

PB83-916502



# NATIONAL TRANSPORTATION SAFETY BOARD

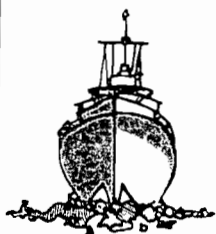
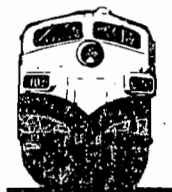
WASHINGTON, D.C. 20594

## PIPELINE ACCIDENT REPORT

NORTHERN NATURAL GAS COMPANY  
PIPELINE PUNCTURE,  
EXPLOSION AND FIRE  
HUDSON, IOWA  
NOVEMBER 4, 1982

NTSB/PAR-83/02

UNITED STATES GOVERNMENT



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**Adopted: May 17, 1983**

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**NORTHERN NATURAL GAS COMPANY  
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HUDSON IOWA  
NOVEMBER 4, 1982**

**SYNOPSIS**

About 2:15 p.m., c.s.t., on November 4, 1982, a tile plow installing field drainage tile on a farm located 4 miles west of Hudson, Iowa, struck and punctured a well marked, 20-inch-diameter natural gas transmission pipeline. Natural gas escaping at about 820 psig ignited immediately, and the ensuing explosion and fire killed five persons, destroyed five pieces of excavation machinery and two pickup trucks, and burned several acres of soybean stubble.

The National Transportation Safety Board determines that the probable cause of the accident was the puncture of a 20-inch-diameter gas transmission pipeline by a contractor's tile plow, due to the contractor's failure to inform the pipeline company and to have the depth of the pipeline checked at a new crossing point when he changed his work plans. The accident might have been avoided had the pipeline company inspector remained on the job site until after tiling operations in the vicinity of the pipeline had been completed.

**INVESTIGATION**

**Events Preceding the Accident**

At 11:28 a.m., c.s.t., Friday, October 29, 1982, a tile contractor (contractor) requested the Northern Natural Gas Company (Northern) via the Iowa "one-call" system to locate two gas pipelines on a farm about 4 miles west of Hudson, Iowa. The contractor was going to install drainage tile on the farm to provide better drainage, which would prevent soil erosion and enhance soil conservation. Northern's 26- and 20-inch diameter gas transmission pipelines were well marked where they crossed Grundy Road adjacent to the farm, and at the valve site on the farm where the pipelines were connected to a 10-inch diameter "Waverly" pipeline. Shortly after the call, Northern contacted one of its utility repairmen by radio and instructed him to mark the 26- and 20-inch diameter pipelines which extended in an east-west direction from Grundy Road and to mark the 10-inch diameter pipeline which extended in a north-south direction at that location. (See figure 1.)

When the utility repairman, who had been employed by Northern for 28 years, arrived at the site, he used an electronic pipeline locator (M-Scope) to locate the pipelines and placed markers about 150 feet apart on each pipeline. Each marker was 3 feet long and consisted of a stiff wire with a small, white, plastic pennant with the company's name and telephone number imprinted on it. The 26- and the 20-inch diameter pipelines were marked from the Grundy Road valve location across the field east to a property line fence about 1,300 feet away; the markers were lined up well over the pipelines, which were

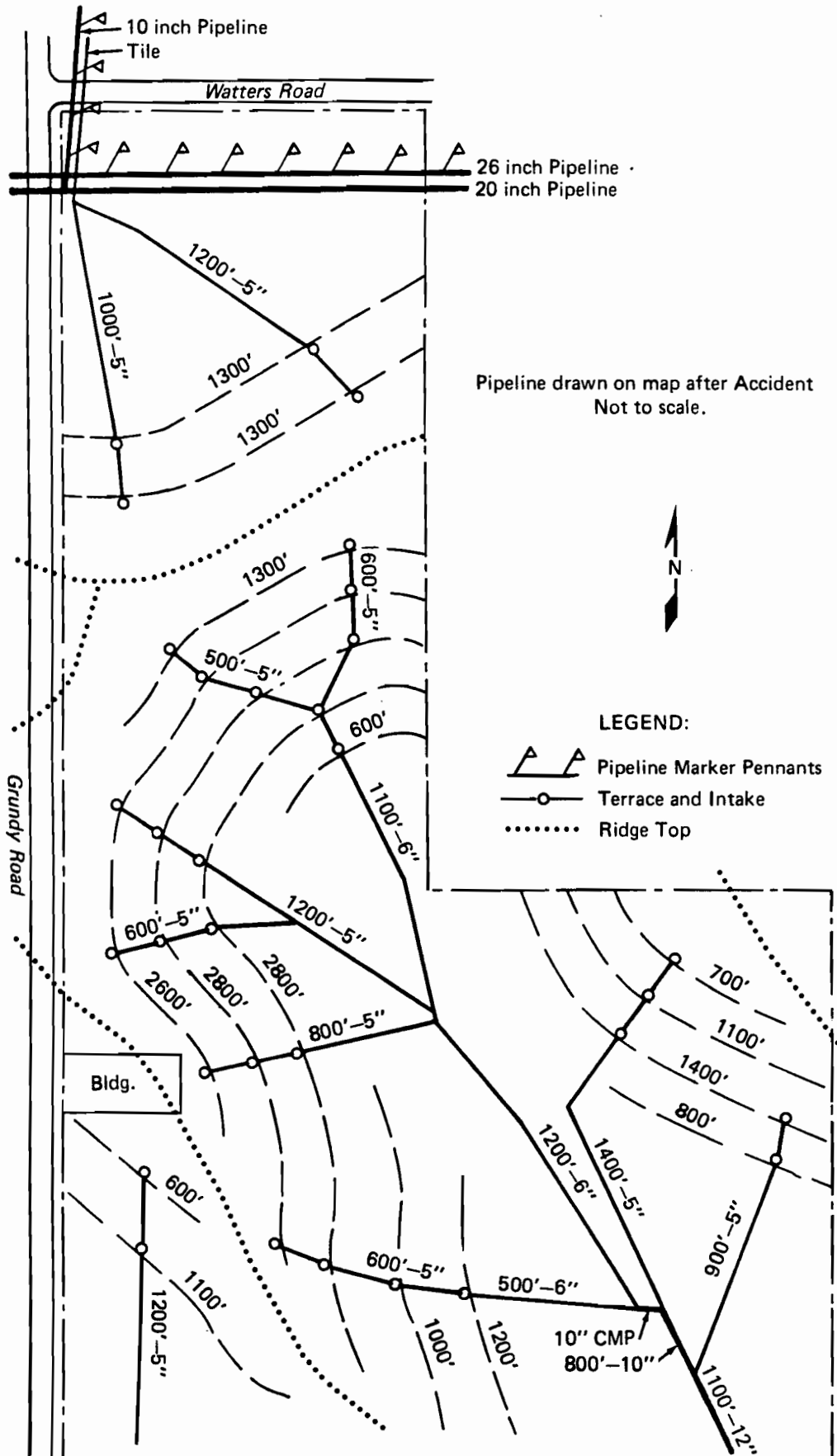


Figure 1.--Accident site showing pipelines and proposed tile.

parallel, straight and about 150 feet apart. The 10-inch diameter "Waverly" line was marked in a similar manner from the valve site at Grundy Road north to Watters Road, an east-west gravel road about 500 feet away. According to the utility repairman, after he had marked the pipelines, he showed their location to one of the contractor's employees and explained that there were three pipelines; no mention was made about the depth of the pipelines, and a spotting bar 1/ was not used to measure the depth. The utility repairman then left the area and reported to his next assignment; he did not visit the work area again until after the accident.

On Thursday morning, November 4, 1982, the contractor telephoned Northern and requested that it have someone locate and mark the pipelines near valve No. 9, about 4 miles west of Grundy Road. Northern dispatched a maintenance man with 4 1/2 years of experience to proceed to the area. En route the maintenance man found the tile contractor about 40 feet east of the valve site at Grundy Road where the pipelines had been located and marked previously, rather than at valve No. 9. According to the maintenance man, the contractor said that he was going to install a 6-inch diameter plastic drain tile to the east of Northern's 10-inch diameter Waverly line, connect its north end to an existing 4-inch drain tile, install it to the south across the 26- and the 20-inch diameter pipelines, and then end it about 10 to 15 feet south of the 20-inch pipeline. (See figure 2.) The contractor planned to dig the 6-inch plastic tile ditch 48 inches deep and to connect two 5-inch diameter tiles to the 6-inch tile on the south end after it crossed the 26- and 20-inch pipelines. The maintenance man said that because the tile contractor expressed concern about crossing over the top of the 26- and 20-inch diameter pipelines, he attempted to measure depths of each pipeline where the tile was to cross over the lines, using a 5-foot and then a 7-foot spotting bar. However, both spotting bars were too short to contact either pipeline. While the maintenance man was standing above the 26-inch pipeline, just west of the intended tile ditch crossing, the contractor used a trencher 2/ and, according to the maintenance man, slowly and carefully excavated across the top of the 26-inch pipeline, and continued a few feet south of where the new ditch crossed the pipeline. The maintenance man then stood in the 48-inch tile ditch and probed for the 26-inch diameter pipeline, using the 5-foot spotting bar. He contacted the 26-inch pipeline about 4 feet down, indicating that the pipeline was about 8 feet below the surface at this location. The contractor then continued excavating with the trencher about 10 to 15 feet farther south across the top of the 20-inch diameter pipeline. The maintenance man then stood in the 48-inch tile ditch and, using the 5-foot spotting bar, probed for the 20-inch diameter pipeline which he also contacted about 4 feet down.

Meanwhile, the drainage tile was being automatically lowered into the ditch behind the ditching machine. (See figure 3). According to Northern's maintenance man, when the trencher was about halfway between the 26- and 20-inch pipelines, the supply of tile ran out but the contractor continued to dig the 48-inch ditch to a point 10 to 15 feet south of the 20-inch diameter pipeline. Further, according to Northern's maintenance man, the contractor stated that he would "hand lay" the additional 35 to 40 feet of 6-inch tile needed to reach the south end of the ditch, that he would continue ditching operations from the end of the ditch in a southerly direction away from the 20-inch diameter pipeline, and that he would then dig another ditch parallel to and then going away from the 20-inch gas line using a tile plow 3/ and installing 5-inch diameter flexible plastic tile.

1/ A long, slender, steel rod with a TEE handle on one end and a hardened steel tip at the other end. It is pushed down through the ground to locate and measure the depth of underground facilities.

2/ Trencher - A Machine using a revolving wheel with cutting teeth to dig a continuous ditch, and remove and displace the soil in preparation for the installation of a pipeline, drainage tile, etc.

3/ Tile Plow - A large, heavy, tooth or shank mounted perpendicularly on the rear of a large mobile power unit to rip open a trenchless void in the soil to install therein flexible farm drainage tile, underground cables or lines immediately behind it.

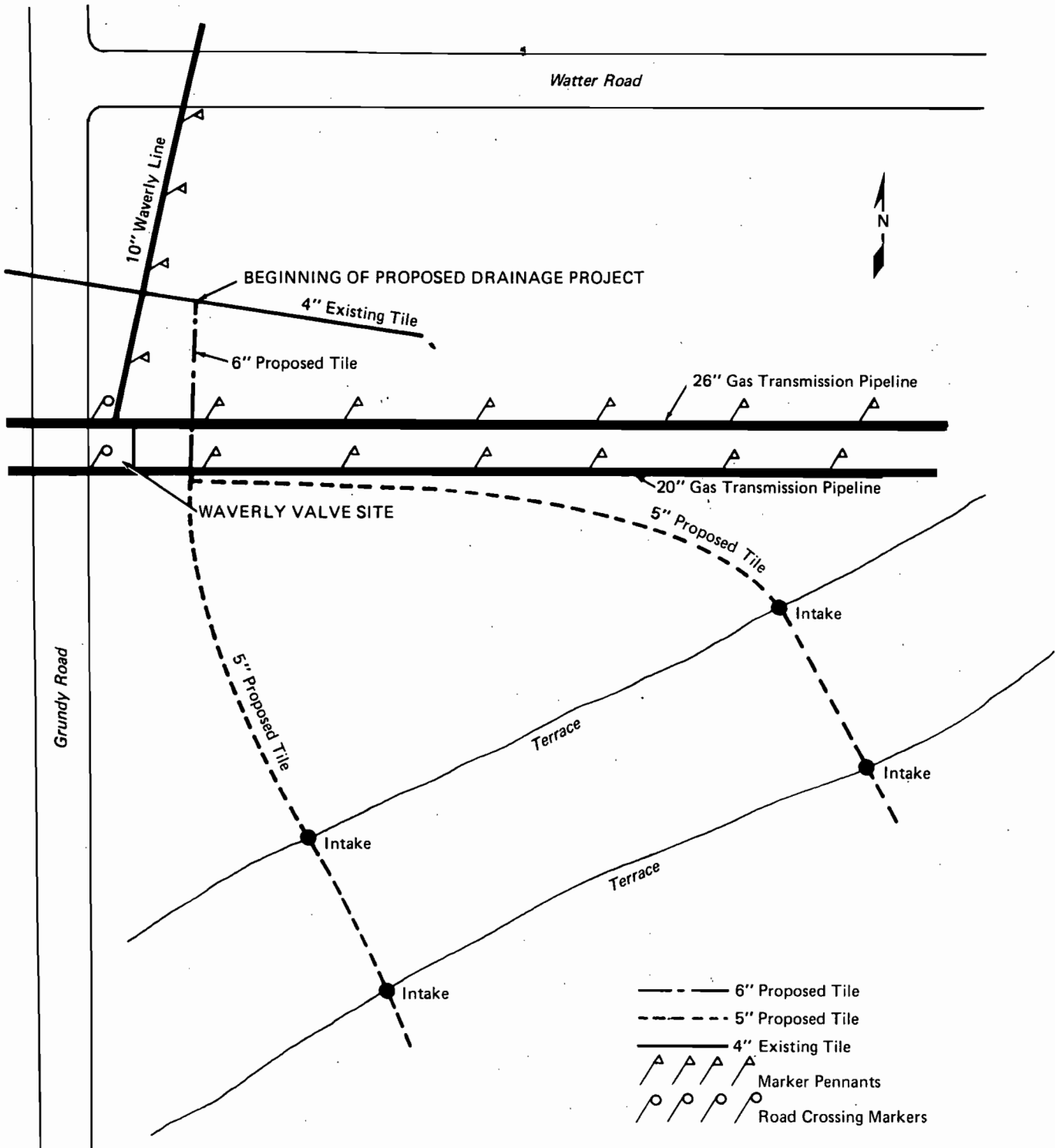


Figure 2.--Diagram of proposed tile installation.  
(Pipelines not shown on original.)

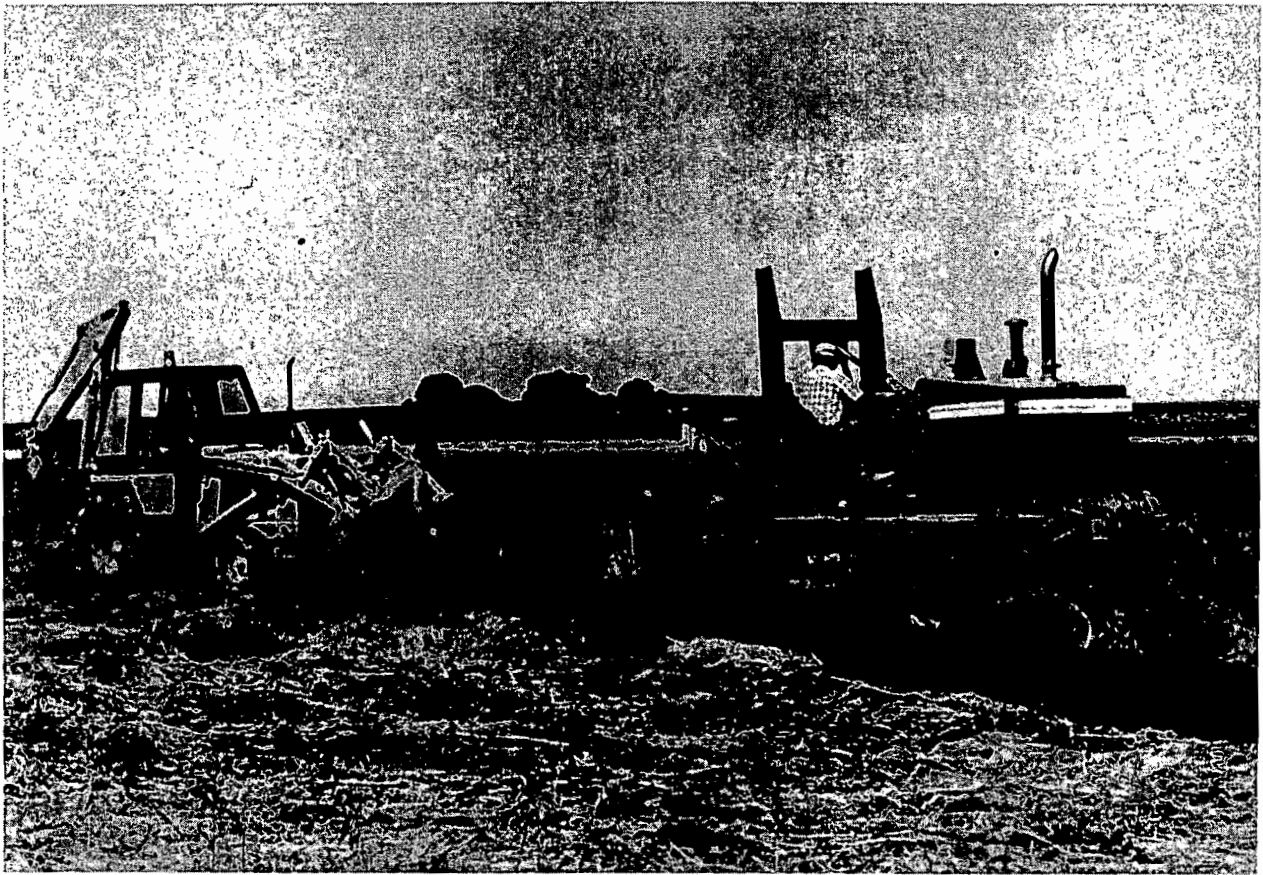


Figure 3.--Typical tile plow operations.

Northern's maintenance man told Safety Board investigators "When we crossed both lines he (the contractor) commented about how deep the pipeline was and I said coming under a road crossing it isn't unusual to be that deep, but I told him after it gets past the road then it starts to come back up to three or four feet." However, no maps which showed the profile of the pipelines and their decreasing depths across the field were available to or in the possession of the maintenance man. The maintenance man stated that shortly before noon the contractor told him that he would not be digging across the lines any more, and the maintenance man assumed the contractor would not need him any more. The contractor indicated that they were going to shut down the operation and break for lunch. At 12:10 p.m., Northern's maintenance man left the area and returned to the company's Waterloo office, ate lunch, and filled out his job order, charging 3 1/2 hours time to marking pipelines. The Office Manager was notified at 1 p.m. that the maintenance man had returned to the office.

### The Accident

About 1:15 p.m., the contractor's crew returned to the job site. The tile plow was started and the plow was set at about 18 to 24 inches to break the soil surface - an operation called "pre-rip" by the contractor. The pre-rip, which began about 1,000 feet south of the two gas pipelines, was made in a northerly direction and ended at the



previously dug 48-inch ditch 10 feet south of the 20-inch pipeline. The tile plow was then turned around and set to its final depth of 48 inches. After tying in to a 6"x5"x5" Y-tile previously installed between the 20- and the 26-inch pipelines where tiling operations had been suspended in the morning, 1,000 feet of 5-inch tile was installed in a southerly direction. (See figure 2.) The contractor then moved the tile plow to the southeast corner of the field at the terrace intake and pre-ripped the soil 18 to 24 inches deep to the end of the 6-inch tile located between the 20- and 26-inch pipelines. (See figures 4 and 5.) After completing the pre-rip pass, the contractor turned the equipment around, set the plow at a 48-inch depth and, with extra power supplied by the Caterpillar D-6 Tractor pulling the tile plow, proceeded to install 5-inch tile in a southeasterly direction from the origin point midway between the two pipelines. The work crew consisted of the contractor and his son and a laborer; the contractor and his son operated the two pieces of equipment.



Figure 4.--Northwest view of the 18- to 24-inch deep pre rip made by tile plow.  
Photograph taken after the accident.

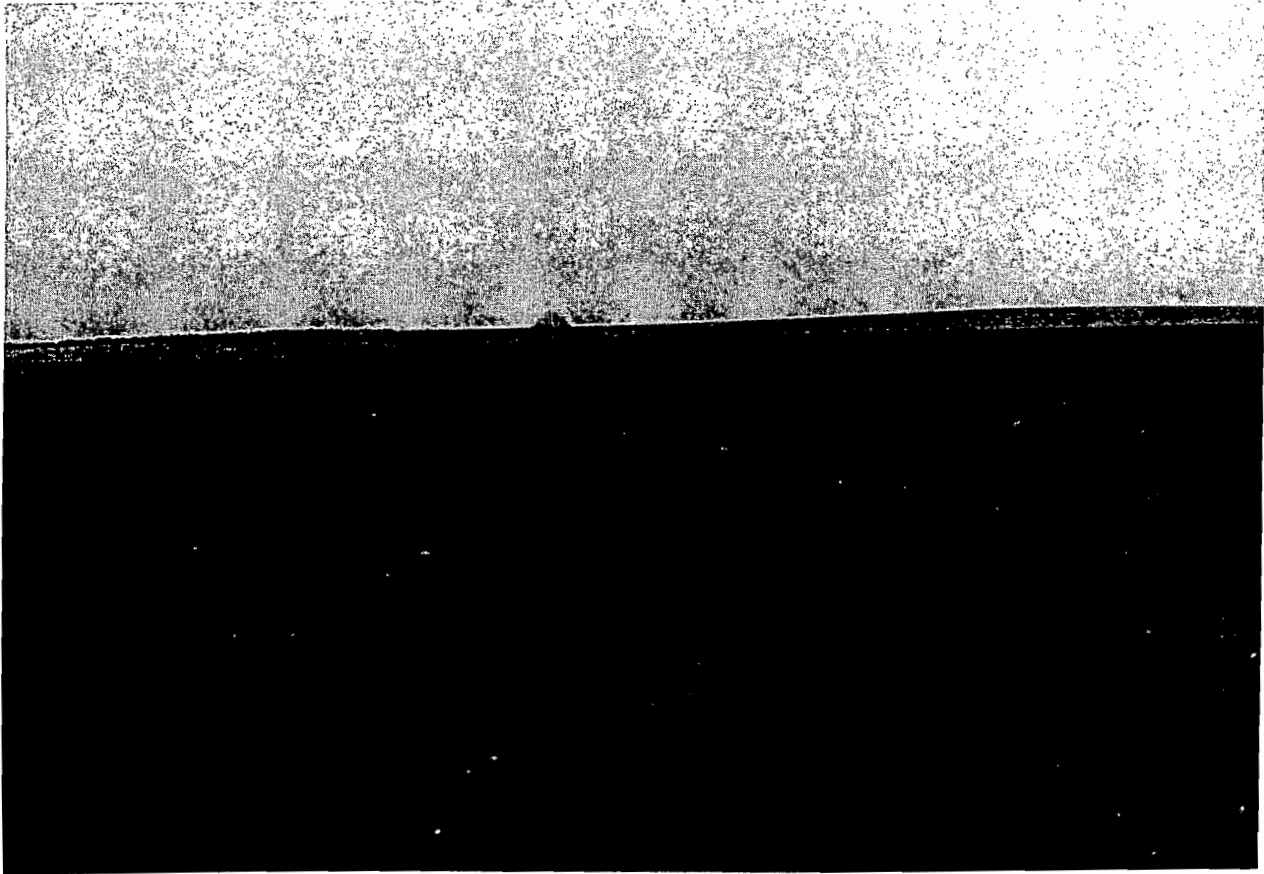


Figure 5.--Southeast view of the 18- to 24-inch deep pre rip made by tile plow.  
Photograph taken after the accident.

As the tiling operation proceeded in a southeasterly direction between the two pipelines, two persons from the U.S. Department of Agriculture, Soil Conservation Service drove into the field in a pickup truck to observe operations. At 2:00 p.m., Northern's Aerial Patrol radioed Waterloo Station to alert Northern that a contractor was working near the pipelines at the Waverly valve site.

At 2:15 p.m., the tile plow struck and punctured the 20-inch diameter pipeline, which was about 36 inches below the surface, about 35 feet east of the 6-inch tile ditch. Natural gas at an initial pressure of 820 psig erupted from the punctured pipe, tore the pipe from the ground, turned the tile plow completely around, and was ignited almost immediately, possibly by one of the operating machines or the nearby pickup truck. All five persons at the site -- the three-person work crew and the two soil conservationists -- were killed. Flames rose several hundred feet into the air; the 20-inch pipeline, which had been blown out of the ground, opened up; and the force of the escaping gas dug a hole 30 feet wide, 64 feet long, and 9 feet deep. (See figures 6 and 7.)

#### Events Following the Accident

At the time of the accident, the pressure recording chart at Northern's Waterloo compressor station, which is located about 10 miles east (downstream) of the accident site, indicated a suction pressure drop of 200 pounds. (See figure 8.) About the same time, Northern's Aerial Patrol saw the fire and reported it to Northern's Waterloo compressor station.

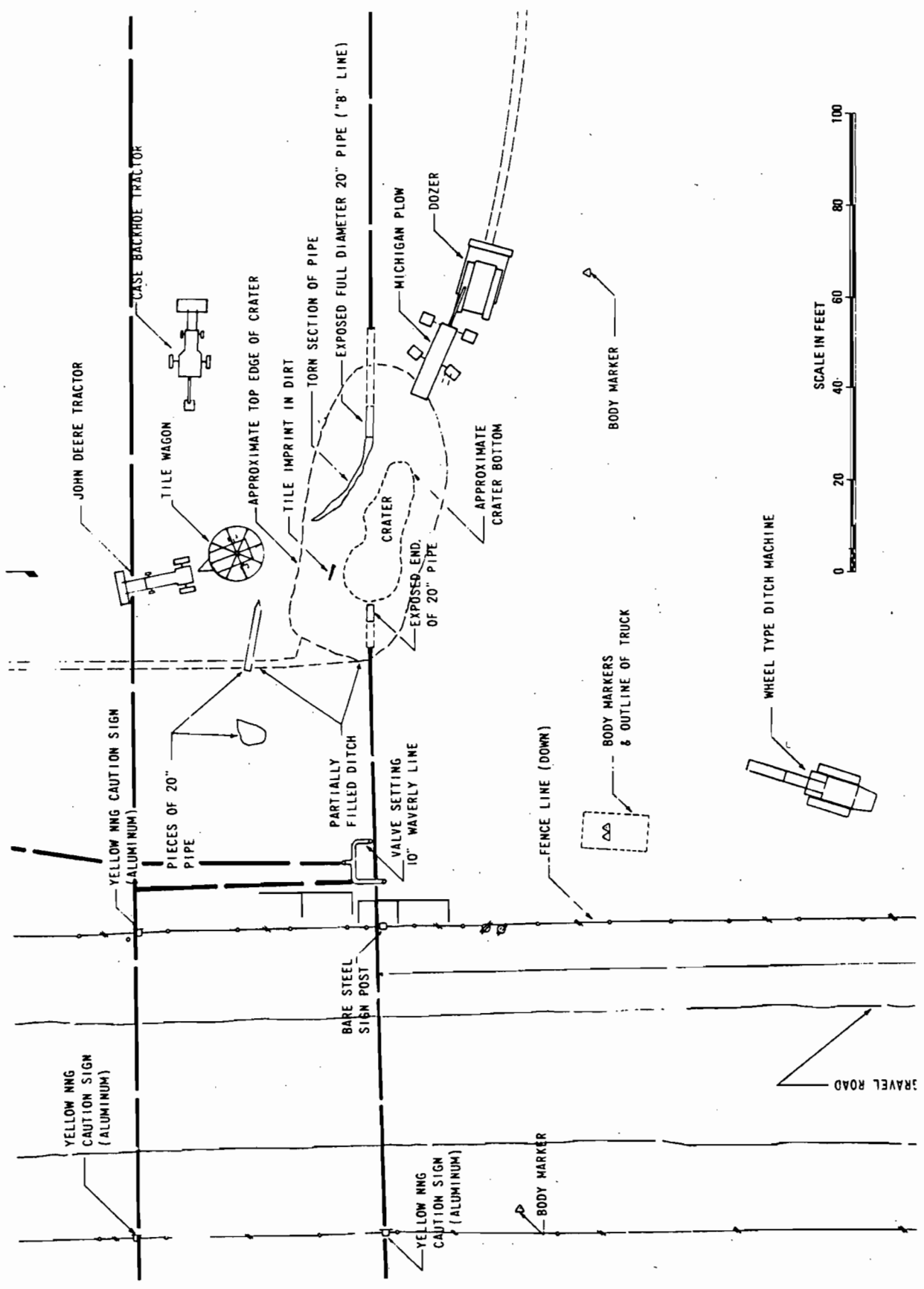


Figure 6.--Accident site details.

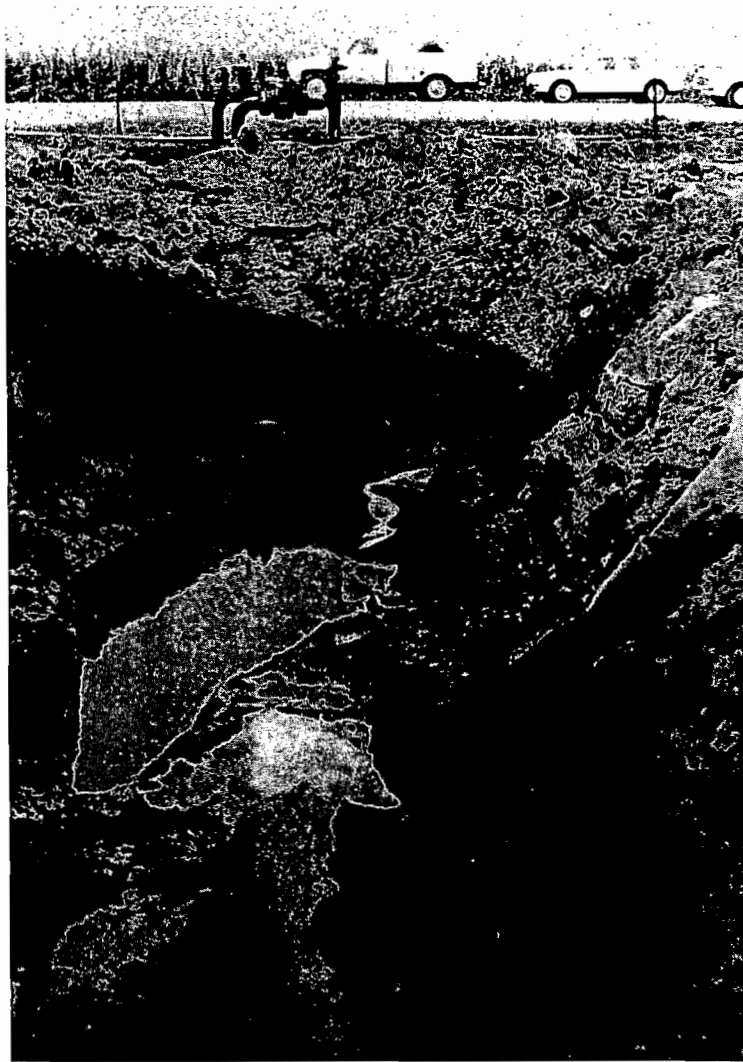


Figure 7.--Photographs of punctured pipe.

Shortly afterward, Northern sent personnel to close mainline valves upstream and downstream from the accident site, and notified the Hudson, Iowa, Volunteer Fire Department at 2:25 p.m. Northern personnel closed valve No. 11 at milepost 93.75 and the Hudson "B" line takeoff valve at milepost 87.70 at 2:57 p.m. Valve No. 9 at milepost 79.47 was closed at 3:20 p.m.

Meanwhile, firefighters from the Hudson Fire Department (Hudson), located 4 miles away, had arrived at the accident site at 2:30 p.m. and had attempted to close the Waverly line takeoff valves. However, the asbestos umbrellas (heat shields) used by the firefighters were not adequate to allow the firefighters to get close enough to close the valves. Hudson then requested assistance from the Dike, Reinbeck, and Waterloo Fire Departments. At 3:13 p.m., two Waterloo Fire Department firefighters arrived at the scene with asbestos suits equipped with a 30-minute oxygen supply. A Northern employee instructed the asbestos-suited firefighters about the closure of the valve, and the Hudson firefighters directed a water fog at the asbestos suited firefighters while they cut the chain used to lock the control wheel and turned this wheel to close the valve. (See figures 9 and 10.). At 3:40 p.m., about 30 minutes later, the valve was completely closed

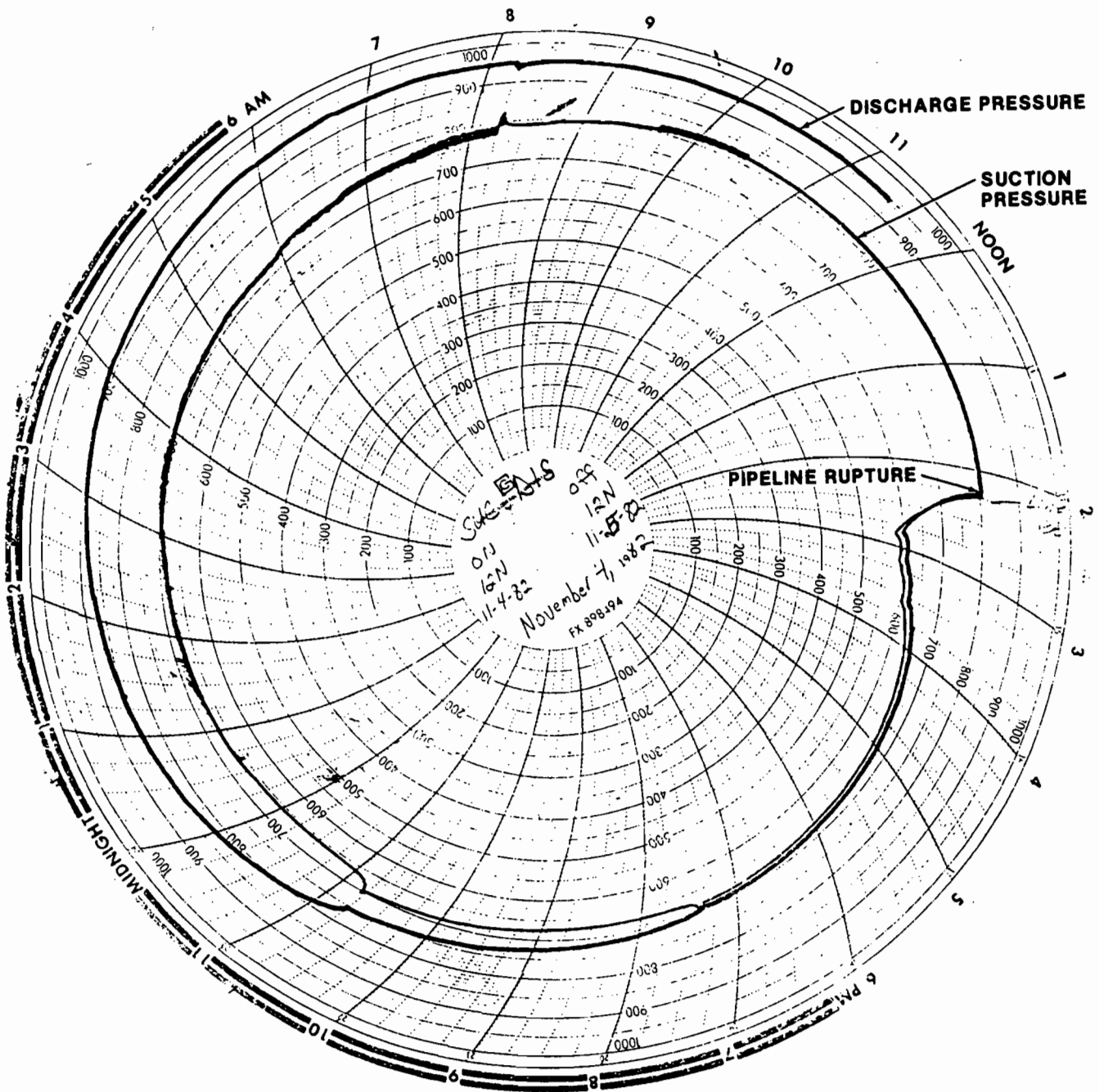
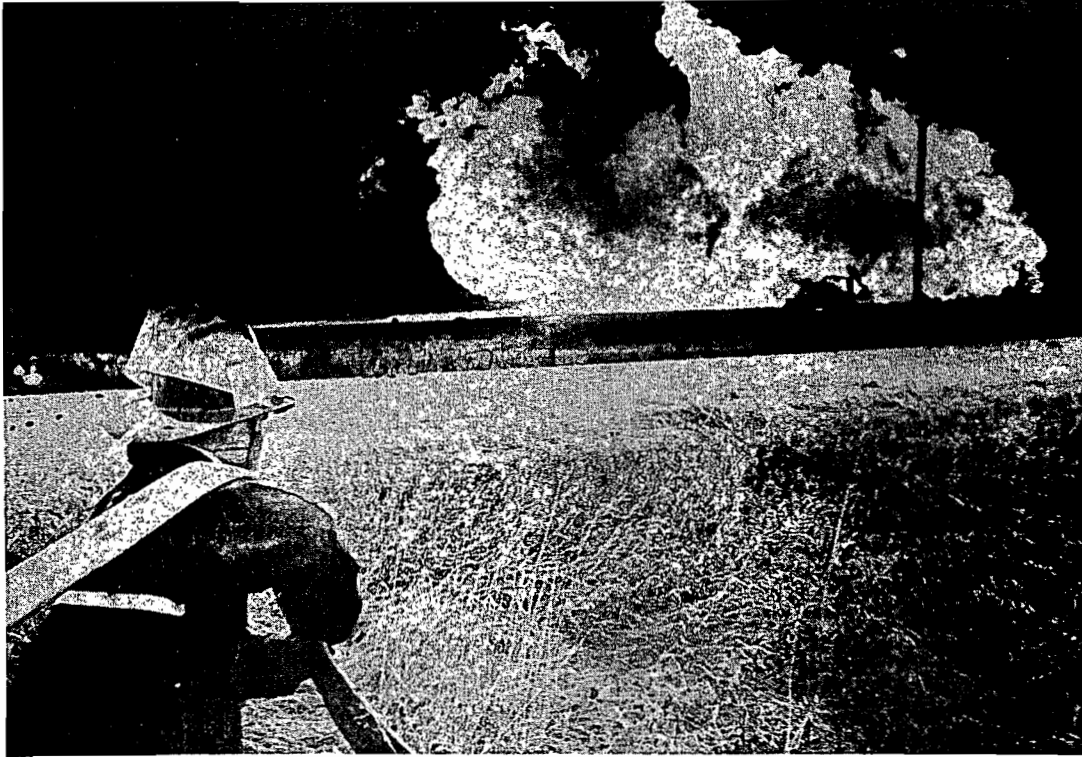


Figure 8.--Recording pressure gage charts Waterloo Compressor Station.



Figures 9 and 10.--Firefighters at the accident site with protective gear.

and the flames retreated rapidly to each end of the ruptured pipe. By 3:50 p.m., fire had been extinguished and the 20-inch pipeline had been isolated within a 14.3-mile section of line.

### Injuries to Persons

<u>Injuries</u>	<u>Contractor's Personnel</u>	<u>Others</u>	<u>Total</u>
Fatal	3	2	5
Nonfatal	0	0	0
Total	3	2	5

### Damage to Pipeline

About 63 feet of 20-inch-diameter, .281-inch wall thickness, API 5LX-52 line pipe was destroyed and had to be replaced. The aboveground valves and piping, which were engulfed in the flames, were tested for heat damage and were found to be unaffected; the road crossing markers were replaced. About 46,800 thousand cubic feet (MCF) of natural gas escaped or was burned.

### Fire Damage

The fire destroyed a bulldozer, a tile plow, a trencher, a backhoe, a trailer, and two pickup trucks, and burned several acres of soybean stubble. Two wooden electric power poles were burned, and electric wires were downed.

### Pipeline System

Northern Natural Gas Company, a wholly owned subsidiary of Internorth, Inc., with headquarters in Omaha, Nebraska, is a gas transmission pipeline company which owns and operates more than 14,000 miles of transmission pipelines, 7,000 miles of gas gathering pipelines, and three gas storage fields. Northern supplies natural gas to 74 utility customers which serve 1,095 communities in Illinois, Iowa, Kansas, Michigan, Minnesota, Nebraska, South Dakota, Wisconsin, and Texas. The transmission system has an authorized capacity of 3,187,000,000 cubic feet of gas per day.

The gas transmission system directly involved in the accident -- the Ogden to Waterloo transmission system -- is a "looped line" <sup>4/</sup> composed of 26- and 20-inch diameter pipelines which are parallel and about 50 feet apart. Crossover valves connect the two pipelines at numerous locations. (See figure 11.) The 20-inch-diameter pipeline, which was constructed in 1954, had the following specifications:

- 20-inch outside diameter (OD)
- .281-inch wall thickness
- 59.23 pounds per linear foot
- API 5LX-52
- 1,470 psig internal pressure at minimum yield
- 2,020 psig ultimate bursting pressure

Both the 26- and the 20-inch pipelines were coated, wrapped, and cathodically protected. The maximum allowable operating pressure (MAOP) of the 20-inch pipeline was 960 psig. At the time of the accident, the pipeline was operating at about 820 psig.

<sup>4/</sup> Looped line - an industry term for the construction of an additional line or lines generally parallel and close to the original line to provide an increase in system capacity.

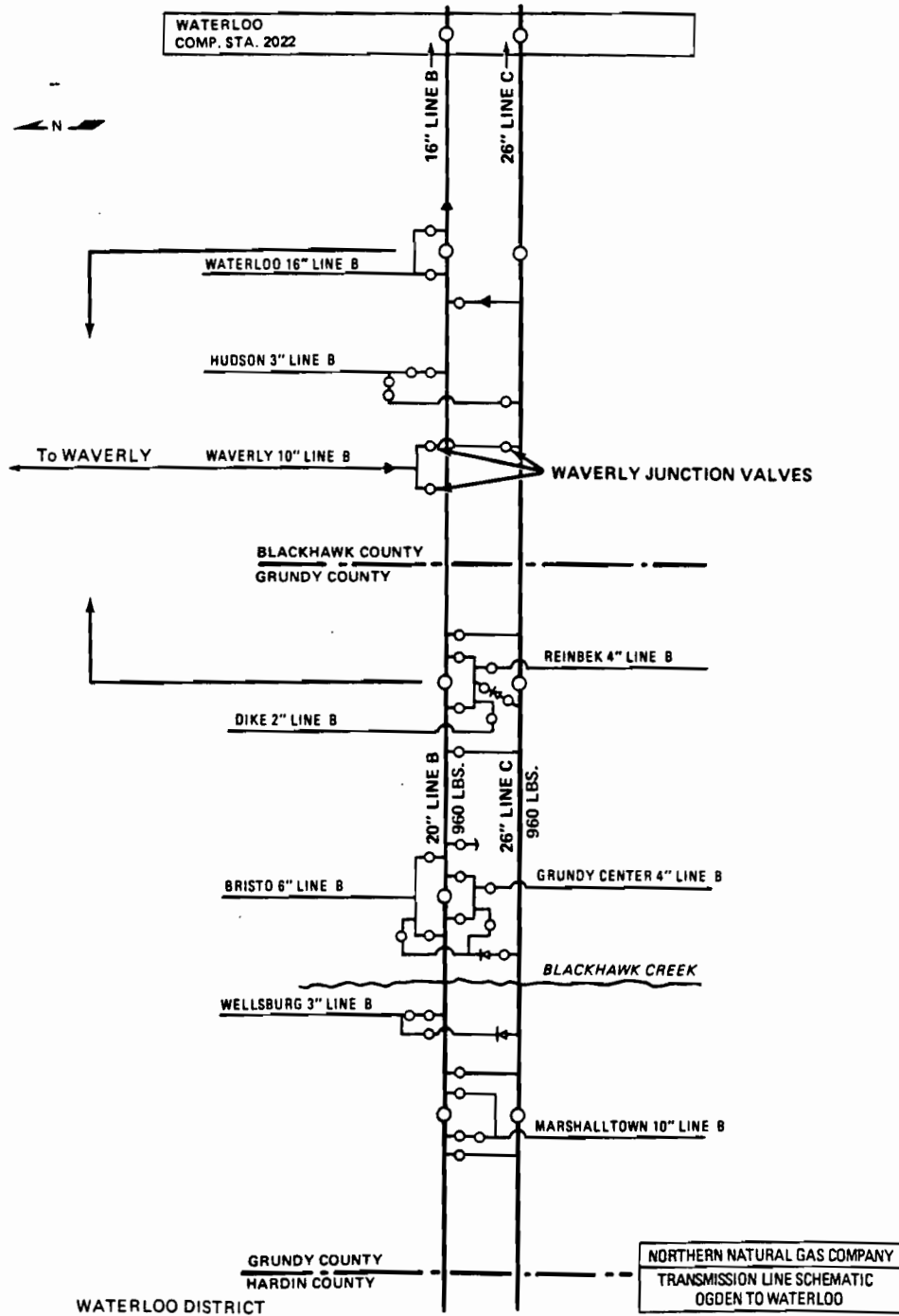


Figure 11.--Pipeline diagram Ogden to Waterloo, Iowa.



Between main line valves Nos. 9 and 11, the towns of Waterloo, Hudson, and Waverly are supplied with natural gas from both the 20- and 26-inch pipelines. The 20- and the 26-inch pipelines are cross connected to each other through the takeoff lines. Gas from both the 20- and the 26-inch pipelines supply Hudson and Waverly; Waterloo is supplied by only the 20-inch pipeline. (See figure 8.) When Northern's personnel arrived at the Hudson valve site after the accident, the Hudson 10-inch takeoff line was isolated from the 20-inch-diameter pipeline by closing one valve. However, the 26-inch pipeline still supplied gas to the town of Hudson.

The terrain west of Hudson is gently rolling farmland, and the nearest inhabited building was about 540 feet from the pipeline where it crossed Grundy Road. The area is designated as Class I, which is defined as follows by the Code of Federal Regulations, 49 CFR 192.5(b) Class Locations.

(a) . . .The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. Except as provided in paragraph (d)(2) and (f) of this section, the class location is determined by the buildings in the class location unit. For the purpose of this section, each separate dwelling unit is counted as a separate building intended for human occupancy.

(b) A Class 1 location is any class location unit that has 10 or less buildings intended for human occupancy.

Depth of Pipelines.--In the early 1900's, cross-country pipelines in rural areas generally were installed with about 24 inches of cover to keep them below plow depth. However, the depth varied from company to company and from area to area. In 1970, Federal regulations were promulgated for the design, construction, operation, and maintenance of gas transmission pipelines. Title 49 CFR Section 192.327 cover ((a) states:

Except as provided in paragraphs (c) and (e) of this section, each buried transmission line must be installed with a minimum of cover as follows:

Location	Normal Soil	Consolidated Rock
<hr/>		
Inches		
Class 1 location	30	18
Class 2 location	36	24
Drainage ditches of public roads and railroad crossings	36	24

The regulation does not address the transition rate from one depth to another, such as the case of Northern's 20-inch pipeline being 8 feet deep at the first excavation and 3 feet deep at the point of rupture only 35 feet away.

Maps and Records.--Gas transmission companies are not required by State or Federal regulations to maintain maps and records of their facilities (except for records of corrosion control) or maps of specific areas, such as road or railroad crossings. However, many gas transmission pipeline companies, including Northern, maintain atlases which show such information as line size, valve locations, major property lines, mileposts or

stake numbers, river crossings, and other important locations. At the time of the accident, Northern did not maintain a profile of its facilities which showed the specific depths of its 20- and 26-inch pipelines across Grundy Road and at the Waverly valve site.

Pipeline Marking.--In its Pipeline Procedures Encroachments and Construction near Pipelines (see appendix B), Northern states, in pertinent part, that:

II. The exact location of affected pipelines or facilities must be made known to persons planning construction or working near company facilities (emphasis added).

\* \* \* \*

II.C. Show the depth of the pipeline in the milepost space on the marker when there is a possibility that the contractor will move them (emphasis added).

\* \* \* \*

III. Assign an employee to be present when excavation activities occur near the pipeline. Supervise and monitor the exposure of a pipeline whenever a new foreign or company facility crosses an existing pipeline (emphasis in original).

### Meteorological Information

The National Weather Service at Waterloo, Iowa, 9 miles from the accident site, recorded the following weather information on November 4, 1983:

From 8:00 a.m. to 3:00 p.m. skies were overcast. The visibility at 8:00 a.m. was 15 miles with light snow and snow flurries beginning at 9:42 a.m. and lasting until 1:45 p.m. During that time period visibility was reduced to 2 miles at 10:11 a.m. and increased to 10 miles by 2:00 p.m. Winds were from the west-northwest at 12 to 15 knots gusting to 20 to 25 knots. Temperatures ranged from 22° F at 8:00 a.m. to 28° F at 3:00 p.m. There was no measurable amount of snow during that period. (All times herein referred are central standard time.)

### Fire

The Hudson Volunteer Fire Department, located 4 miles from the accident site, was notified of the fire at 2:21 p.m. Shortly afterward, at 2:30 p.m., 56 firefighters, 3 firefighting engines, and 11 other fire vehicles arrived at the site. Mutual aid was requested from the Dike, Reinbeck, and Waterloo Fire Departments. The gas fed flames were extinguished about 90 minutes after the alarm was received by the valve closure at Waverly Junction. A small flame was left burning in the open end of the ruptured pipeline to consume the small amount of remaining gas.

### Medical, Pathological, and Survival Information

Because of the rapid ignition of the escaping gas and the ensuing fire, none of the persons at the accident site escaped to safety. The two previously identified SCS persons died in their pickup truck, one of the work crew died within 30 feet of the pipeline rupture, another died within 300 feet of the rupture, and the third died on the west side of Grundy Road about 200 feet from the rupture. No autopsies were conducted. The fire department casualty report listed the cause of death for all five persons as thermal blast injuries.

### Tests and Research

After the accident, an independent consultant was retained by Northern to inspect, test, and analyze sections of the failed 20-inch pipe. The following is a summary of the consultant's conclusions:

1. The pipe failed at a point 7 1/2 inches below the top of the pipe due to an external impact which created a hole approximately 7 to 8 inches long and 2 inches wide. More precise measurements and descriptions of the hole were impossible because after the puncture, the pipe was flattened in that area by the blast.
2. The impact point at 7 1/2 inches below the top of the pipe placed the puncture at approximately the 2:30 o'clock position looking west.
3. The pipe wall thickness at the rupture point was slightly heavier than specified (.284 inches).
4. The chemical composition of the pipe was not required by the American Petroleum Institute (API) Specification for line pipe (1953 edition). However, the chemical composition met or exceeded the API 1978 specifications for X-52 line pipe.
5. The yield strength was found to be about 3 percent below that specified for this type and grade, but was not a factor in the accident.
6. The general condition of the pipe was good although it had been blackened by flame exposure; no pitting or areas of general corrosion were found.
7. The failure was due solely to the puncturing of the pipe by external forces; there were no pipe defects or anomalies that contributed to the failure or to the degree of failure.

### Other Information

Tiling and Terracing.--Drainage tiles are used on farmland to reduce the amount of surface runoff water which can erode topsoil. The tile allows excess water to seep into the tile drains and then be diverted into a ditch, creek, or sump. Properly installed, the tile system maintains a water table of about 3 feet. Tiling eliminates standing water in the field, increases the number of days farmers can work in the fields during wet weather, decreases crop damage caused by standing water, and increases the effectiveness of the fertilizer. Terracing, which complements tiling, is the construction of carefully spaced and graded embankments to slow surface runoff water. When terracing is combined with tiling, soil erosion is minimized.

Both tiling and terracing are commonly used procedures in areas of relatively level farmlands. Statistics for the State of Iowa indicate that more than 1,379,000,000 feet of drain tile have been installed throughout the State and that an estimated 19,611,000 feet of drain tile are installed annually. The U.S. Department of Agriculture estimates that about 5,300,000,000 feet of drain tile have been installed nationwide and that an

estimated 145,000,000 feet of drain tile are installed annually. In addition, subsoiling and chiseling <sup>5/</sup> operations at a depth up to 6 feet are conducted annually on an estimated 1 million acres of farmland.

On May 5, 1982, the Land Management Company, as the agent for the owner of the property where the pipeline ruptured, filed a "Cooperator Agreement" with the Iowa Department of Soil Conservation to "...request assistance from the soil conservation district in planning, applying, and maintaining soil conservation and water management practices on my land. . . ." Estimates were prepared for tiling and terracing 232 acres of farmland in Black Hawk County, Iowa. (See appendix C.) Maps were prepared showing drain tile location and amounts and terrace work involved.

One 5-inch-diameter drain tile line was to be installed for each set of intakes on the two north terraces; the tile was to drain the low-lying northwest corner of the farm. The tile location maps, which did not show the location of pipelines or other buried facilities, were made from a visual observation of the farm by SCS persons, and by the use of area soil and contour maps. After the 1982 harvest, some minor changes in tile location, which resulted in additional tile requirements, were hand drawn on the tile location map. The map, which was in the possession of the two soil conservationists at the time of the accident, was destroyed in the ensuing fire.

The U. S. Department of Agriculture, Soil Conservation Service's (SCS) National Engineering Manual specifies procedures to be followed regarding tiling and terracing projects. In part, the manual states that the SCS personnel "are to take adequate precautions to minimize hazards from or damage to utilities, both overhead and underground," located in the area to be tiled or terraced, and that "...landowners, sponsoring organizations, and contractors" (emphasis added) will be notified of their liability for damage to utilities. (See appendix D.)

The tiling and terracing project at the accident site had been approved by SCS and the contractor had been shown the location of the two Northern pipelines by Northern's maintenance man. The property owner had also, talked to Northern about the tiling project. All communications were verbal; the required written followup, SCS-ENG-5 postcard, was not used.

Land Improvement Contractors of America (LICA).--LICA, a not-for-profit organization, was established in 1951, to serve persons, firms, corporations, and organizations involved in soil, water, and natural resource conservation. LICA is organized into eight regions throughout the contiguous States and currently has a membership of about 4,000 contractors. (See appendix E.)

At the annual national meeting in San Diego, California, on February 6-9, 1983, LICA members discussed some of their problems with pipeline operators and pipeline contractors. They agreed that:

- (1) One call systems are good but not all underground utilities are members; therefore, utilities that are not members must be notified individually or be struck because their location is neither known nor suspected.
- (2) The requested 48-hour advance notice by an excavator sometimes presents a hardship to that excavator.

<sup>5/</sup> A term used to describe "loosening the soil, without inverting and with a minimum of mixing of the soil surface to shatter restrictive layers below normal plow depth that inhibit water movement or root development." (U.S. Department of Agriculture, National Handbook of Conservation Practices.)

- (3) On farmlands that are being merged, property line fences with attached pipeline markers are being removed; now when tiling in the middle of a field, it sometimes is no longer possible to see the pipeline markers on the new, more distant property line fences.
- (4) The merging of the small farms means that in many cases the farm owner is no longer living on the farm and is not available to tell the tile contractor where any pipelines or other underground facilities are located.
- (5) Pipeline contractors who are installing new pipelines often cut field drainage tile and either do not replace them or incorrectly replace them.
- (6) Pipeline companies should have a representative on site whenever tiling work is conducted near the pipelines.

According to the Land Management Company, agent for the Rathman Farm Operations, the tile contractor at the accident site had been awarded the tile contract because of his experience in tiling (more than 30 years), the good quality of his workmanship in the installation and connection of field drain tile, and his conscientiousness.

As a result of this accident, the Occupational Safety and Health Administration of the Iowa Bureau of Labor cited the contractor for a failure "to determine the exact location of a Natural Gas Pipeline when the tile plow approached the estimated location of the gas pipeline which exposed the employees to the hazard of an explosion and fire." A fine of \$140, which was imposed on the contractor for the infraction, is being contested.

## ANALYSIS

### Excavation Damage Prevention

Excavation damage to pipelines is the largest single cause of all reported pipeline accidents. Since 1969, the Safety Board has issued 58 reports of major pipeline accidents of which 21, or 36 percent, were directly caused by excavation equipment or excavation processes. (See appendix F.) Because of its concern about the increasing number of excavation accidents, the Safety Board conducted a symposium in Washington, D.C. on April 18, 1972, on Prevention of Damage to Pipelines. The symposium discussed excavation caused damage to pipelines and reviewed some damage prevention programs and regulatory action taken by Federal, State and local governments. From material developed in part from the symposium, the Safety Board issued a special study on the prevention of damage to pipelines. <sup>6/</sup> The study discussed the damage prevention responsibilities of excavators, contractors, and pipeline operators and concluded that:

Pipeline accidents caused by excavation and construction activities, including blasting, can be prevented. The operators of all underground systems must work together with local government officials, contractor associations, individual contractors, State officials, planners, and developers. . .The assistance of the excavator and his machine operator in determining methods of and cooperation in avoiding damage should be enthusiastically sought. They should be educated as to the damage and loss of life which they can cause and should be given as much assistance

<sup>6/</sup> Special Study -- "Prevention of Damage to Pipelines" (NTSB-PSS-73-1).

as necessary to help them avoid hitting a pipeline (emphasis added). On the other hand, both contractors and machine operators should be licensed and have their licenses revoked if they will not cooperate and if they continue to cause accidents. A concerted effort by all parties involved can drastically reduce the numbers of excavation accidents.

Statistics are not readily available to indicate the number of pipeline punctures caused by tiling and other agricultural operations. Department of Transportation pipeline accident report forms do not specifically identify the cause or lend themselves to automatic data processing retrieval. However, data from the U.S. Department of Agriculture indicates that farm drainage tile and farm sub-soiling operations have been increasing yearly. Also new pipeline installations have been increasing yearly. Because of these construction activities, the Safety Board is concerned about the potential for additional accidents similar to the November 4, 1982, accident.

The Safety Board believes that excavation-caused damage to pipelines can be prevented by pipelines being well marked, by notifying pipeline operators in advance of proposed excavating activities, by having pipeline operator representatives on site during excavation, and by utilizing contractors who perform their work in a careful, conscientious manner. In this accident these precepts had been met. The contractor had notified the company of his intention to excavate well in advance of work commencement as well as on the day of the excavation, and the company had responded by marking its facilities and sending a maintenance man to monitor the operations. The contractor, in the presence of the maintenance man, had successfully excavated across both pipelines, and the maintenance man had determined that both pipelines were 8 feet deep where they were crossed; up to that point everything had been done correctly. However, two things were then done which negated all of the previous good work and which set the stage for this accident.

First the contractor changed his plans, but did not inform Northern's maintenance man. Second, the maintenance man left the job site before all work over the pipelines had been completed. The contractor had previously excavated 10 feet south of the 20-inch pipeline, from which point he reportedly had said that he would continue with two strings of 5-inch tile one in a south and one in a southeasterly direction (away from the pipelines). This would have necessitated the installation of a 6"x5"x5" Y-tile at this point. Apparently, between the time that Northern's maintenance man left and the time that the contractor resumed tiling, the contractor decided to start the 5-inch tile installation between the 20- and the 26-inch pipelines, rather than to the south of the pipelines.

The contractor may not have wanted to take the time to obtain the necessary additional 6-inch tile needed to "hand lay" the 30 to 35 feet to clear the pipelines before he started to install the 5-inch tile. However, it is unlikely that the contractor, who had been so cautious and attentive when first crossing the two pipelines and who had about 30 years of experience and was well aware of the hazards of excavating near high pressure pipelines, would have started tiling from a point between the two pipelines unless he believed that the lines were as deep 35 feet to the east as they were at the first crossing. For whatever reason the contractor changed his plans, he did not inform Northern's maintenance man.

The maintenance man left the job site before the tiling operation had been completed across both pipelines. Although the excavation had been completed across both pipelines, a 6-inch tile installation and a backfill operation had yet to be completed, and the maintenance man should have remained at the job site. If he had remained, the

maintenance man would have learned of the change in plans and, based on his prior actions, it seems likely that he would have measured the pipeline depth with his spotting bar at the point of the new crossing. Based upon the shallower depth, which thus would have been determined, it would have become obvious to the maintenance man and to the contractor that the new crossing would have required hand excavation because the use of mechanical equipment would have been too dangerous. In this case, if either the contractor had mentioned his change of plans to the maintenance man or if the maintenance man had remained at the job site, preventive measures would likely have been taken to avoid the puncture.

### Valve Closure

Considering that the valves involved were manually operated, the valve closures which isolated the 20-inch pipeline between valves Nos. 9 and 11 were performed in a timely manner. However, it should be noted that if the firefighters had not been available, the Waverly takeoff valve could not have been closed until the fire had burned down, since the 26-inch line was still carrying gas through the isolated sector and was still supplying gas to the ruptured 20-inch line at the Waverly takeoff valve. Although all the fatalities and the property damage occurred within minutes of the pipeline puncture, the consequences could have been much more serious in a more populous location.

### Maps and Records

Northern did not have any detailed maps of the pipelines at the Waverly valve site which showed their depth and profile. The depth of the pipelines -- 8 feet -- at the valve site had been determined by the maintenance man. Even if, as he stated, the company maintenance man had told the tile contractor that the lines were shallower further away in the field, the information did not provide the contractor with specific information on the depth of the pipelines at the accident site. The need for accurate maps and records has been discussed previously by the Safety Board in other accident investigations.

On May 17, 1978, in Mansfield, Ohio, a pipeline accident 7/ occurred which involved the erroneous tapping by a gas company maintenance crew of high pressure gas into a low pressure distribution system because of inaccurate gas main maps. Gas at 42 psig entered the 0.4 psig low pressure system. Pilot lights flared 2 feet high and burned 16 houses, 5 of which suffered extensive damage.

On June 28, 1982, a gas company's service line was snagged by a contractor in Portales, New Mexico. 8/ The line was pulled out of a compression coupling under the street in front of a house. Thirty-seven days later, the slowly migrating gas exploded in the house and six persons were killed. At the time of the accident, none of the gas service lines in Portales were shown on the gas company maps. In both the Mansfield and Portales accidents, if accurate maps had been available and had been used, the accidents would not have occurred.

By the same token, Northern did not have a profile map for the Grundy Road crossing to better inform its maintenance man and, in turn, the contractor. As Northern's representative, the maintenance man should have been briefed about the pipeline depth, the pipeline profile, and how abruptly the lines ascended from the road crossing at the accident site. Without maps and records, a spotting bar would have had to have been used to measure the depth where other excavation activities close to the pipeline were to be undertaken.

7/ Safety recommendations P-78-45 through -52, issued August 21, 1978.

8/ Pipeline Accident Report—"The Gas Company of New Mexico, Natural Gas Explosion and Fire, Portales, New Mexico," (NTSB-PAR-83-1).

## CONCLUSIONS

### Findings

1. Although the 20-inch natural gas transmission pipeline was well marked and identified, nevertheless it was struck and punctured by a tile plow because its depth was not carefully ascertained.
2. Northern did not have profile maps of its 20-inch pipeline at the Grundy Road crossing. It did not make a depth measurement of the pipeline at the point where it was to be crossed because the maintenance man had left the job site unaware that further excavation was to be done over the pipeline. If an accurate profile map had been available and provided to the maintenance man, specific information about the abruptly changing depth of the pipeline could have been communicated to the contractor.
3. At the time of the accident, northern's maintenance man did not effectively communicate the fact that the depth of the pipelines decreased abruptly east of the valve site.
4. The tile contractor must have assumed that the pipelines were as deep at the accident site as they were where he had earlier crossed them since he had not been informed precisely of the depth of the pipelines east of the valve site.
5. Northern's maintenance man should not have left the job site before the tile had been completely installed and backfilled across both pipelines. If he had remained, he would have learned of the contractor's change in plans and could have taken preventive action which would have avoided the puncture.
6. The use of asbestos fire suits by the firefighters and the water screen provided by several fire departments permitted the prompt closing of the Waverly valve.

### Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the puncture of a 20-inch-diameter gas transmission pipeline by a contractor's tile plow, due to the contractor's failure to inform the pipeline company and to have the depth of the pipeline checked at a new crossing point when he changed his work plans. The accident might have been avoided had the pipeline company inspector remained on the job site until after tiling operations in the vicinity of the pipeline had been completed.

## RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

--to the Northern Natural Gas Company:

Revise its procedures to require that employees performing excavation inspection work near company facilities be fully informed as to the location, depth, and change in depth of these facilities and to remain on the job until all excavation activities are well clear of company facilities. (Class II, Priority Action) (P-83-12)



Instruct its employees to clearly explain to contractors working near company facilities that the depth of a pipeline may change abruptly in short distances and that the contractor should immediately notify the company about any changes in planned excavation activities. (Class II, Priority Action) (P-83-13)

--to the American Gas Association, the Interstate Natural Gas Association of America, and the American Petroleum Institute:

Notify its member companies of the circumstances of the accident in Hudson, Iowa, on November 4, 1982, and urge them to emphasize to their employees the importance of communicating fully with excavators about the extent of the proposed work and about the importance of remaining on the job site until all excavation activities are well clear of the pipeline. (Class II, Priority Action) (P-83-14)

to the Land Improvement Contractors of America and the American Public Works Association:

Notify its members of the circumstances of the accident in Hudson, Iowa, on November 4, 1982, and urge them to cooperate and communicate with pipeline operators before beginning excavation work and to explain fully their excavation plans and any changes in plans. (Class II, Priority Action) (P-83-15)

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JAMES E. BURNETT, JR.  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ G. H. PATRICK BURSLEY  
Member

/s/ DONALD D. ENGEN  
Member

May 17, 1983

**APPENDIXES**

**APPENDIX A**

**INVESTIGATION**

The National Transportation Safety Board was notified of this accident at 6:30 p.m., e.s.t., on November 4, 1982, by the Materials Transportation Bureau. Early on November 5, 1982, the Safety Board dispatched an investigator from its Washington, D.C., headquarters to the accident site to conduct the investigation.

APPENDIX B

TRANSMISSION OPERATIONS DIVISION PROCEDURES MANUAL

TRANSMISSION OPERATIONS DIVISION  
PROCEDURES MANUAL NOVEMBER 1, 1979

Transmission Operations Division Procedures Manual



Date Issued 11-1-79	PIPELINE PROCEDURES ENCROACHMENTS CONSTRUCTION NEAR PIPELINES	No. 121.04-7
Date Revised		Page 1 of 3
Date Reviewed		

PURPOSE:

This establishes the procedures required when an outside party plans or is observed performing construction activities in areas where Company facilities are located.

RESPONSIBILITY FOR ADMINISTRATION:

District Manager

GENERAL

- I. Construction activities as referenced in this procedure include but are not limited to:
  - A. Agricultural tiling activities
  - B. Utility crossings
  - C. Road construction
  - D. Building construction
  - E. Blasting of rock, trees, etc.
- II. The exact location of affected pipelines or facilities must be made known to persons planning construction or working near Company facilities.
- III. Related Procedures:
  - A. No. 100.06-5, "Electric and Telephone Cable Crossings."
  - B. No. 121.15-12, "Public Education Program."

PROCEDURE:

- I. Contact the persons responsible for planning any construction near our pipeline:
  - A. Advise them of the pipeline location and liability and Northern's easement rights with regard to the operation and maintenance of the pipeline.

# Transmission Operations Division Procedures Manual



Date Issued 11-1-79	PIPELINE PROCEDURES ENCROACHMENTS CONSTRUCTION NEAR PIPELINES	No. 121.04-7
Date Revised		Page 2 of 3
Date Reviewed		

- B. Advise them of the probable hazard and liability if the pipeline is damaged.
- C. Distribute the brochure "Dig Our Message - Not Our Pipeline."
- D. Request notification when construction activities will occur immediately adjacent to or crossing Northern's pipelines.

II. Locate and mark pipelines in areas where construction activities are observed or anticipated.

- A. Place standard pipeline caution markers over the pipeline in temporary work areas as soon as notification of the precise construction location is received.
- B. Set the markers at intervals required by conditions of the site and job, but not to exceed 200 feet.
- C. Show the depth of the pipeline in the mile post space on the marker except when there is a possibility that the contractor will move them.
- D. Distribute the brochure "Dig Our Message - Not Our Pipeline."
- E. Request notification when construction activities will occur immediately adjacent to or crossing Northern's pipelines.
- F. Remove the markers when the work has been completed.

III. Assign an employee to be present when excavation activities occur near the pipeline. Supervise and monitor the exposure of a pipeline whenever a new foreign or company facility crosses an existing pipeline.

# Transmission Operations Division Procedures Manual



Date Issued 11-1-79	PIPELINE PROCEDURES ENCROACHMENTS CONSTRUCTION NEAR PIPELINES	No. 121.04-7
Date Revised		Page 3 of 3
Date Reviewed		

IV. Delay unexpected construction work in progress over or near pipelines whenever possible through mutual agreement with the involved outside party. Explain procedures necessary if Company facilities must be relocated.

V. Records

- A. Prepare an MJT on each request for a line location. See the MCS Manual for instructions on preparation.
- B. Maintain factual records when Company personnel request that construction activities be delayed or stopped.

APPENDIX C

RECORD OF COOPERATOR'S DECISIONS AND PROGRESS IN APPLICATION

RCN-COON-40  
Rev. 9-59

SOIL AND WATER  
CONSERVATION  
PLAN

Co. Engineer  
Larry Clark

20-12"

16-6"

Edna Rathman  
Cooperator

Black Hawk Co.

CONSERVATION DISTRICT

Assisted by

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

U.S. GOVERNMENT PRINTING OFFICE 16-72303-6

Cooperator Agreement No. D-3 1587

Form SCD-1  
February, 1981

COOPERATOR AGREEMENT

Iowa Department of Soil Conservation  
Black Hawk County Soil Conservation District

Name of Landowner Barl Edna Rathman Telephone Hart Farm Mkt - 515-382-6596  
 Name of Farm Operator Mark Schilderich Telephone 319-345-2958  
 Mailing Address: Name Ch. Hertz Farm Mkt Telephone Jim Fuxell - 7048  
 RR, P.O. Box Box 505  
 City, State, Zip Newman, Ia. - 52261

Legal Description of Land Covered by This Agreement:

232 NW 1/4 Sec 31 Black Hawk 88-14 Black Hawk  
 (No. Acres) (Qtr.) (Sec.) (Township-Range) (County)

I hereby request assistance from the soil conservation district in planning, applying, and maintaining soil conservation and water management practices on my land. I hereby grant to the members of the soil conservation district, or their designated representative, the right of ingress and egress to my land for the purpose of conducting surveys, planning, or inspecting conservation works of improvement during the period this agreement is in force.

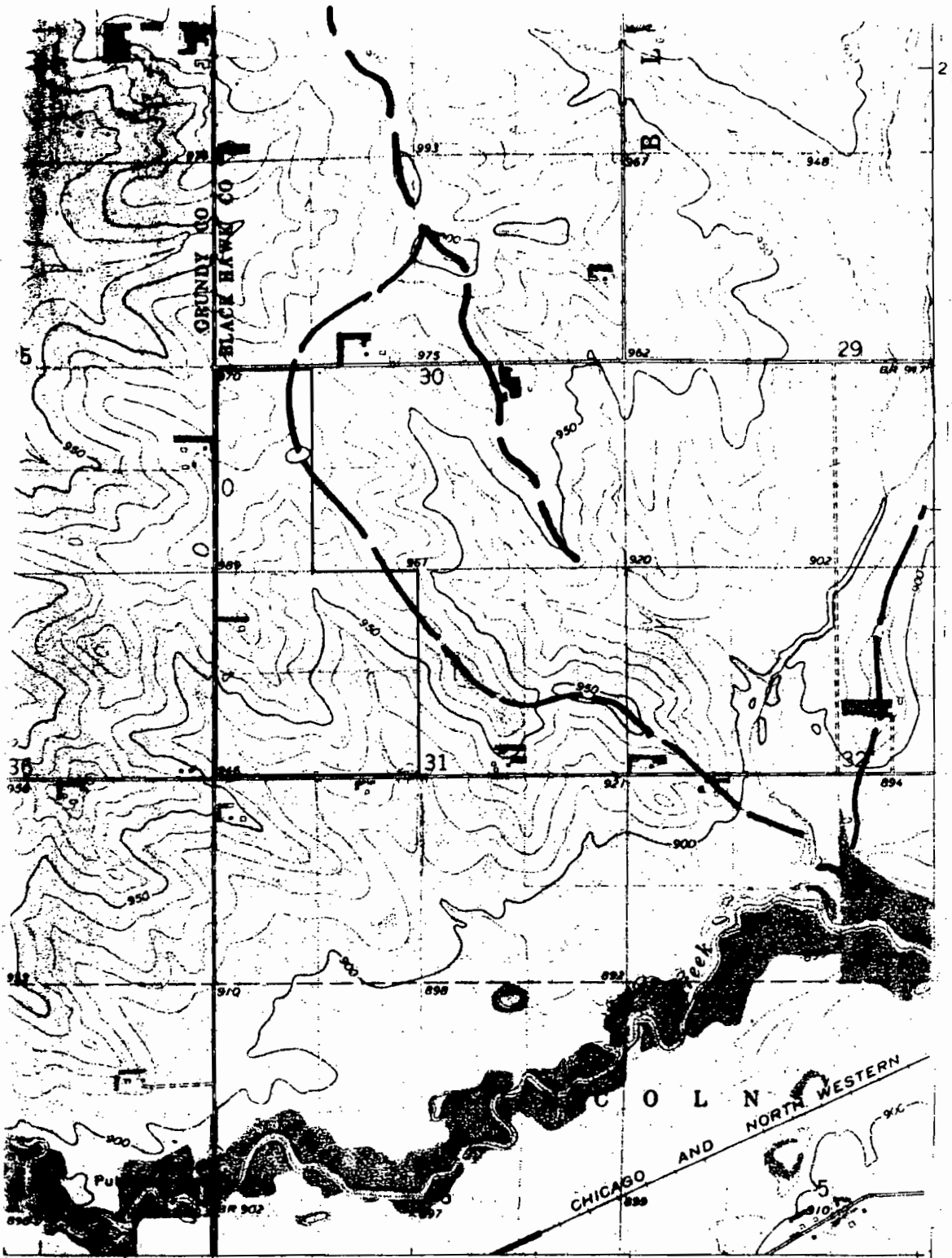
Barl Edna Rathman 5-4-1989  
 (Signature - Landowner) (Date)

The soil conservation district hereby agrees to furnish assistance in planning, applying, and maintaining soil conservation and water management practices on the land designated in this agreement. Such assistance will be in accordance with the policies of the district. This agreement will remain in effect until mutually terminated or by either party giving thirty (30) days written notice.

The Black Hawk County Soil Conservation District has approved and entered into this agreement by action taken at the meeting of the district commissioners held \_\_\_\_\_  
 (Date)

[Signature] 5/1/89  
 (Chairman - SCD) (Date)

Distribution:  
Landowner  
SCD



ROAD CLASSIFICATION

Primary highway

Light-duty road, hard or

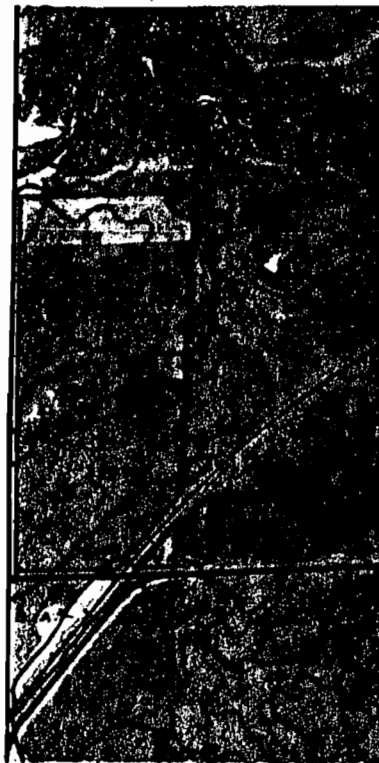
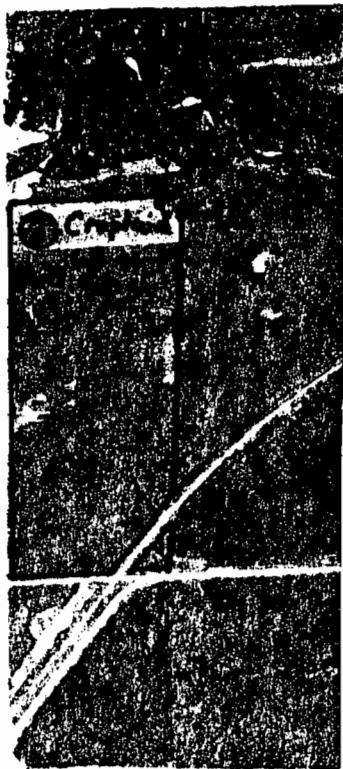


APPENDIX C

-30-



4" = MILE





LA PORTE ROAD  
W. WATERLOO, IOWA 50702  
TELEPHONE 296-3262

*Dave Krsnak*  
DISTRICT CONSERVATIONIST

WORKING THROUGH

THE BLACK HAWK SOIL CONSERVATION DISTRICT

May 5, 1982

Dave Krsnak  
District Conservationist  
Black Hawk County SCS Office  
5324 LaPorte Road  
Waterloo, Iowa 50702

Dear Dave:

Enclosed are the two signed cooperater agreements which we have completed for Mrs. Rathman. This morning I checked through all of our farm files for Mrs. Rathman and there is no record of any tile plat for the main waterway area through the middle of her farm. We plan to call our tiler this evening and will attempt to dig along the waterways within the next several weeks to locate whatever tile lines possible, as well as determine their size and condition. As soon as this information is available, we will forward it to you.

We would prefer that you design the entire area for completion this fall. We discussed the project with Mrs. Rathman yesterday and she is very interested if adequate cost-sharing funds are available. She is very pleased with the terraces we installed on her 80 acres south of the blacktop two years ago and has always been very supportive of good conservation practices.

As you are developing the terrace plans and cost estimate for the tile and terraces, we would appreciate your reviewing them with us. It is always difficult to estimate a large job, as the costs can increase considerably after the actual survey work is completed. We look forward to working with you on this and are contacting several contractors so that we have commitments for the work this fall.

Sincerely,

HERTZ FARM MANAGEMENT, Inc.

James G. Prevert

JGF:bjjs  
Enclosures  
1714R

Form SCD-1  
February, 1981

Cooperator Agreem. No. \_\_\_\_\_

COOPERATOR AGREEMENT

Iowa Department of Soil Conservation  
County Soil Conservation District

Name of Landowner Pearl Edna Rathman Telephone Hwy 774 - 515-382-659  
 Name of Farm Operator Mark Schilders Telephone 319-345-2998  
 Mailing Address: Name Ch Hertz Iowa Map Telephone Jim Fournet - 774  
 RR, P.O. Box Box 505  
 City, State, Zip Newada, Ia - 50201

Legal Description of Land Covered by This Agreement:

<u>232</u>	<u>NW 1/4</u>	<u>Sec 31</u>	<u>Black Hawk 88-14-</u>	<u>Black Hawk</u>
(No. Acres)	(Qtr.)	(Sec.)	(Township-Range)	(County)

I hereby request assistance from the soil conservation district in planning, applying, and maintaining soil conservation and water management practices on my land. I hereby grant to the members of the soil conservation district, or their designated representative, the right of ingress and egress to my land for the purpose of conducting surveys, planning, or inspecting conservation works of improvement during the period this agreement is in force.

Pearl Edna Rathman 5-4-1989  
(Signature - Landowner) (Date)

The soil conservation district hereby agrees to furnish assistance in planning, applying, and maintaining soil conservation and water management practices on the land designated in this agreement. Such assistance will be in accordance with the policies of the district. This agreement will remain in effect until mutually terminated or by either party giving thirty (30) days written notice.

The \_\_\_\_\_ County Soil Conservation District has approved and entered into this agreement by action taken at the meeting of the district commissioners held \_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Chairman - SCD) (Date)

Distribution:  
Landowner  
SCD

June 17, 1982

MEMO

Re: #268 N. Rathman Tile and Terracing Plan by Dave Krsnak - Black Hawk  
SGS Office, phone 319-296-3262.

I called Dave today to confirm that there were no large tile suitable for the terrace project. He has completed the following estimates for this project.

1,100' - 12" tile @ \$4.10	\$ 4,510.00
200' - 10" tile @ \$2.70	540.00
1,200' - 8" tile @ \$1.60	1,920.00
2,300' - 6" tile @ \$1.15	2,645.00
7,800' - 5" tile @ \$.95	7,410.00
28 intakes @ \$105.00	

The total cost of the tile and intakes would be slightly above \$20,000.00.

His estimate included 20,770 feet of terraces. This does not include the 7,000 feet of terraces to be completed under the Grundy County ASCS cost-sharing.

Dave asked that I call him on July 2 to schedule an appointment with him on my next visit to the farm.

James G. Frevert

JGF:bjs

0189A

U.S. DEPARTMENT OF AGRICULTURE Soil Conservation Service  <b>CONSERVATION PLANNING INFORMATION</b>	SCS-CO-228 3-78	OWNER Pearl Edna Schman	
		AGENT Dave Krsnak	
		DATE June, 1982	ACRES 302
		FARMER Farm Manager - Jim Frevert	

1 - CROPLAND  
234 acres

Soils information: 377B Dinsdale silty clay loam      5%, 250 ft slopes  
 377C Dinsdale silty clay loam      7%, 150 ft slopes  
 83C Kenyon loam      7%, 200 ft slopes  
 11B Colo-Ely Complex      4%, 200 ft slopes

Field 1 will be managed to control erosion down to tolerable limits using a corn-soybean rotation.

Terraces are planned in this field to reduce soil loss to about 5 tons/acre/year on the Dinsdale and Kenyon soils. By contouring and using reduced tillage methods on the Colo-Ely soils, soil losses would be about 4 tons/acre/year. Terraces will be spaced at 120 to 180 ft spacings.

Alternative 1 - By limiting tillage to no-till corn following soybeans and fall chisel, spring disk following corn, soil losses would be close to 5 tons/acre/year on the Dinsdale and Kenyon soils. Soil losses on the Colo-Ely soils would be about 3 tons/acre/year. Assume contouring for all acres.

Alternative 2 - By using no-till on all acres on the contour, soil losses on the Dinsdale and Kenyon soils would be 2-3 tons/acre/year.

2 - CROPLAND  
68 acres

Soil information: 133 Colo silty clay loam      1%, 400 ft slopes

Corn and soybeans are grown in this field. With reduced tillage methods, soils losses will be as low as 3 tons/acre/year.

UNIVERSAL SOIL LOSS EQUATION

A = RQLSCP

R = 1/5

FIELD #	SOIL TYPE	(K)	(L)	(S)	(P)	PMLSP	ROTATION & PLANTAGE	(C)	SOIL LOSS T/AC/HR	T
1	377B	.32	250	.5	1.0	47.3	C-8* 1000/4000	.32	15.1	5
"	377C	.32	150	.7	1.0	54.4		.32	18.1	5
"	83C	.28	200	.7	1.0	58.8		.32	18.8	5
1	377B	.32	180	.4	.5	14.3	C-8*	.32	4.6	5
"	377C	.32	120	.6	.5	20.7	1000/4000	.32	6.4	5
"	83C	.28	120	.6	.5	18.1		.32	5.8	5
1	377B	.32	250	.5	CONTOUR	23.7	C-8**	.22	5.2	5
"	377C	.32	150	.7	.5	28.0	2400/3200	.22	6.2	5
"	83C	.28	200	.7	.5	29.4		.22	6.5	5
1	377B	.32	250	.5	CONTOUR	23.7	C-8**	.09	2.1	5
"	377C	.32	150	.7	.5	28.0	5200/600	.09	2.5	5
"	83C	.28	200	.7	.5	29.4		.09	2.6	5
2	153	.28	400	1	1.0	9.8	C-8* 1000/4000	.32	3.1	5

\* C-8 Following beans → spring disk  
Following corn → fall chisel, spring disk and field cultivate

\*\* C-8 Following beans → no-till  
Following corn → fall chisel, spring disk

\*\*\* C-8 All no-till

U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

SD-4-CONS-9 (4-78)  
FILE CODE-CONS. 10-9

RECORD NO: 1

SOIL SURVEY INTERPRETATIONS

COLO-ELY OR COLO-JUDSON COMPLEX

Date 1978

**SOIL DESCRIPTION:** This is a complex of deep, dark colored, poor and somewhat poorly drained soils. They have developed in silty alluvial sediment. The complex is along waterways in narrow valleys and the adjacent footslopes. Individual areas are typically long and narrow, 15 to 75 acres in size with about equal amounts of each soil. The Colo soil is typically in the center of the drainage way with Ely soils on both sides in a band between the drainage way and the higher lying soils on adjacent hillsides. This unit is suited for corn, soybeans, small grains, and grasses and legumes for hay if it can be properly drained and protected from flooding. Many areas immediately adjacent to the small streams that commonly drain the area, are difficult to farm because of stream meanders and frequency of flooding. The Ely or Judson soils occur at higher elevation, but crops on some areas of this soil are damaged from excessive runoff and siltation from higher lying soils. Contouring, terracing and minimum tillage help to control erosion and reduce runoff and siltation damage.

MAP UNIT SYMBOL	SLOPE	EROSION	CAPABILITY	CORN	% ORGANIC	PERMEABILITY	PH-RANGE	EROSION FACTORS	
				SUITABILITY RATING	MATTER FLOW LAYER			PLDg LAYER	PLDg LAYER
11B	2-5	SLI	2V	68	5.0 - 7.0	Moderate	5.6 - 8.4	-	-

LAND TREATMENT NEEDS:

YIELD PREDICTIONS—HIGH MANAGEMENT

MAP UNIT SYMBOL	CORN (BU/AC)		SOYBEANS (BU/AC)		OATS (BU/AC)	GRASS (TONS/AC)	BROMEGRASS ALP ALFA (LBS/AC)	BLUEGRASS (LBS/AC)
	STATE	PREDICTED	STATE	PREDICTED				
11B	100	170	38	41	80	4.1	6.8	3.8

CLASS-DETERMINING PHASE	BIRDSNEAKS			
	SPECIES	INT	SPECIES	INT

CLASS-DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS								POTENTIAL AS HABITAT FOR			
	GRAIN & STRAW	GRASS & LEGUME	WLD HERB.	HARDW. TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLD WETLAND	WOODLD WETLAND	RANGELD WETLAND	

REMARKS: REFER TO INDIVIDUAL INTERPRETATION SHEETS FOR ADDITIONAL INFORMATION.

AVM — AVERAGE UNIT MONTHS  
MAAT — MEAN ANNUAL AIR TEMPERATURE  
COR AND YIELDS ARE FOR HIGH MANAGEMENT AND REPRESENT AVERAGE FIGURES FOR THESE SOILS IN IOWA.

APPENDIX D

U.S. DEPARTMENT OF AGRICULTURE PART 503 - SAFETY

SUBPART A - ENGINEERING ACTIVITIES AFFECTING UTILITIES

503.02(e)

§503.00 General.

(a) Private and public utilities may be jeopardized and equipment operators and others may be injured during site investigations and construction of engineering structures if proper procedures are not followed.

(b) Established procedures for locating utilities and notifying owners are the first step in eliminating many potential accidents. These procedures, if followed, will reduce personal injuries, property damage, and interruption of utility service.

§503.01 Scope.

(a) This subpart is concerned only with the minimum requirements for developing a plan to prevent damage to public or private utilities and injury to people from contact with utilities during engineering and construction activities.

(b) Public and private utilities include transmission lines, cables, and pipelines.

§503.02 General considerations.

(a) SCS personnel are to take adequate precautions to minimize hazards from or damages to utilities, both overhead and underground, during location, investigation, design, and construction of any works carried out under SCS programs.

(b) Land owners or operators, sponsoring organizations, and contractors are to be informed of their liability for damage to utilities and damage resulting from disruption of service caused by construction activities. They are to be informed that SCS makes no representation on the existence or nonexistence of any utilities. A letter may be used for this purpose. Absence of utilities on construction drawings is not assurance that no utilities are present at the site.

(c) SCS may be held responsible for damage done by its employees during site investigations.

(d) Indicate known utilities on construction drawing with appropriate symbols and identification.

(e) Each state office is to develop a procedure for carrying out its responsibilities within these guidelines.

503-1



## PART 503 - SAFETY

## 503.03

## §503.03 Investigations.

If subsurface investigation or construction is proposed, the responsible SCS employee is to check with the land owner or operator or with the sponsoring organizations to determine if there are underground utilities in the work area. Also check records of known utilities on file in the field office. On field inspection, particular attention should be given to utility markers set in fence lines or elsewhere.

## §503.04 Buried utilities.

(a) If buried utilities are known to be in the vicinity of proposed work, the responsible SCS employee is to inform the land owner or operator or the sponsoring organizations of this fact and of the land owner or operator's responsibility to take the following actions:

(1) Notify the utility company of time, place, and type of work to be done.

(2) Request that the buried utility be located and staked on the ground by the utility owner.

(3) Request that a representative of the utility company be present during any excavation operations.

(4) Notify the contractor of the location of the utility in relation to the job work area.

(5) Fill out postcard Form SCS-ENG-5, sign, and return to SCS after the required action has been completed. Failure to return completed postcard will result in termination of SCS assistance.

(b) The responsible SCS employee must make sure that the preceding steps have been carried out by the land owner or operator or the sponsoring organizations before beginning work in the vicinity of the buried utility.

## §503.05 Checklist.

The responsible SCS employee is to keep a checklist, recording action taken pertaining to work in the vicinity of buried utilities. The checklist is to be maintained in the SCS job file. See Form SCS-ENG-6.

## §503.06 State laws.

If State laws and regulations have different requirements, SCS is to comply with the laws and regulations. Procedures may vary from §503.04 if equivalent in effectiveness.

503-2

(210-V-(NEM), July 1980)

INSTRUCTIONS

FORM APPROVED  
GMS NO. 46-R386\*

DEAR \_\_\_\_\_

BECAUSE OF THE GREAT HAZARD TO LIFE AND PROPERTY FROM THE DISTURBANCE OF UTILITIES BY CONSTRUCTION OR FOUNDATION INVESTIGATION EQUIPMENT AND BECAUSE THE CONSERVATION WORK TO BE DONE ON LAND CONTROLLED BY YOU IS IN THE VICINITY OF \_\_\_\_\_

UTILITY CO.

\_\_\_\_\_ ; BEFORE WORK PROCEEDS IT IS YOUR RESPONSIBILITY TO DO THE

TYPE OF UTILITY  
FOLLOWING:

1. NOTIFY THE UTILITY COMPANY OF THE LOCATION AND KIND OF WORK TO BE DONE AND THE PROPOSED DATE THAT WORK WILL START.
2. REQUEST THAT UTILITY OWNER ASSIST IN LOCATING AND STAKING THE UTILITY ON-SITE.
3. REQUEST THAT A UTILITY COMPANY EMPLOYEE BE PRESENT DURING CONSTRUCTION WITHIN THE UTILITY RIGHT OF WAY.
4. NOTIFY CONTRACTOR OF LOCATION OF UTILITY.
5. FILL OUT AND SIGN THE ATTACHED POSTCARD AND RETURN TO THE SOIL CONSERVATION SERVICE.

\_\_\_\_\_  
DISTRICT CONSERVATIONIST

U.S. Government Printing Office: 1973 - 506-288

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300

POSTAGE AND FEES PAID  
U. S. DEPARTMENT OF  
AGRICULTURE  
AGR 101



USDA SOIL CONSERVATION SERVICE

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300

ENGINEERING DIVISION  
CENTRAL FILES

POSTAGE AND FEES PAID  
U. S. DEPARTMENT OF  
AGRICULTURE  
AGR 101



TO:

FORM APPROVED  
OMB NO. 40-R3860

LANDOWNER'S NAME \_\_\_\_\_ ADDRESS \_\_\_\_\_

UTILITY COMPANY \_\_\_\_\_ ADDRESS \_\_\_\_\_

UTILITY REPRESENTATIVE NOTIFIED \_\_\_\_\_  
NAME TITLE

IF UTILITY NOTIFIED BY LETTER, DATE OF ACKNOWLEDGMENT OF RECEIPT \_\_\_\_\_

UTILITY REPRESENTATIVE WILL LOCATE AND STAKE \_\_\_\_\_ YES  NO

UTILITY REPRESENTATIVE WILL BE PRESENT DURING CONSTRUCTION \_\_\_\_\_ YES  NO

CONTRACTOR NOTIFIED \_\_\_\_\_ DATE \_\_\_\_\_  
NAME & TITLE

SCS MA. 973 \_\_\_\_\_ DATE \_\_\_\_\_  
OWNER-OPERATOR-SPONSER (SIGNATURE)

SCS-ENG-6  
March, 1973

U.S. Department of Agriculture  
Soil Conservation Service

UTILITY CHECK SHEET

Reference Engr. Memo-73

Farm Name \_\_\_\_\_ Location \_\_\_\_\_

Utilities Involved and Location: \_\_\_\_\_  
\_\_\_\_\_

Landowner or operator notified \_\_\_\_\_  
Who \_\_\_\_\_ By Whom \_\_\_\_\_

How \_\_\_\_\_ Date: \_\_\_\_\_

Work to be done \_\_\_\_\_ When: \_\_\_\_\_

Utility Company Notified: \_\_\_\_\_  
Who \_\_\_\_\_ By Whom \_\_\_\_\_

How \_\_\_\_\_ Date: \_\_\_\_\_

Request to locate utility \_\_\_\_\_

Work to be done \_\_\_\_\_ When: \_\_\_\_\_

Request for Company representative to be present \_\_\_\_\_

Utility marked or staked \_\_\_\_\_ Date: \_\_\_\_\_

Representative present during construction \_\_\_\_\_

Contractor Notified: \_\_\_\_\_  
Who \_\_\_\_\_ By Whom \_\_\_\_\_ How \_\_\_\_\_ Date \_\_\_\_\_

Type of utility \_\_\_\_\_ Location: \_\_\_\_\_

Vertical location in relation to work \_\_\_\_\_

Horizontal location in relation to work \_\_\_\_\_

Contractor shown markings or stakes \_\_\_\_\_

Utility location shown on plans \_\_\_\_\_

Other remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Signature

## APPENDIX E

### LICA ARTICLES OF INCORPORATION

#### ARTICLES OF INCORPORATION

EFFECTIVE FEBRUARY 4, 1981

##### ARTICLE I (Name)

The name of the corporation is LAND IMPROVEMENT CONTRACTORS OF AMERICA, INC. It is not-for-profit association incorporated under the General Not-for-Profit Corporation Act of the State of Illinois. Its headquarters is in Maywood, Illinois, or elsewhere as may be specified by its Board of Directors.

##### ARTICLE II (Objectives)

The purpose or purposes for which the corporation is organized are:

- A. To be and serve as an organization, association or society instituted for the purpose of mutual help, not conducted for profit and comprised of:
- (1) Not-for-profit corporations, unincorporated associations and other organizations, hereinafter referred to as State Chapters, organized within one or more states whose members are:
    - (a) Persons, firms, corporations, associations and organizations, hereinafter referred to as land improvement contractors, engaged in land improvement and other contracting. Land improvement contracting is work performed by contractors to promote soil, land, natural resource conservation and rehabilitation and water conservation and to control or prevent soil erosion, depletion and misuse of natural resources and soil and water pollution and contamination.
    - (b) Persons, firms, corporations, associations or organizations that manufacture or sell machinery, equipment, materials, supplies or services to land improvement contractors or State Chapters.
    - (c) Persons, firms, corporations, associations or organizations that have demonstrated a definite and ascertainable interest in soil, water and natural resource conservation.
  - (2) Persons, firms, corporations, associations or organizations that manufacture or sell machinery, equipment, materials, supplies, goods or services to land improvement contractors, State Chapters or to the corporation.
  - (3) Persons, firms, corporations, associations or organizations that have demonstrated a definite and ascertainable interest in soil, water and natural resource conservation.
  - (4) Land improvement contractors that reside in or have their principal place of business in a state that is not included in a State Chapter.
- B. Promote and encourage soil, land, natural resource conservation and rehabilitation and water conservation and the control and prevention of soil erosion, depletion and misuse of natural resources and soil and water pollution and contamination.

- C. Encourage and urge State Chapters to encourage, urge and require their members that are engaged in land improvement and other contracting to carry on their work in a skillful, sound and efficient manner so that contouring, terracing, surface and subsurface drainage, water impoundment, land leveling, tillage, constructing and working on irrigation systems, control of soil and water contamination and pollution, land rehabilitation, practices to prevent misuse of natural resources and any other work or practices carried on to provide soil, water and natural resource conservation will meet high and acceptable standards and reflect credit on the corporation, its members, members of State Chapters and land improvement contractors in general.
  
- D. To conduct or have conducted research and inquiry into fields and areas where the results of said inquiry and research may promote soil, land, water and natural resource conservation and control or prevent soil erosion, depletion and misuse of natural resources and soil and water pollution and contamination and to:
  - (1) "Disseminate information in respect thereto;
  
  - (2) "Aid the public generally in understanding the results of said research and inquiry, and
  
  - (3) "Publish or otherwise make public from time to time the results of said research or inquiry.
  
- E. To collect information, news and statistics of every kind and nature that relates to the purposes and objectives of the corporation, its members and members of State Chapters, either by research, investigation or by employing others for any such purpose; to classify, analyze and digest such information, news and statistics; to print, publish, broadcast and disseminate such information, news and statistics that relates to the purposes, objectives, problems and accomplishments of the corporation, its members and members of State Chapters, either as literature or other printed matter, or by lectures or otherwise at meetings and conferences, or by radio or television broadcasting or other mass media.
  
- F. To promote the use by land improvement contractors of sound and uniform accounting practices and methods of ascertaining and evaluating costs.
  
- G. To conduct and encourage State Chapters to conduct educational programs to:
  - (1) Enable land improvement contractors to operate their businesses more efficiently.
  
  - (2) Promote safety and thereby prevent or reduce liability to land improvement contractors attributable to personal injury or property damage.
  
  - (3) Provide information to land improvement contractors on up-to-date practices and techniques that can be used in their business and developments that affect their business.
  
- H. Provide or enter into agreements with persons, firms, corporations, associations or organizations to provide insurance and other services to State Chapters and land improvement contractor members of State Chapters and annually or more frequently assess those receiving insurance and other services on an equitable basis, an amount sufficient to defray the cost to the corporation in providing the insurance and other service.

- I. Sponsor or conduct programs, projects and activities for its members and members of State Chapters and annually or more frequently assess those participating in the projects, programs and activities, on an equitable basis, an amount sufficient to defray the cost to the corporation of sponsoring or conducting the projects, programs and activities.
- J. To purchase, own, lease, conduct, operate, maintain and dispose of newspapers, magazines, other publications or other means and facilities or means of disseminating information.
- K. To enter into agreements with other corporations, individuals, partnerships, associations, cooperatives and other organizations for the purchase, sale or exchange of real estate, tangible and intangible personal property and services of every kind, description and nature required by the corporation to fulfill and accomplish its purposes and objectives.
- L. To become a member of, cooperate with and enter into agreements with any corporations, organization or association whose purposes and objectives are altogether or in part, similar to those of the corporation, its members and members of State Chapters.
- M. To cooperate with and enter into agreements with the United States government and any department, bureau, board, commission, division or agency thereof, or the various states and any political subdivision department, bureau, board, commission, division or agency thereof, any and all units of local government and institutions of higher learning and other educational institutions for mutual benefit on problems, programs and activities that will affect or enhance the objects and purposes of the corporation, its members, members of State Chapters and land improvement contractors in general.
- N. To make a thorough study of proposed and pending measures introduced or to be introduced into the United States Congress that may affect the corporation, State Chapters or members of State Chapters and inform the members of the Congress and members of the executive branch of the government of the United States of the effect that the measures may have on the corporation, State Chapters, members of State Chapters and land improvement contractors in general, if they become law.
- O. Make a thorough study of existing or proposed rules or regulations adopted by or under consideration by any department, agency, bureau, board, commission or division of the government of the United States, and suggest amendments or changes in the existing or proposed rules and regulations, and advise and inform officials of these various governmental entities of the effect that existing or proposed rules and regulations or amendments thereto would have on the corporation, its members or land improvement contractors in general.
- P. To assist State Chapters in any way lawfully possible, including assistance in developing, promoting and implementing programs, projects and activities that will enable them to better serve their members and make them a stronger and more effective organization.

## APPENDIX F

NATIONAL TRANSPORTATION SAFETY BOARD  
PIPELINE ACCIDENT REPORTS INVOLVING  
EXCAVATION DAMAGE

1.	Burlington, Iowa	PAR-70-1
2.	Annandale, Virginia	PAR-72-4
3.	Lake City, Minnesota	PAR-73-1
4.	Coopersburg, Pennsylvania	PAR-74-1
5.	Conway, Kansas	PAR-74-6
6.	Devers, Texas	PAR-76-5
7.	Romulus, Michigan	PAR-76-7
8.	Los Angeles, California	PAR-76-8
9.	Cartwright, Louisiana	PAR-77-1
10.	Atlanta, Georgia	PAR-78-3
11.	Kansas City, Missouri	PAR-78-5
12.	Donnellson, Iowa	PAR-79-1
13.	Offshore, New Orleans, Louisiana	PAR-80-1
14.	Stanardville, Virginia	PAR-80-3
15.	Washington, D.C.	PAR-80-4
16.	Cordele, Georgia	PAR-80-5
17.	Puerto Rico	PAR-80-6
18.	San Francisco, California	PAR-82-1
19.	Ackerley, Texas	PAR-82-2
20.	Centralia, Missouri	PAR-82-3
21.	Portales, New Mexico	PAR-83-1