

FINAL CONSTRUCTION COMPLETION REPORT FOR THE GARDNER EMERGENCY 2009

Richland County, Montana

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Table of Contents

1) Introduction	3
2) Location.....	4
3) Mine History for Eligibility Purposes	5
4) Cultural Resources	6
5) History of Past Work by the DEQ AML Program	6
1984	6
1985 and 1986	7
1997	7
1999	7
6) 2009 Emergency DEQ Actions	7
Phase 1 – Historic Research, Backfilling Subsidence Features and Landscaping	8
Phase 2 – Subsurface Investigation	10
Phase 3 – Horizontal/Directional Drilling and Grouting	10
Phase 4 – Installation of a Storm Water Culvert	17
7) Total Project Cost.....	18
8) Miscellaneous.....	18
Figure 1	Site Location Map
Figure 2	Collapsed Adit Location Map
Figure 3	HDD Boring Location Map
Appendix 1	Limited Solicitation Bid and Invitation for Bid
Appendix 2	Approved Purchase Orders
Appendix 3	Historical Work
Appendix 4	Administrative Documents
Appendix 5	Consent, Well Logs and Various Maps
Appendix 6	OSM Correspondence
Appendix 7	Photographs
Appendix 8	Field Notes
Appendix 9	Geoprobe® Logs

Gardner Emergency 2009

1. Introduction

The Montana Department of Environmental Quality's (DEQ) Abandoned Mine Lands (AML) Section conducted several phases of work in response to the development of two subsidence features proximal to the Gardner residence in the Spring of 2009. The subsidence features developed from the collapse of underground workings from a historic coal mine located underneath the residential structure.



Subsidence Feature 1



Subsidence Feature 2

2. Location

The Gardner residence is located one mile southwest of Fairview in Township 24 North, Range 60 East, Section 18, SE1/4, NW1/4, NE1/4 in Richland County, Montana. The residence is located off of Montana Hwy 200 to Richland County Road 345T with a physical address of 13386 County Road 354T. (Figure 1)



Aerial View of Gardner and Sullivan residences

3. Mine History for Eligibility Purposes

The Gardner Mine was started by Leonard Gardner who obtained a coal entry patent (#5433313) on August 22, 1916. The Gardner Mine operated from 1916 until the 1930's. The operation was reported to cover approximately 40 acres. The mine was a one-person operation, which was mined by hand and facilitated by mine cars hauled by a horse, and later a modified car engine. The majority of the mining was conducted by Leonard's son, Delbert. The coal seam was within the Fort Union Formation and was approximately 30' underground and about 6' thick. Room and pillar mining methods were employed. The Gardner Mine was operated seasonally and the coal was used locally. No mining activity has occurred at the site since the 1930's. Five collapsed adits were identified nearby the Gardner and Sullivan residences. (Figure 2) Slack piles are located at the collapse area of Adit 1 and Adit 2. Jerry Gardner, the current property owner, indicated that a tippie was located at Adit 2 and an old car engine on a frame remaining in the area was used to haul mine cars from the workings.



Slack pile at collapsed Adit 2

4. Cultural Resources

The Gardner Mine was originally inventoried in 1986 by GCM Services, Inc. of Butte, Montana. The cultural resources site number is 24RL127. GCM concluded that the overall condition of the site is very poor. The site is lacking in physical integrity and has no potential to add further information to the local history. No eligible cultural resources were recommended for preservation.

5. History of Past Work by the DEQ AML Program

1984

The Sullivan Emergency occurred in the spring of 1984. Five subsidence features developed near the adjacent Sullivan and Gardner residences. The DEQ AML Program contracted with LC Hanson of Helena, Montana to complete the work activities. The work consisted of drilling numerous test boreholes, investigating discovered mine voids with a TV camera and smoke tracing, conducting a geophysical resistivity survey, and injecting grout barrier walls. The work was completed from April to June 1984 at a cost of \$68,000. Most work focused on the adjoining neighbor's property, Mr. Bill Sullivan. Several

borings were drilled inside the Sullivan residence to inject grout directly underneath the house to stabilize it.

1985 to 1986

Gardner Emergency #1 occurred in 1986. The DEQ AML Section contracted with LC Hanson of Helena, Montana. The work was completed to complement the work done at Sullivan residence in 1984. The 1984 investigation at the Sullivan residence indicated that several mine workings were located directly underneath the Gardner residence. A drilling and grouting program resulted in the drilling of approximately 26 test holes with about 700 cubic yards of grout injected into 6 of the test holes. The project cost was approximately \$71,000.

1997

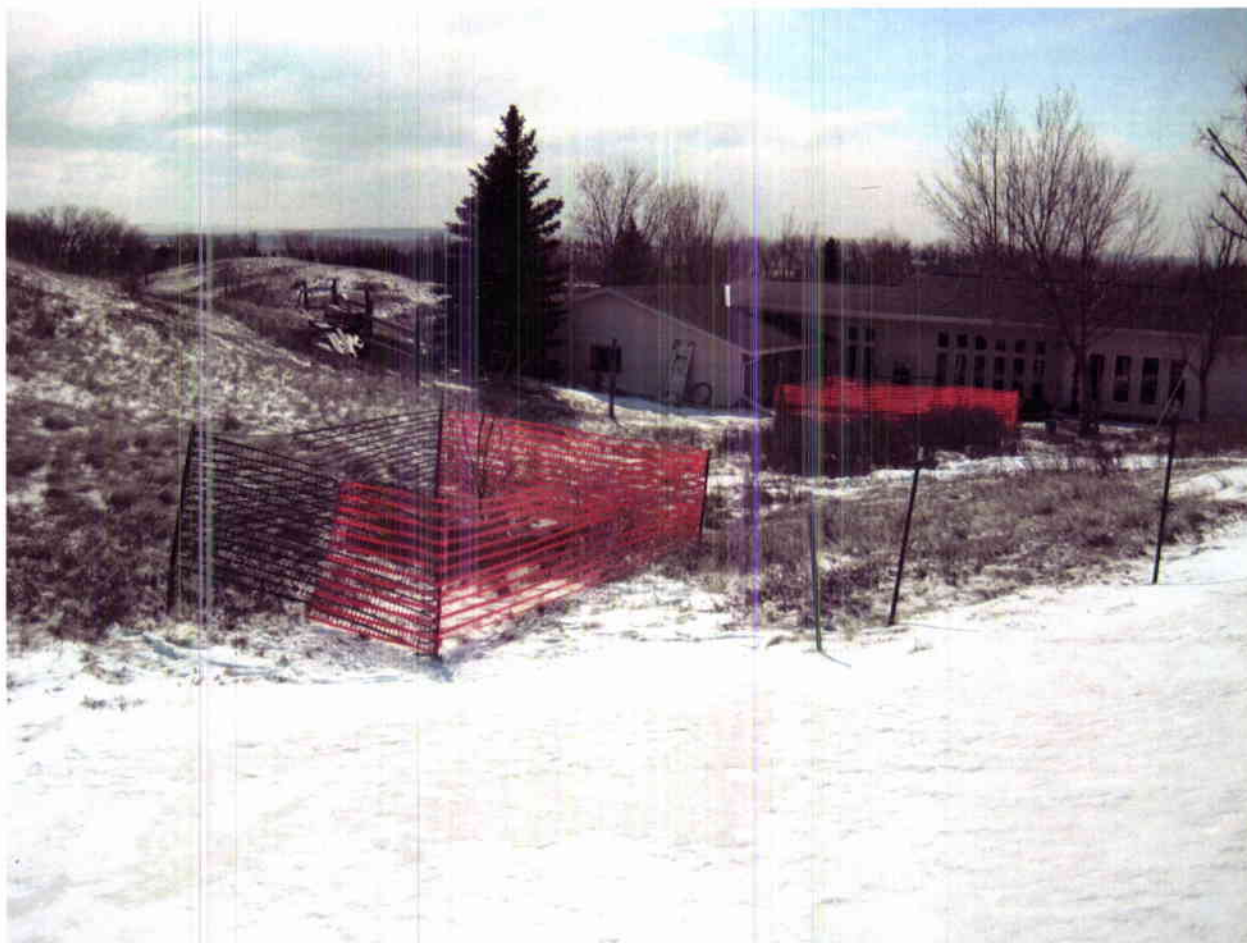
An additional subsidence occurred in 1997 at the Gardner residence in front of the garage. The subsidence feature was over-excavated and backfilled by Baxter Construction under a DEQ AML Call-When-Needed Contract. The cost of the project was not found in the historic files.

1999

Three more subsidence features that developed around the Gardner and Sullivan residences were reclaimed in May 1999. The DEQ AML Program contracted with Spectrum Engineering of Billings, Montana to oversee the work activities. Spectrum subcontracted Donnes Construction to excavate and backfill one subsidence feature at Gardner residence and two at Sullivan residence at a cost of approximately \$15,000.

6. 2009 Emergency DEQ Actions

Jerry Gardner contacted Jeffrey Fleishman in the Casper, Wyoming Office of Surface Mining on March 24, 2009. Bill Botsford and Steve Opp of the DEQ AML Section drove out to Fairview on March 25, 2009 and conducted a site visit to the residence on March 26, 2009. Two subsidence features were identified behind the Gardner residence. The subsidence collapse 20 feet from the Gardner residence's backdoor, began on the morning of March 24, 2009. A collapse further from the house had occurred the previous year and continued to get larger and deeper. The feature closest to the house measured 5' -5.5' in circumference and 6' deep. The subsidence feature furthest from the house measured 9.5' to 13.5' in circumference and 4' deep. Botsford and Opp put safety fencing up around both features.



Safety Fencing Surrounding Subsidence Features

Phase 1 – Historic Research, Backfilling Subsidence Features and Landscaping

Personnel from the DEQ AML section returned on April 21, 2009 with an operator and CAT 430D 4x4 backhoe of W. L. Neu Construction Inc. of Fairview, Montana to oversee the backfilling the subsidence features. The two subsidence features were over-excavated and the bottom of the features was compacted. An onsite borrow source recommended by Jerry Gardner was used for backfill. Additionally, an onsite stockpile of topsoil was used to top off the backfill in the subsidence features. Upon completing the reclamation of the subsidence features, the safety fences were removed. The reclamation cost was \$1405.00.

Upon returning to the office, personnel from the DEQ AML Program conducted a file review for all of the past work that was conducted at the Gardner and Sullivan residences. It was determined from the file review that several voids underneath the northeast portion of the Gardner residence were identified during the 1986 drilling investigation and were not addressed. It is assumed that the voids were not addressed, because at the time the Gardner residence was a double-wide trailer and not considered a permanent structure. Since the 1986 work, the Gardner's have added many additions to the residence

creating a permanent structure. It was determined that additional work would be necessary to protect the north east portion of the residence.

Once the subsidence features were backfilled, the DEQ AML subcontracted J&J Services of Fairview, Montana for landscaping work at a cost of \$2750.00.



Over-excavating and backfilling Subsidence Feature 1



Subsidence Feature 2 After Landscaping

Phase 2 – Subsurface Investigation

The DEQ AML Program wanted to cost effectively identify mine voids around the eastern portion of the Gardner residence to pinpoint potential grouting locations. The DEQ AML Program proposed installing approximately 40 Geoprobe® holes to detect mine voids around the Gardner residence. The DEQ solicited bids for a subsurface investigation utilizing a Geoprobe®. The low bidder was West Central Environmental Consultants of Morris, Minnesota. Several holes probed in the front of the house identified subsurface areas with potential loose soil and/or voids. Probe holes were attempted behind the house, but a heavy rain event prevented access with the Geoprobe® rig. The results of the investigation were inconclusive. The work was partially completed at a cost of \$7077.84.

Phase 3 – Horizontal/Directional Drilling and Grouting

A review of project documents from previous work conducted at the Gardner and Sullivan residences indicated that several mine voids were located directly underneath the garage and the eastern portion of the Gardner residence. Personnel from the DEQ AML Program proposed an experimental

horizontal/directional drilling (HDD) investigation followed by a grouting program. The DEQ AML Program developed an Invitation for Bid (IFB) and specifications for this phase of work. Agri Industries Inc. of Williston, North Dakota was the low bidder for the IFB and was awarded the contract. In the summer of 2009, Agri Industries with oversight by personnel from the DEQ AML Program, began an HDD investigation. Four horizontal/directional holes were advanced parallel and perpendicularly underneath the Gardner residence to identify mine voids (Figure 3). Two of the HDD holes (Number 2 and Number 4 on Figure 3) did not identify mine voids. HDD holes Number 1 and Number 3 intersected several mine voids underneath the house and in front of the garage. These holes were day-lighted and perforated HDPE pipe was pulled back through the borehole. The pipe was only perforated in areas of mine voids based on the drilling logs. An end cap was placed on the HDPE pipe at the daylight end. A coupling was installed on the drilling end of the HDPE pipe to connect to a grout pump. Grouting was attempted in HDD hole Number 1, but the pressures created by the grout pump blew the coupling connection several times. It was determined that reducing the viscosity of the grout mix would make the grout more flowable through the perforations, thereby decreasing pumping pressures. Additionally, Agri Industries fabricated a heavy-duty coupling that was successful used in pumping grout into HDD holes Number 1 and Number 3. Approximately 3 cubic yards of grout was injected into HDD hole Number 1 and approximately 15 cubic yards of grout was injected in HDD hole Number 3. The cost of the project was \$51,407.00.



Advancing HDD Hole Number 1



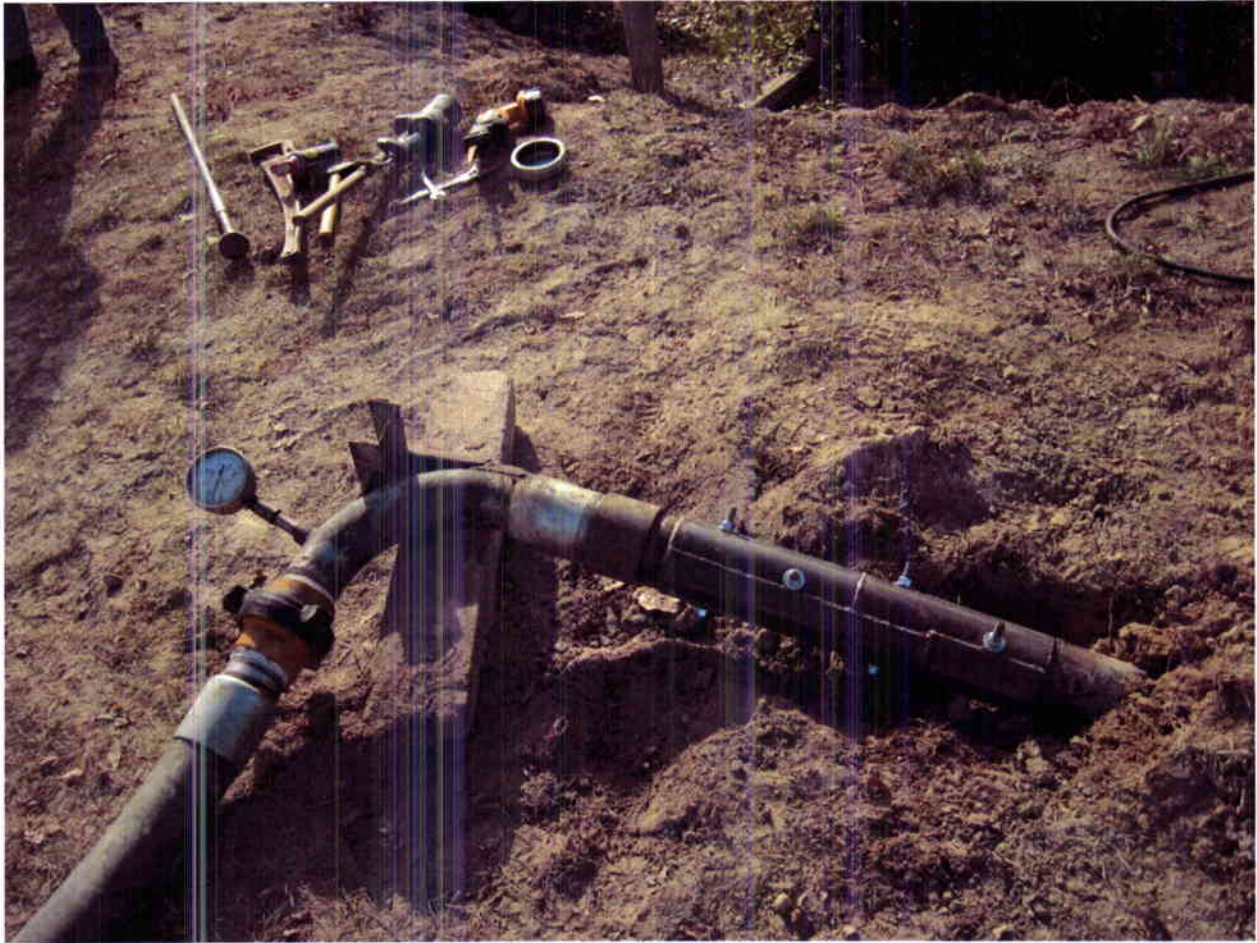
Perforating HDPE pipe for grout injection



Pulling HDPE Pipe Back Through Borehole



Clearing Utilities



Heavy-duty Coupling Fabricated by Agri Industries



Injecting Grout

Phase 4 – Installation of a Storm Water Culvert

The final phase of work for the project included the installation of a storm water culvert in front of the Gardner residence. It was determined that the subsidence features near the residence predominately develop during rainy seasons. Therefore, the culvert was installed to divert storm water away from the residence in an attempt to prevent future subsidence features from developing near the residence. The work was completed in August 2010 by John Wyman of Williston North Dakota at a cost of \$3841.06.



New storm water drainage culvert after installation

7. Total Project Cost

The total subcontracted cost to complete the four phases of work for the Gardner Emergency 2009 Project was \$66,480.90. The total project cost was **\$95,178.49**, which included all subcontracted costs and DEQ AML in-kind services.

8. Miscellaneous

Verbally Jerry Gardner indicated that during pad construction for his home, a bulldozer dropped into a subsidence feature. He also indicated that to stabilize this feature, portions of the old Fairview School were backfilled into the void. This would explain the rubble zone identified during the horizontal/directional drilling.

Gardner Emergency Subsidence Project Site Location Map

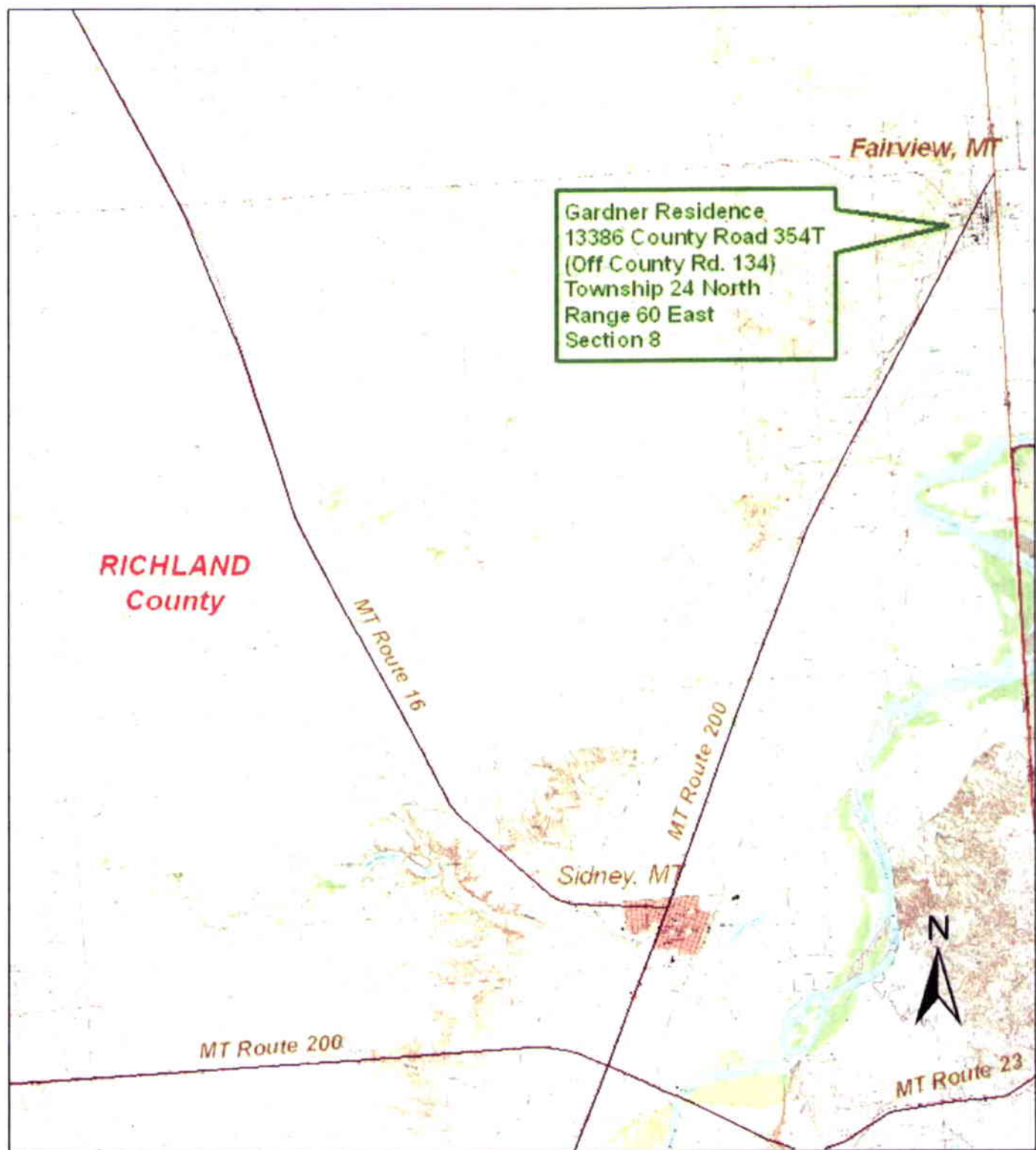


Figure 1

1 in = 2 miles

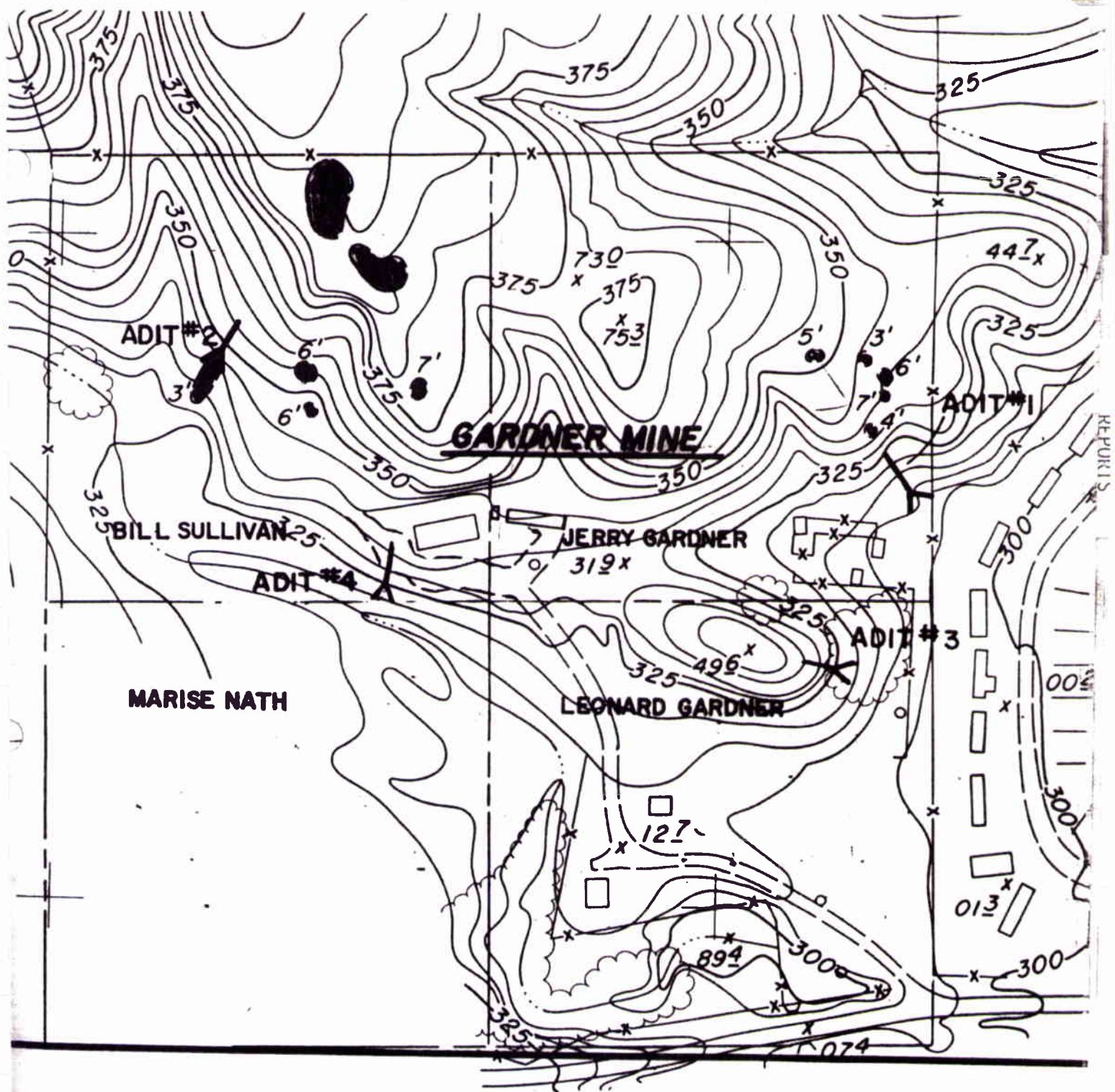
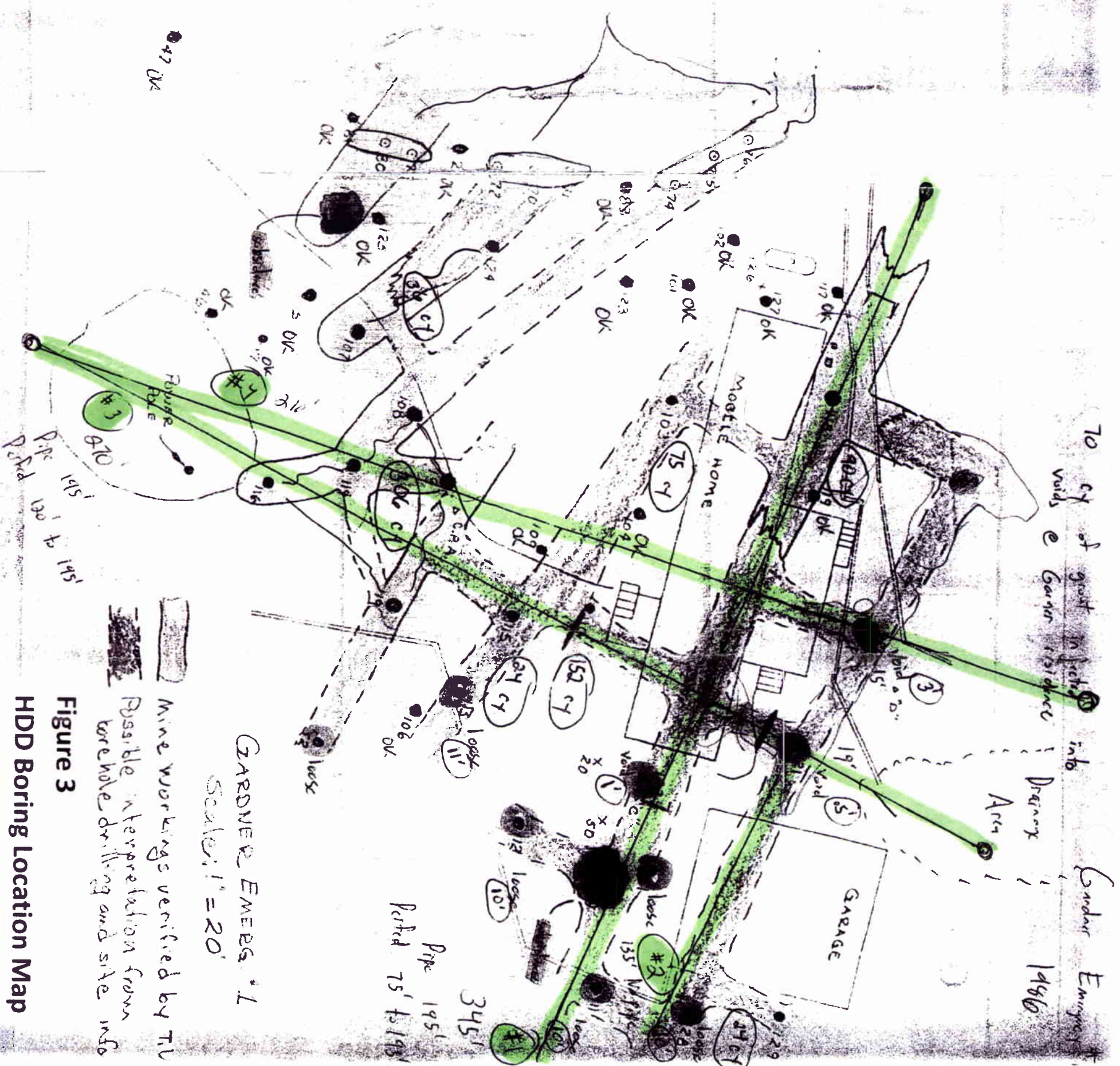


Figure 2
Collapsed Adit Location Map

Grout
barrier
walls



GARDNER EMBERS "L

Scale: 1" = 20'

- Mine workings verified by TL
- Possible interpretation from borehole drilling and site info

Figure 3

HDD Boring Location Map