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC
THIS 28th DAY OF March 2007.

Arlene Warner
NOTARY PUBLIC

Arlene Warner
Notary Public, State of Ohio
My Commission Expires July 23, 2007