

IW0081

PACIFICORP  
TECHNICAL SERVICES REPORT  
RODGER C. FRY

CENTRAL ENGINEERING  
ANNUAL SUBSIDENCE MONITORING REPORT  
EAST/TRAIL MOUNTAIN PROPERTIES  
1999



MARCH 30, 2000

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March 29, 2000

Utah Coal Regulatory Program  
 Division of Oil, Gas and Mining  
 1594 West North Temple, Suite 121 0  
 Box 145801  
 Salt Lake City, Utah 84114-5801

Attention: Ms. Pamela Grubaugh-Littig

*Incoming*

Re: **Submittal of Annual Report for 1999, PacifiCorp, Trail Mountain Mine,**  
~~ACT/015/009~~, Cottonwood Mine, ACT/015/019, Deer Creek Mine,  
 ACT/015/018, Des-Bee-Dove, ACT/015/017, Emery County, Utah.

PacifiCorp, by and through its wholly-owned subsidiary, Energy West Mining Company as mine operator, herewith submit the Annual Report for 1999.

Please find enclosed two copies each of all forms and activities of the above mines related to coal mining and reclamation monitoring during the 1999 year, including the Subsidence and Hydrologic reports.

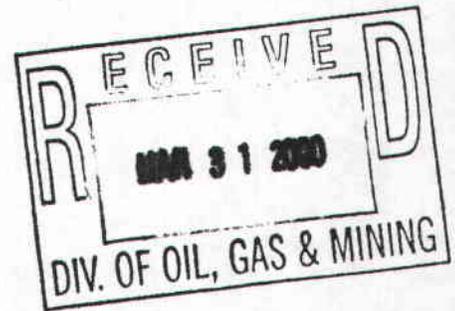
If there are any questions or concerns please call Dennis Oakley at 687-4825.

Sincerely,

Charles A. Semborski  
 Geology/Environmental Supervisor

cc: Blake Webster  
 Carl Pollastro  
 (File)

File in: 01500092000, Incoming  
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J:\Environmental\PERMITS\Annualreports\99annual\ANNUAL99.wpd

Huntington Office:  
 (435) 687-9821  
 Fax (435) 687-2695  
 Purchasing Fax (435) 687-9092

Deer Creek Mine:  
 (435) 687-2317  
 Fax (435) 687-2285

Trail Mountain Mine:  
 (435) 748-2140  
 Fax (435) 748-5125

**PACIFICORP**  
**SUBSIDENCE MONITORING PROGRAM**  
**ANNUAL REPORT FOR 1999**

**March, 2000**

**Submitted to:**

**United States Department of the Interior**  
**Office of Surface Mining**  
**Minerals Management Service**  
**Utah Division of Oil, Gas and Mining**

**RECEIVED**

**MAR 31 2000**

**DIVISION OF**  
**OIL, GAS AND MINING**

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APPENDICES

Subsidence Map

Raw Data

Des-Bee-Dove Mines

Deer Creek Mine

Wilberg/Cottonwood Mine

Trail Mountain Mine

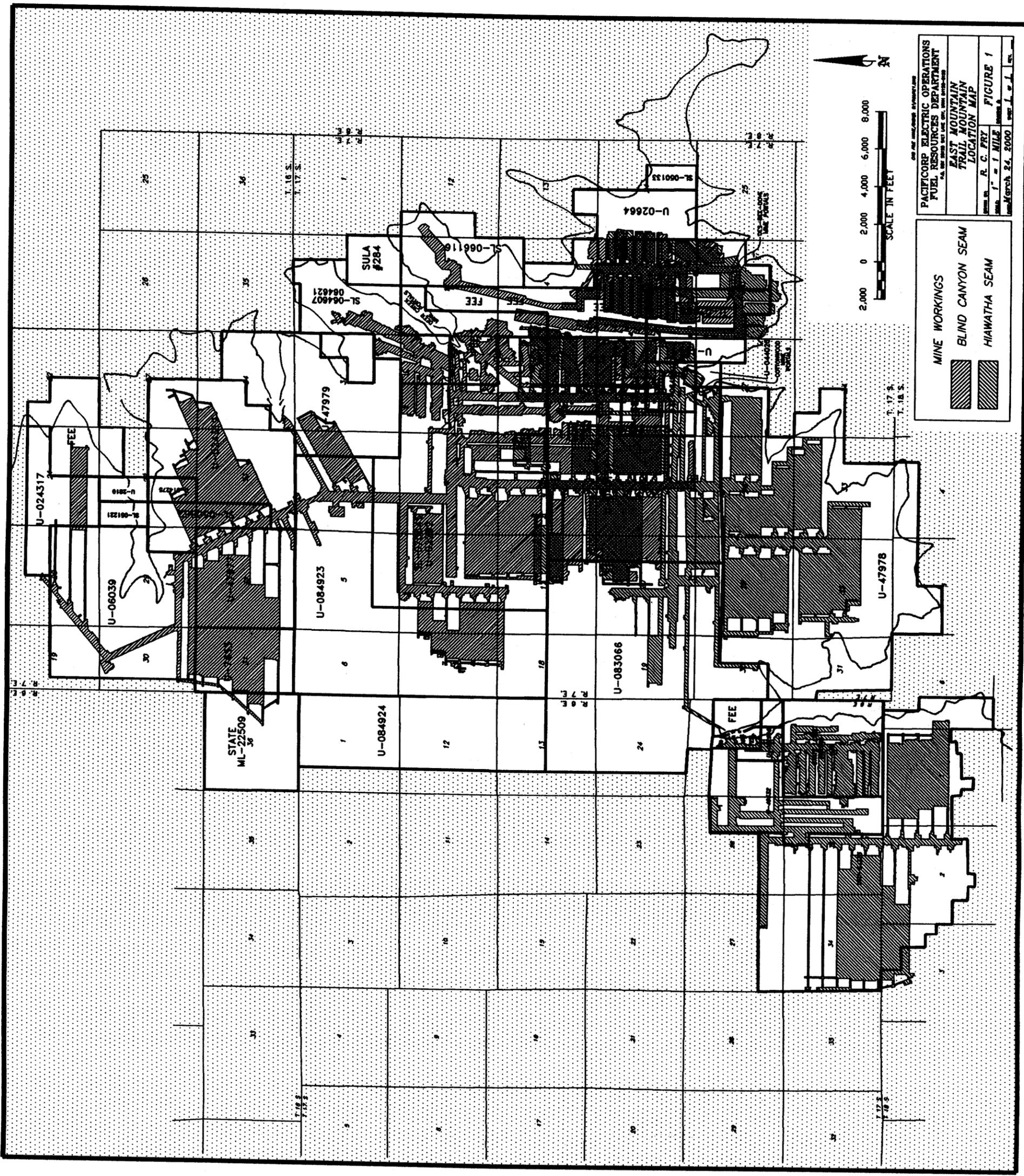
Spring Map with 5-Year Mine Plan Showing Subsidence

Cliff Stability Survey Targets & Transects

## INTRODUCTION

PacifiCorp's East Mountain/Trail Mountain Subsidence Monitoring Study is an ongoing project designed to detect, observe, and report the effects of mining-induced subsidence above the Deer Creek, Wilberg/Cottonwood, Des-Bee-Dove and Trail Mountain Mines (see Figure 1). This, the eighteenth such annual report submitted, covers the period between August 31, 1998 and August 31, 1999.

The initial report submitted in 1982 details the monitoring methods used in the study; therefore, they are not discussed in depth here. Briefly, PacifiCorp uses aerial photogrammetric survey methods and annual helicopter reconnaissance flights to monitor subsidence. The aerial photogrammetry work is contracted to a mapping company. Contracts for the work are bid and awarded for a three year period. This is the third contractor that has been involved with the project. Between 1982 and 1987 the work was contracted through Intermountain Aerial Surveys. They established reading points on generally a 200 foot grid but adjusted the location of each point to be on easily reproducible locations. Between 1988 and 1990 the work was contracted to Maps Inc. Because of the type of equipment it was better for them to establish uniform grid points on 200 foot spacing. In 1991 the work was contracted to MapCon Mapping Consultants. The owners of this company were previously employed by Intermountain Aerial Surveys and felt that better results could be obtained by using the original grid established by Intermountain Aerial Surveys. Therefore, they reverted back to the original monitoring grid. A change in the method of reading the aerial photographs may result in some slight changes in



PACIFICORP ELECTRIC OPERATIONS  
 FUEL RESOURCES DEPARTMENT  
 EAST MOUNTAIN TRAIL MOUNTAIN LOCATION MAP  
 DRAWN BY: R. C. FRY  
 DATE: March 24, 2000  
 SHEET: 1 OF 1

MINE WORKINGS  
 BLIND CANYON SEAM  
 HIAWATHA SEAM

SCALE IN FEET  
 2,000 0 2,000 4,000 6,000 8,000

FIGURE 1

measured subsidence in some areas. Also, it is crucial that accurate paneled control be surveyed and recorded on the photographs to enable close subsidence readings. Between 1987 and 1990, some of the survey control in the more difficult to reach areas were not properly paneled and could not be identified on the photographs. It appears that this diminished the precision of the subsidence reading in some of the areas during those years.

Using the aerial photographs derived from a flight conducted on September 30, 1999, elevations were measured at 19,193 different points. These elevations were then compared with the baseline survey elevations measured from the aerial photos collected in 1980, 1986, 1987 and 1994. The difference in elevation constitutes the amount of subsidence that has occurred. A map of all areas of subsidence is included in the appendix to this report. The raw data is included in the appendix of this report on a 3 ½ inch disk in an ASCII file called 99SUB.TXT. The photography completed on August 29, 1998 included color Infra-red and included all of the areas where longwall or room and pillar extraction has been completed.

A helicopter reconnaissance flight June 29, 1999 revealed no new fracturing or visible signs of subsidence in any of the monitored areas. Prior to PacifiCorp's acquisition of the Trail Mountain Mine from ARCO Coal Co., they monitored subsidence using on the ground monumentation. Nowhere did that monitoring identify subsidence greater than a few tenths of feet. Substantial longwall mining has now occurred in the Trail Mountain Mine.

As a result, subsidence has been detected and is reported herein.

## Location

Figure 2 shows all areas above PacifiCorp's coal mines which have potential for mining-induced subsidence. In 1999, twenty-five areas of subsidence were monitored and are reported herein. In areas where subsidence has been detected, data is shown in the form of contour maps and profiles. Both indicate elevation change from pre-mining elevations. The profile figures present data for all years monitored with the exception of the 1990 data. The computer data files from that year were damaged rendering them unreadable. At this time it is felt that enough data exists from the other years and the task of regenerating that data is not warranted. In many areas of subsidence the angle-of-draw has been calculated and reported; however, in the majority of cases the angle should not be considered the actual final angle-of-draw due to several factors. For example, the zone of subsidence to date may be small and contained within the underlying mined area, suggesting that the subsidence has not yet reached its maximum extent. Also, many mined sections are surrounded by other older workings which influence the calculation. In a few areas where the mined-out workings are surrounded by burned coal, the failure of clinker beds promotes subsidence outside the mined area resulting in an angle-of-draw greater than might be expected.



## Area 1

### Deer Creek 9th East - Wilberg 1st Right

Subsidence in Area 1 was first documented in the 1981 Subsidence Monitoring Report submitted in 1982. The relationship of the subsidence to the underlying Deer Creek and Wilberg mine workings is shown in Figures 3, 4, and 5. Each map covers the same area, Figure 5 being a contour map of subsidence on the surface over the mine workings depicted in the other two figures. The most recent mining in this area occurred in the Wilberg 1st Right section in June 1984.

Figures 6 and 7 are north to south and west to east profiles showing the amount of subsidence in this area during the past sixteen years. The location of each line is shown on Figure 5. The area has seen little change since 1985 and appears to have totally stabilized. Maximum subsidence remains at about twenty-eight (28) feet. A detailed look from a helicopter revealed that the subsidence maximum is located on a steep slope, about 200 feet south of the southernmost mining, where a good-sized rotational slump has occurred. The workings here are also surrounded by burned coal. It is probable that the combination of steep slopes and crushing of clinker beds has allowed subsidence to occur well outside the area of mine workings. An inspection of the area from the ground indicates that many of the open fractures forming the graben-like structure have begun to heal and fill in with soil.

Calculation of the angle-of-draw is complicated because the workings are nearly surrounded by faults, burned coal, and other mine workings. Due to this complexity, angle-of-draw was not determined for Area 1.

In the summer of 1997, some of the fractures in this area were reclaimed per the U. S. Forest Service recommendations. This reclamation consisted of knocking down the abrupt escarpments and filling in the fractures in accessible areas. The top soil was then evenly distributed and the area re-seeded. This reclamation was completed by September 1, 1997 and encompassed 1.5 acres. Visual inspection of the area in the summer of 1999 indicated that the vegetation has grown over the disturbed area to where it blends in with the surrounding areas.

There are no springs, and no hydrologic impacts due to mining have been observed at this location.



E 2,110,000

E 2,100,000

# AREA 1

MINE WORKINGS UPDATED TO : 10/1/1981



**WILBERG COAL-MINE**  
EMERY COUNTY, UTAH

1st RIGHT  
MINE WORKINGS

UTAH POWER & LIGHT COMPANY  
DEPARTMENT OF MINING & EXPLORATION

DATE: 8/2/81 BY: J.J. HENNINGER  
SCALE: 1" = 200'

N 360,000

WATER GAUGE  
G.P.M. AT 3

DATA:  
JOY & DA. EXHAUST FAN  
4150 VOLTS 40 AMP. 3 PHASE  
FULL CAPACITY 118 AMP.  
1175 R.P.M. 1000 H.P.  
BLADE SETTING 22°  
RELIANCE 1000H.P. MOTOR  
500 H.P. DIESEL BACKUP

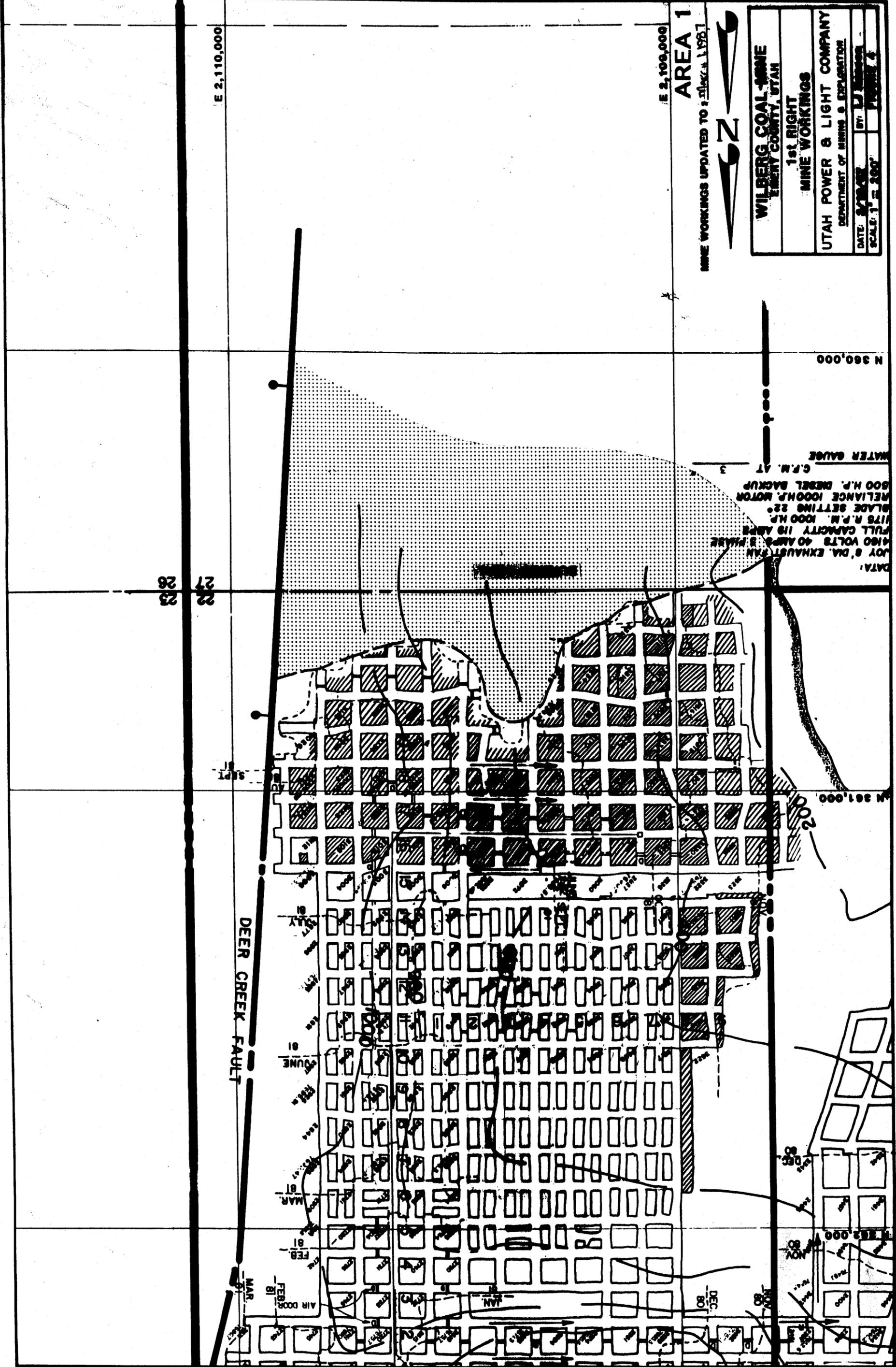
N 361,000

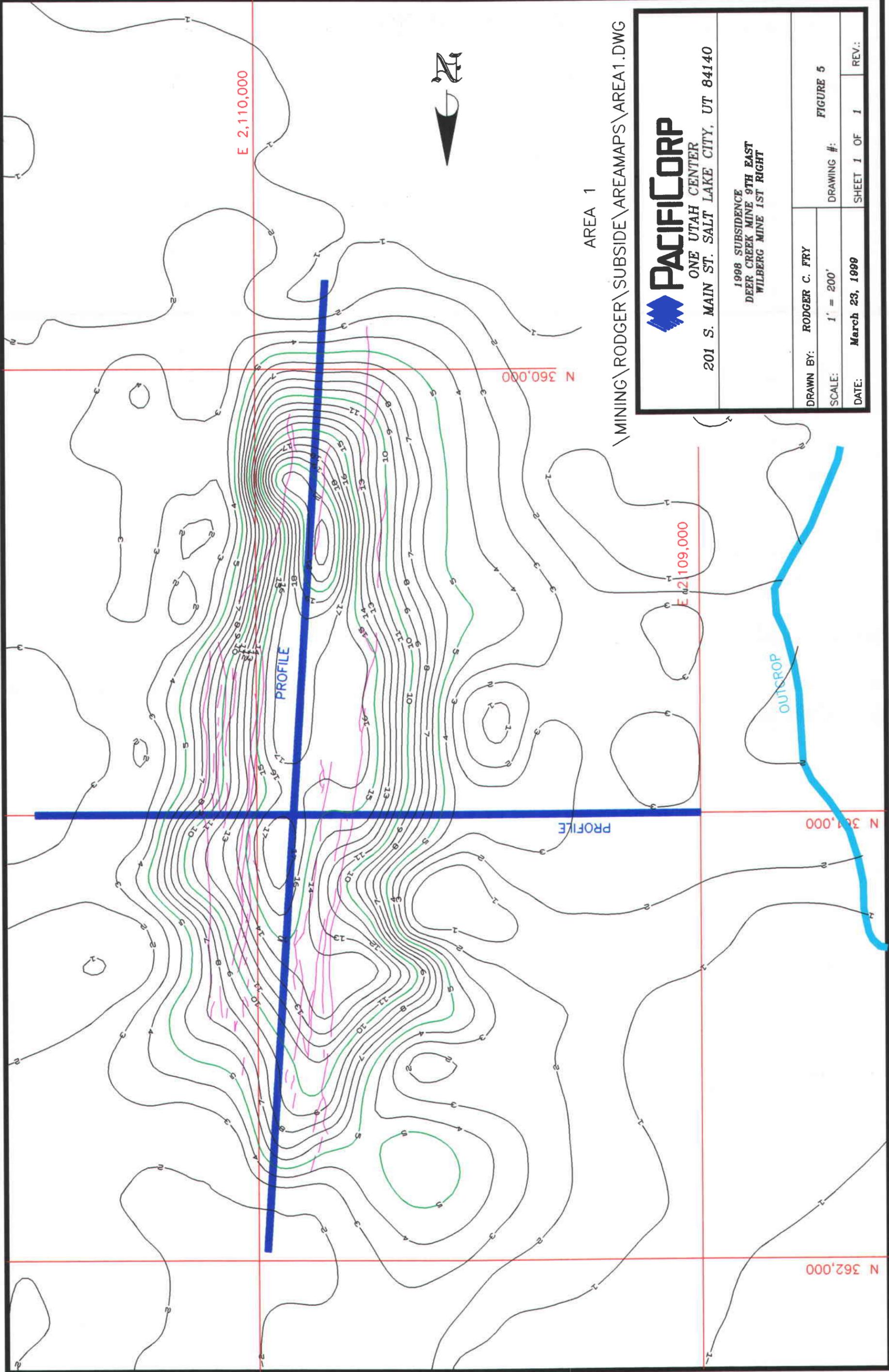
N 362,000

2823

2723

DEER CREEK FAULT





AREA 1

\\MINING\RODGER\SUBSIDE\AREAMAPS\AREA1.DWG



ONE UTAH CENTER  
201 S. MAIN ST. SALT LAKE CITY, UT 84140

1998 SUBSIDENCE  
DEER CREEK MINE 9TH EAST  
WILBERG MINE 1ST RIGHT

DRAWN BY: RODGER C. FRY	FIGURE 5
SCALE: 1" = 200'	DRAWING #:
DATE: March 23, 1999	SHEET 1 OF 1
	REV.:

# Area 1 Subsidence Profile South - North

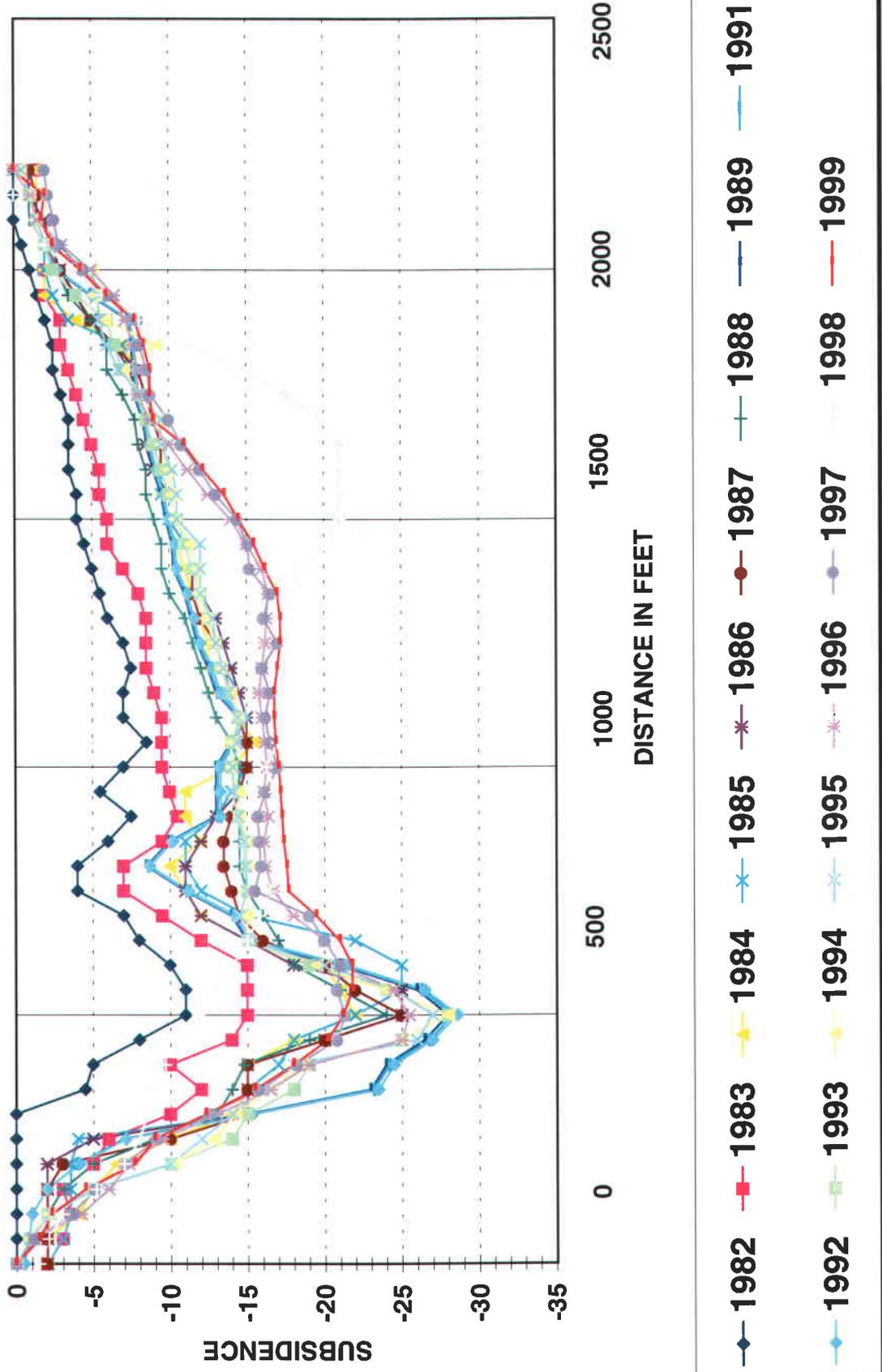


Figure 6

# Area 1 Subsidence Profile West - East

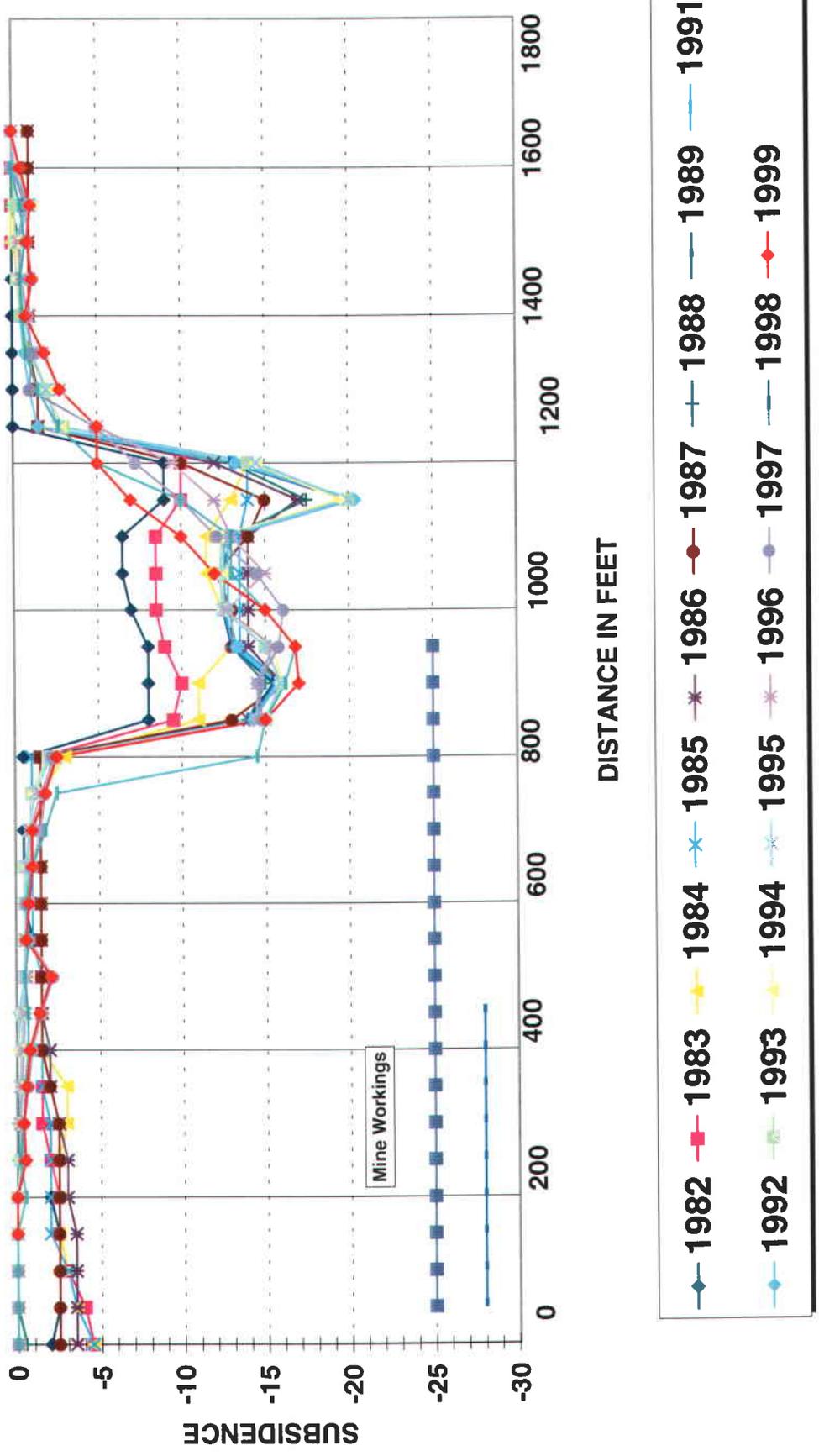


Figure 7

## Area 2

### Deer Creek 5th, 6th, 7th, and 8th East Longwall Panels

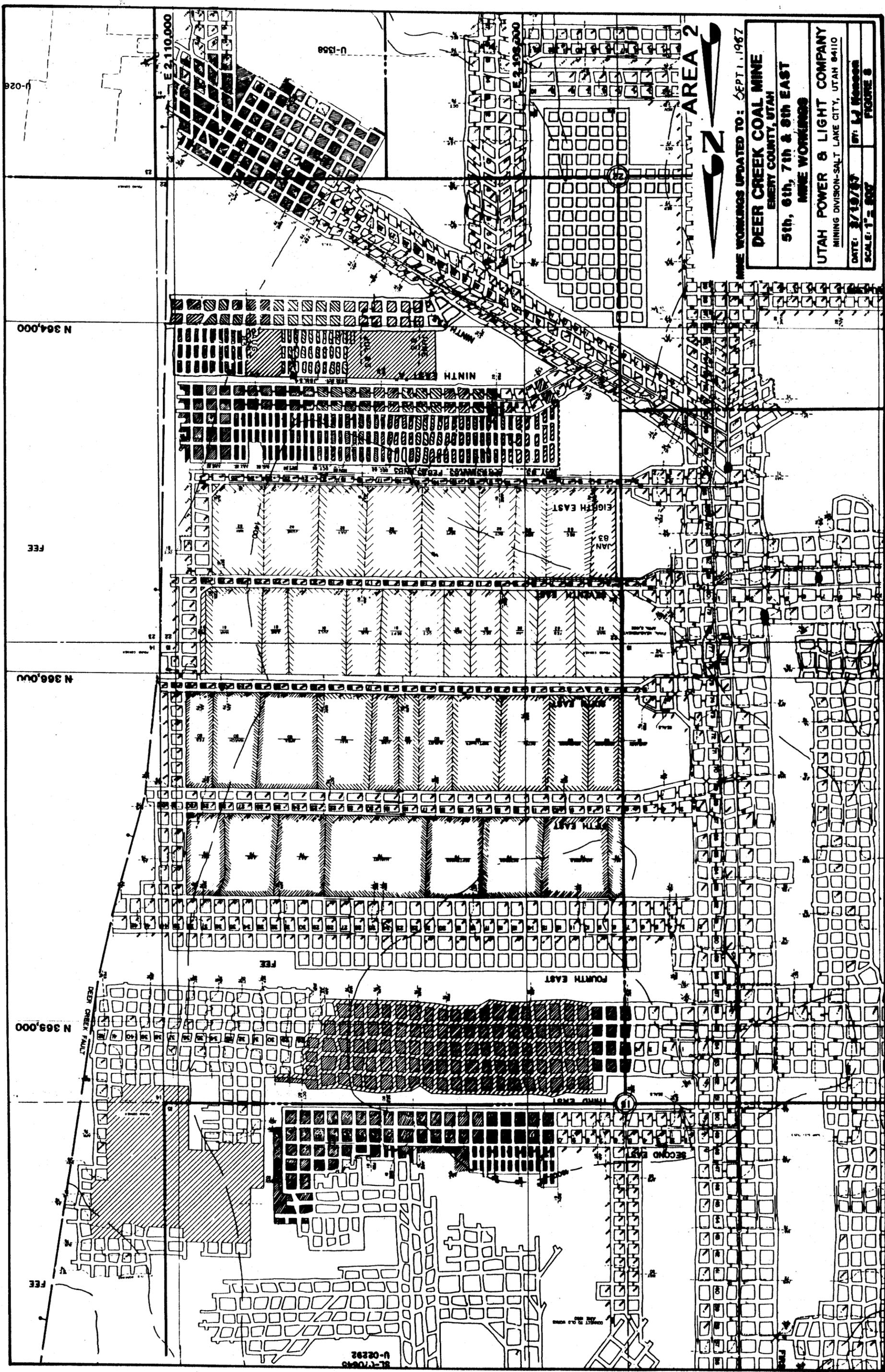
### Wilberg 3rd through 13th Right Panels

Mining in the Deer Creek Mine in Area 2 was completed by February 1985 (Figure 8). Coal extraction in the underlying Wilberg Mine 3rd and 4th Right panels was completed between September 1987 and the end of January 1988 (Figure 9).

Maximum subsidence in Area 2 has stabilized at <13 feet in one area above the center of the multiple seam mining area (Figure 10). The subsidence profiles (Figures 11 and 12) indicate that the subsidence has been stable for the past 7 years or more. Neither PacifiCorp nor other contracted personnel have detected any surface fissures or other visible disturbance in the area.

Angle-of-draw has been calculated where possible. On the eastern side of Area 2 the angle is influenced by the Deer Creek Fault and the adjacent Little Dove Mine workings across the fault; thus, no angle was calculated. On other sides it ranges from less than zero to 11 degrees.

No springs have been identified over the subsidence area but two springs, one-fourth to one-third mile to the west, show no effects from mining (see Hydrologic Monitoring Report, 1999).



**AREA 2**

MINE WORKINGS UPDATED TO: SEPT. 1, 1967

**DEER CREEK COAL MINE**  
 EMERY COUNTY, UTAH

5th, 6th, 7th & 8th EAST  
 MINE WORKINGS

UTAH POWER & LIGHT COMPANY  
 MINING DIVISION-SALT LAKE CITY, UTAH 84110

DATE: 3/19/67 BY: L.J. HANSEN  
 SCALE: 1" = 500' FIGURE 8



U-0282

E 2,110,000

N 364,000

FEE

N 366,000

N 369,000

DEER CREEK FAULT

U-0282

U-1356

E 2,108,000

NINTH EAST

EIGHTH EAST

SEVENTH EAST

SIXTH EAST

FIFTH EAST

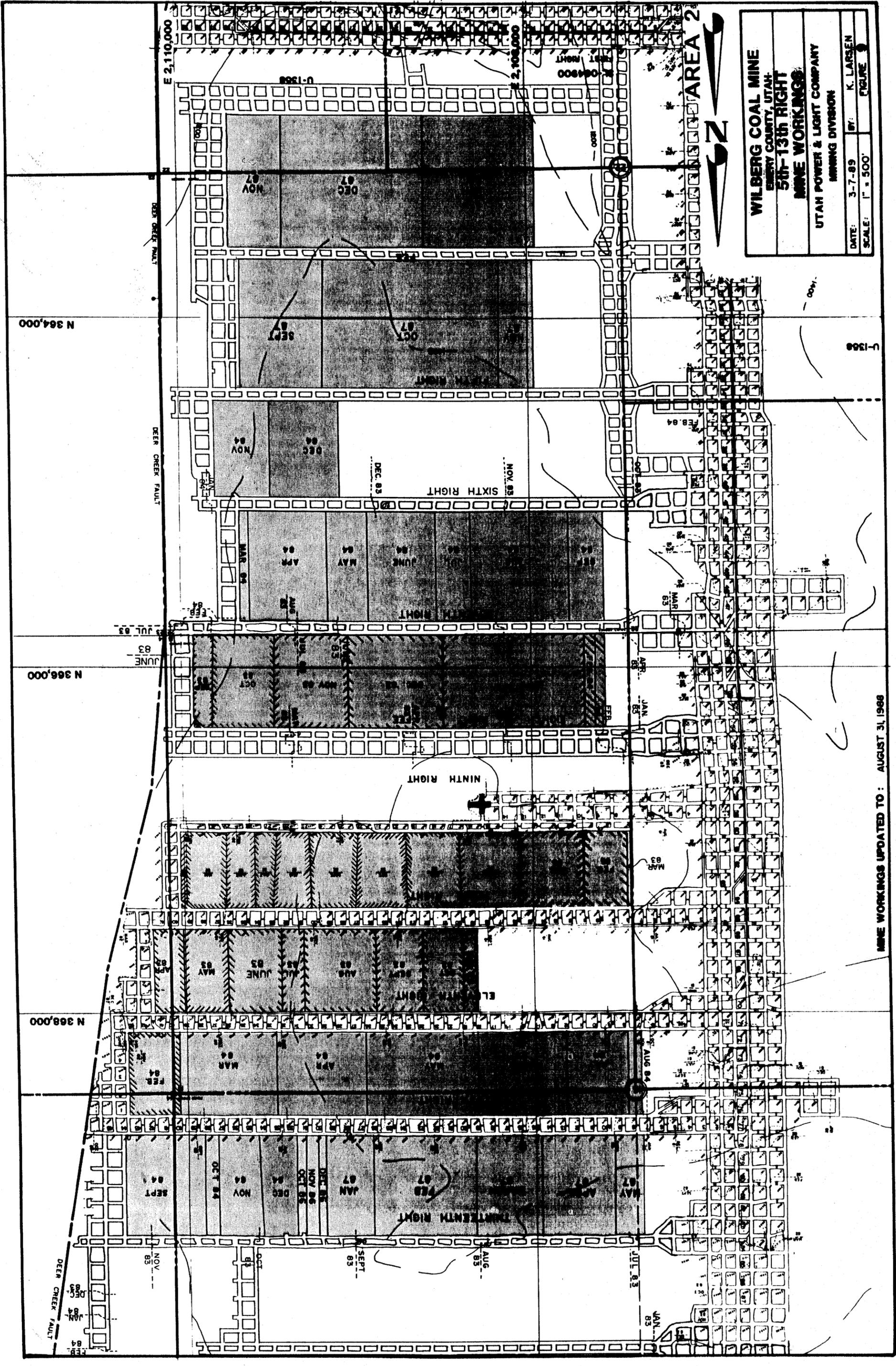
FOURTH EAST

THIRD EAST

SECOND EAST

FIRST EAST

U-0282



AREA 2

<b>WILBERG COAL MINE</b>	
EMERY COUNTY, UTAH	
<b>501-13th RIGHT</b>	
<b>MINE WORKINGS</b>	
UTAH POWER & LIGHT COMPANY	
MINING DIVISION	
DATE: 3-7-89	BY: K. LARSEN
SCALE: 1" = 500'	FIGURE 9

MINE WORKINGS UPDATED TO : AUGUST 31, 1988

MINING/RODGER/SUBSIDE/AREAMAPS/AREA2.DWG



ONE UTAH CENTER  
201 S. MAIN ST. SALT LAKE CITY, UT 84140

1999 SUBSIDENCE  
DEER CREEK MINE 5TH - 8TH EAST  
WILBERG MINE 3RD - 13TH RIGHT

DRAWN BY: RODGER C. FRY

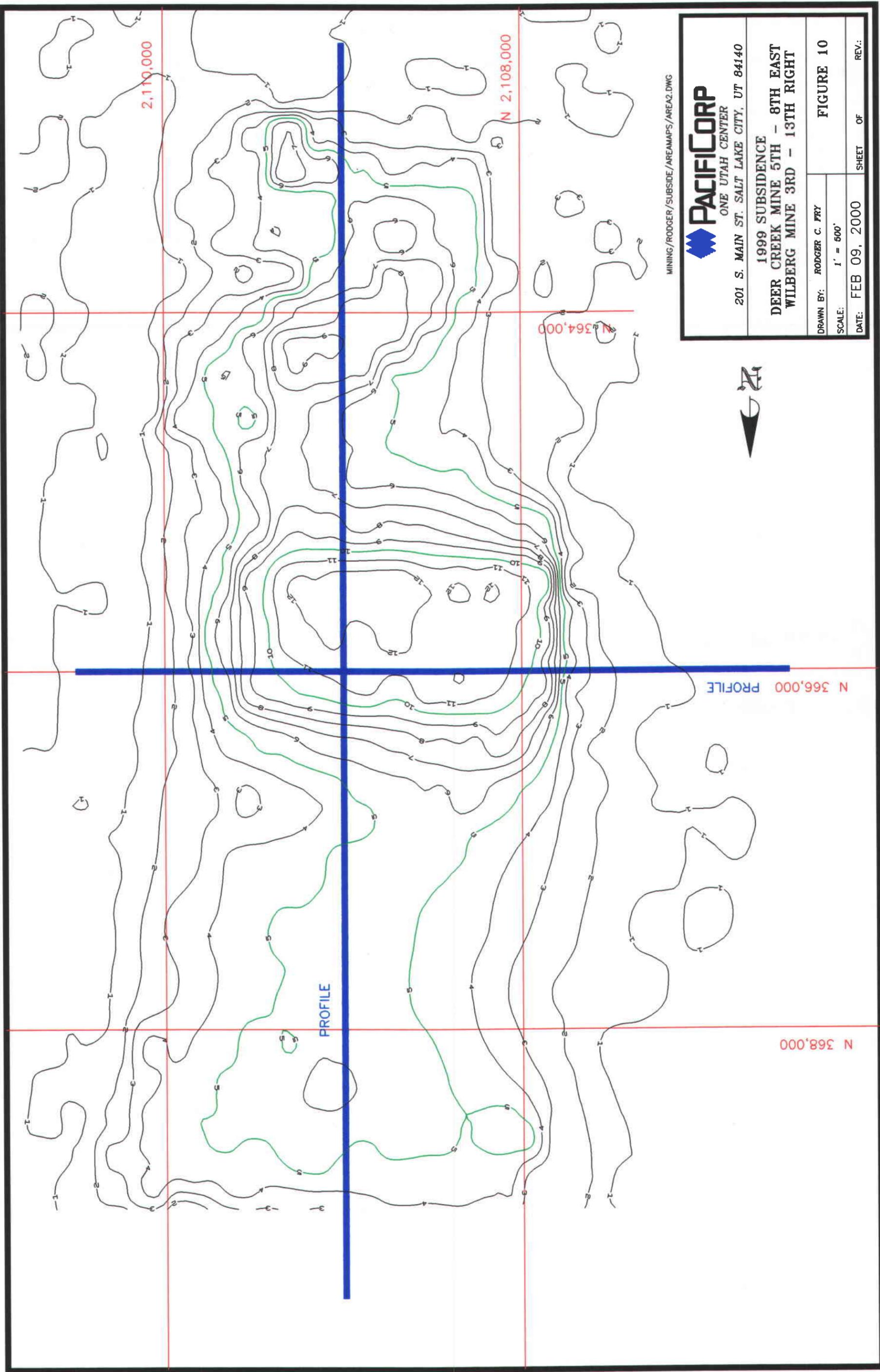
SCALE: 1" = 500'

DATE: FEB 09, 2000

SHEET OF

REV.:

FIGURE 10



# Area 2 Subsidence Profile North - South

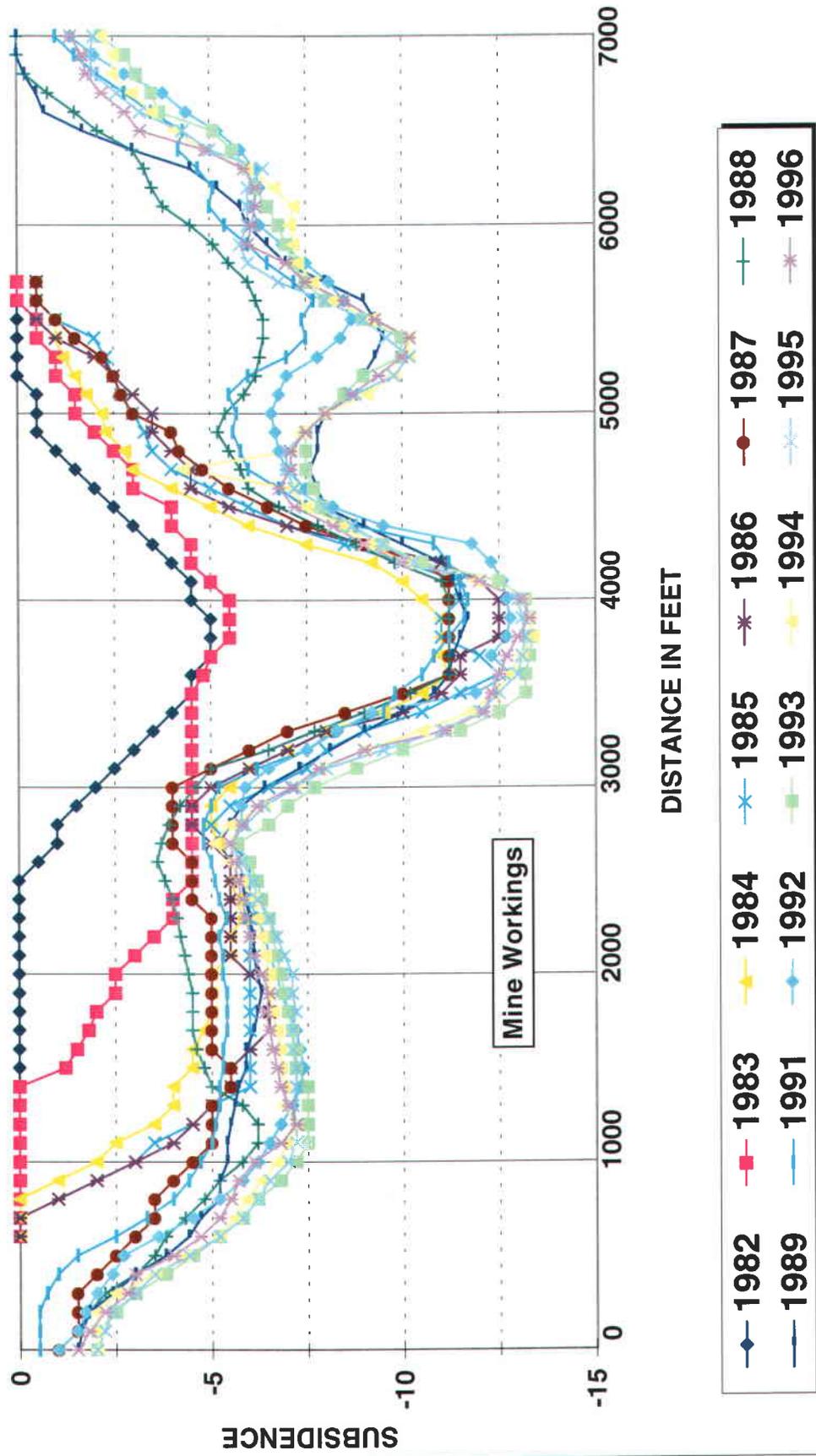


Figure 11

# Area 2 Subsidence Profile West - East

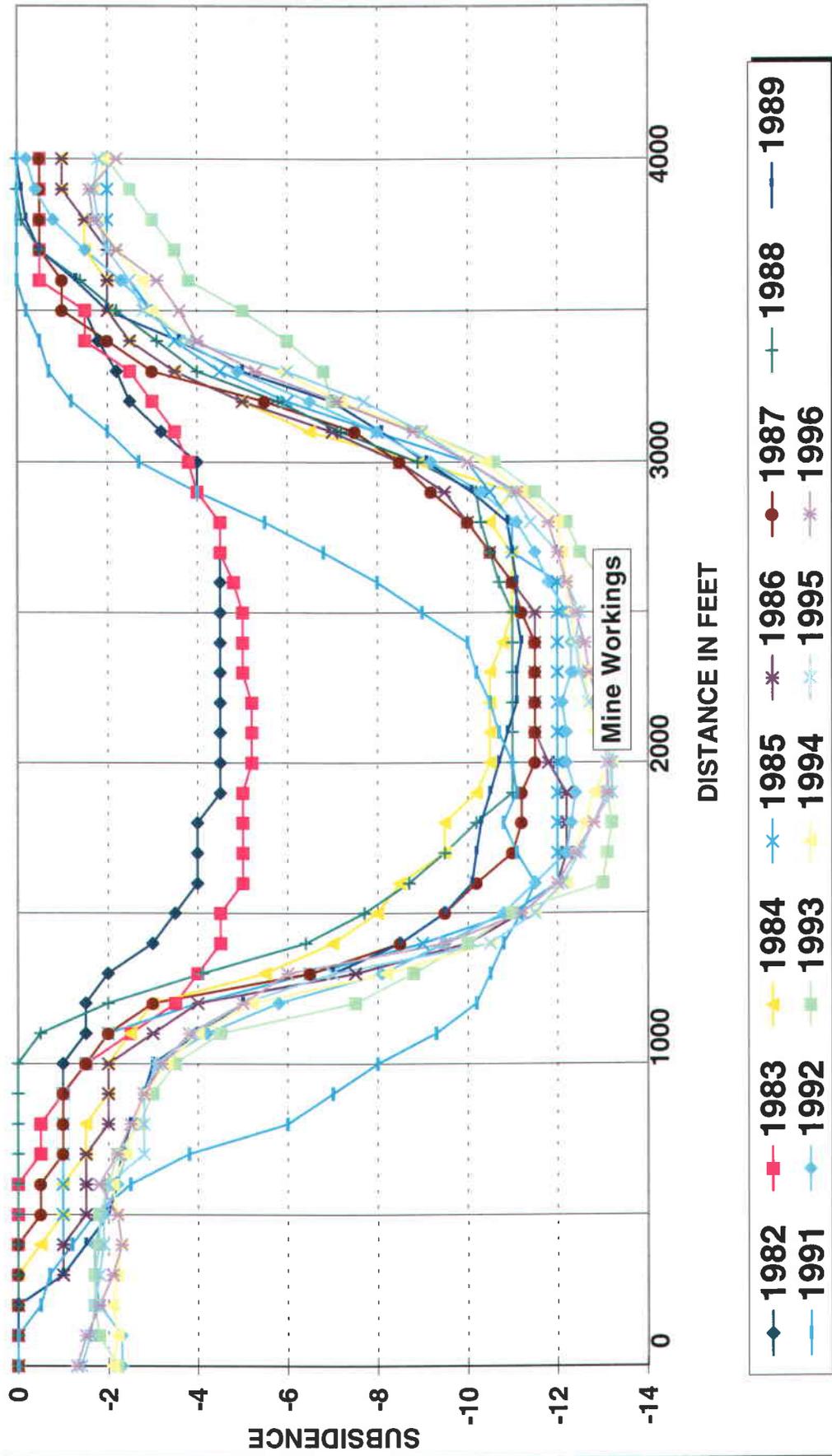


Figure 12

### Area 3

#### Deer Creek 1st North Area

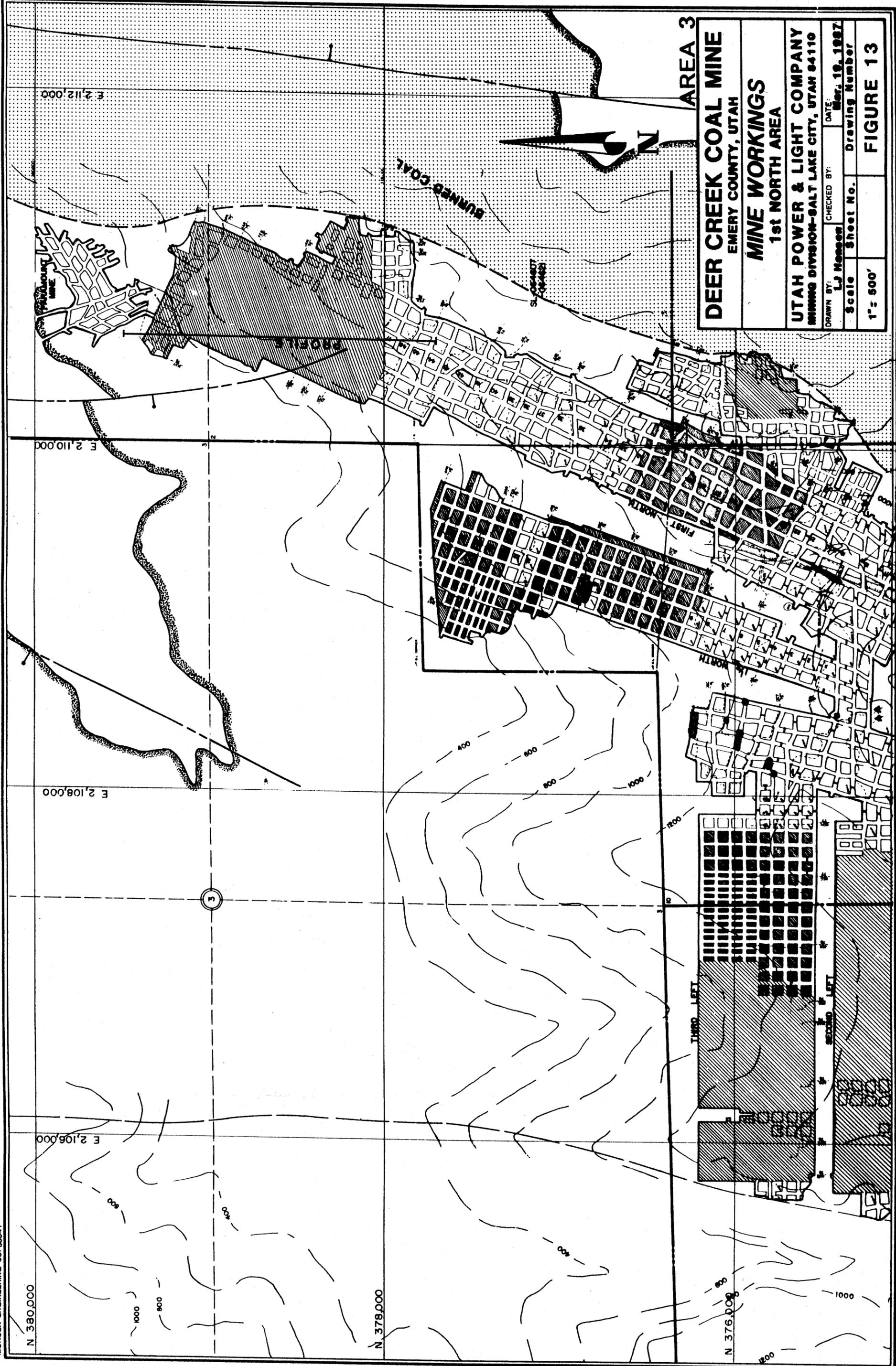
Most of the 1st North section of the Deer Creek Mine was abandoned and sealed in 1978 after being mined out. The southern portion is still open and may be used for access to a block of coal which lies to the west. Pillar extraction in the 3rd Left and 1-1/2 North sections was completed early in 1980 (Figure 13).

The subsidence above 1st North occurs on a narrow ridge capped by a highly fractured sandstone. The subsidence measured is depicted in Figure 13A. Figure 14 is a profile of total subsidence as it occurred along a line of points above the workings. The subsidence in area 3 has shown no significant change in the past 6 years.

A Helicopter survey in 1999 did not reveal any new surface cracks or new areas of cliff failure.

No angle-of-draw was determined due to the steep slopes, burned coal, and mode of subsidence.

The strata surrounding and above the 1st North workings are generally dry; therefore, mining has not adversely affected the groundwater.



AREA 3

# DEER CREEK COAL MINE

EMERY COUNTY, UTAH

## MINE WORKINGS

1st NORTH AREA

UTAH POWER & LIGHT COMPANY  
MINING DIVISION-SALT LAKE CITY, UTAH 84110

DRAWN BY: L.J. Messer      CHECKED BY:      DATE: Mar. 19, 1967

Scale      Sheet No.      Drawing Number

1" = 500'           **FIGURE 13**

N 380,000

N 378,000

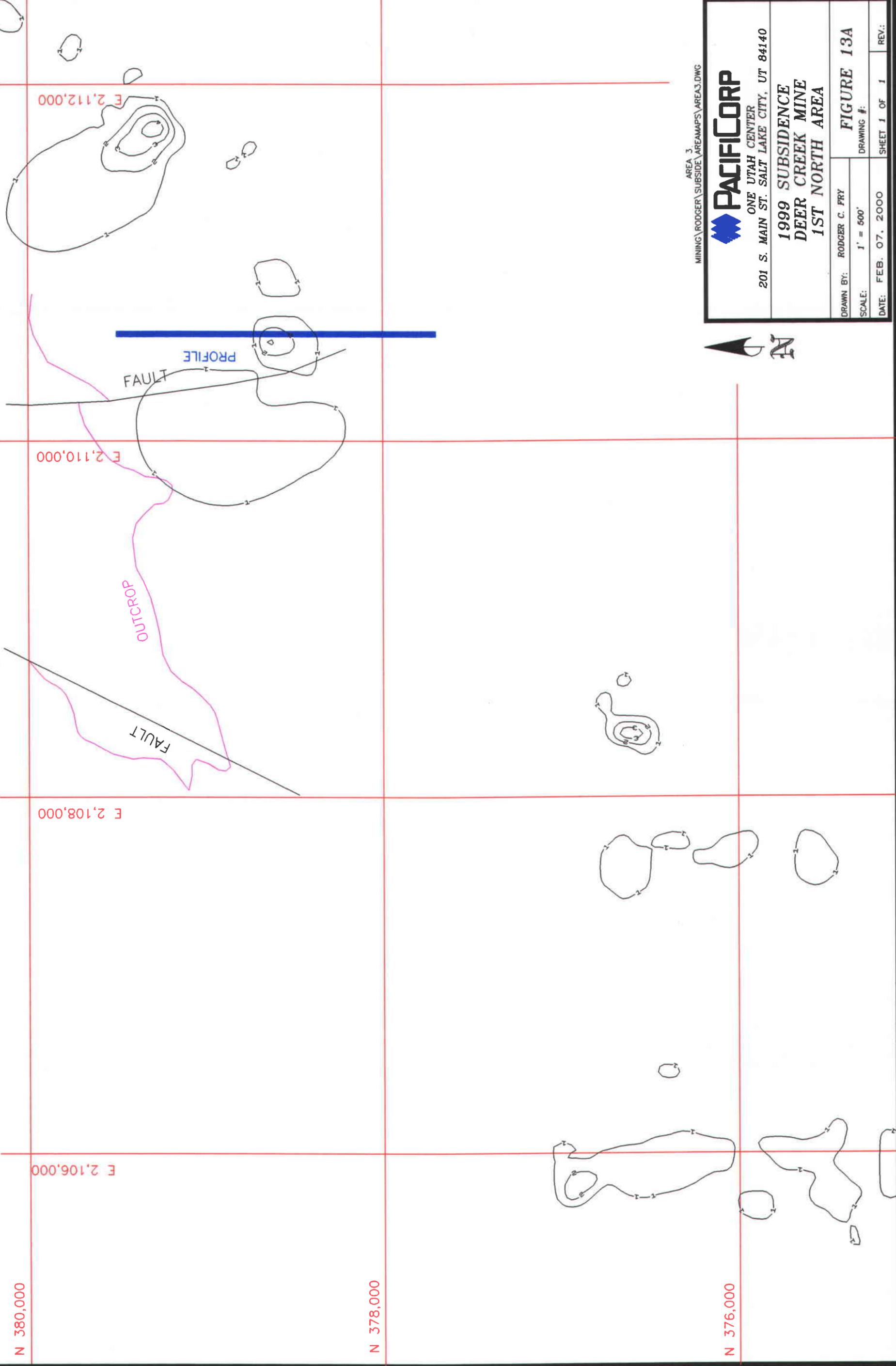
N 376,000

E 2,106,000

E 2,108,000

E 2,110,000

E 2,112,000



MINING\RODGER\SUBSIDE\AREAMAPS\AREA3.DWG AREA 3



ONE UTAH CENTER  
201 S. MAIN ST. SALT LAKE CITY, UT 84140

1999 SUBSIDENCE  
DEER CREEK MINE  
1ST NORTH AREA



DRAWN BY: RODGER C. FRY

SCALE: 1" = 500'

DATE: FEB. 07, 2000

FIGURE 13A

DRAWING #:

SHEET 1 OF 1

REV.:

# Area 3 Subsidence Profile North - South

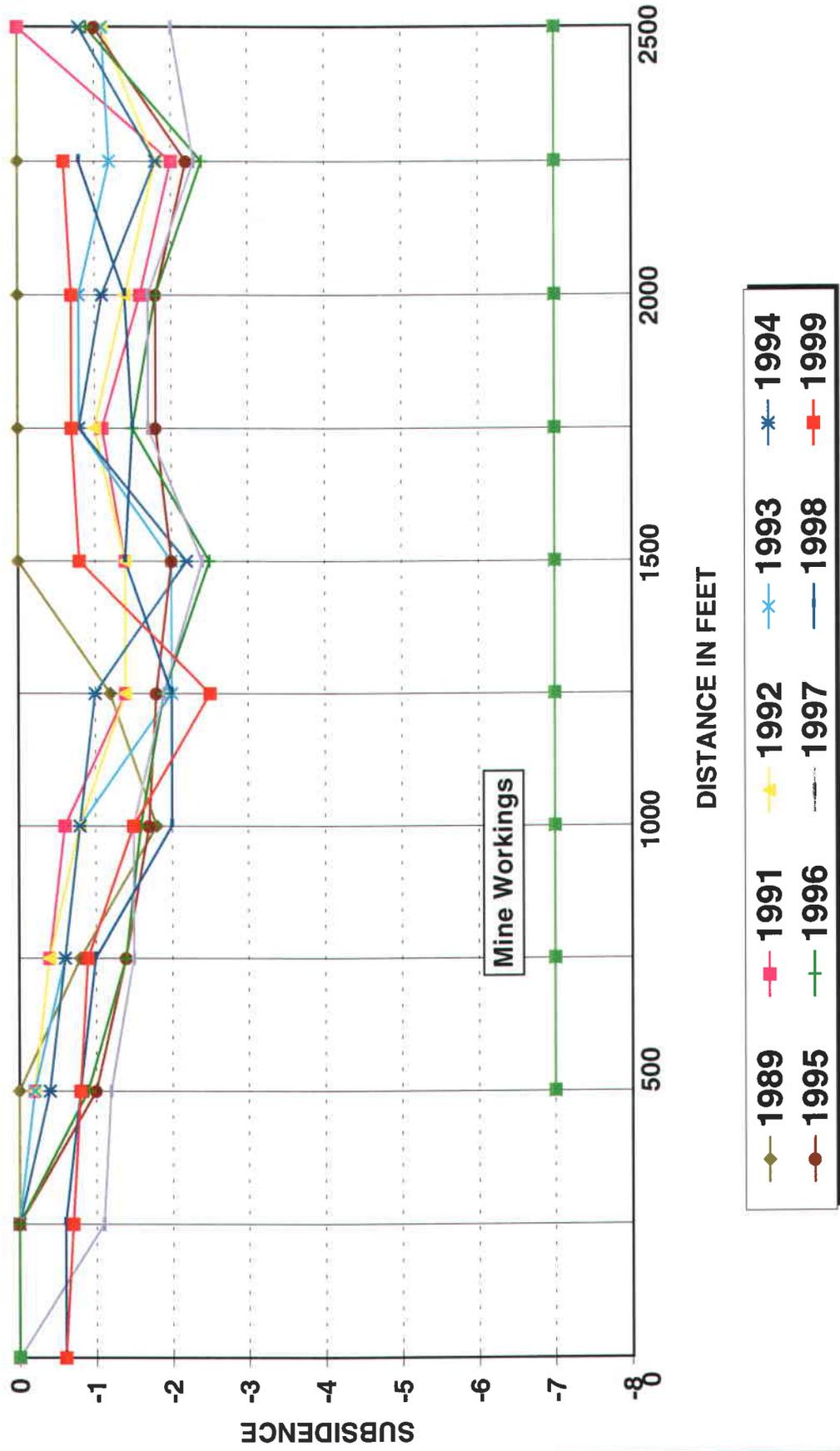


Figure 14

## Area 4

### Deer Creek 2nd through 17th Right Longwall Panels

Subsidence in Area 4 was detected for the first time in 1984 by photogrammetric methods. Longwall mining commenced in the 2nd Right longwall panels in 1980 and by the end of August 1991 the 2nd through 17th Right panels had been completed (Figure 15). In the Cottonwood mine, Longwall mining began in September of 1992 in the 9th Left Panel off 2nd north and the 8th Left Panel was terminated early because of unacceptable coal quality in February 1993. Mining resumed in this area in the 5th Left Longwall Panel in August of 1994 and continued through August of 1995 when mining was active in the 2nd Left Longwall Panel (Figure 15A).

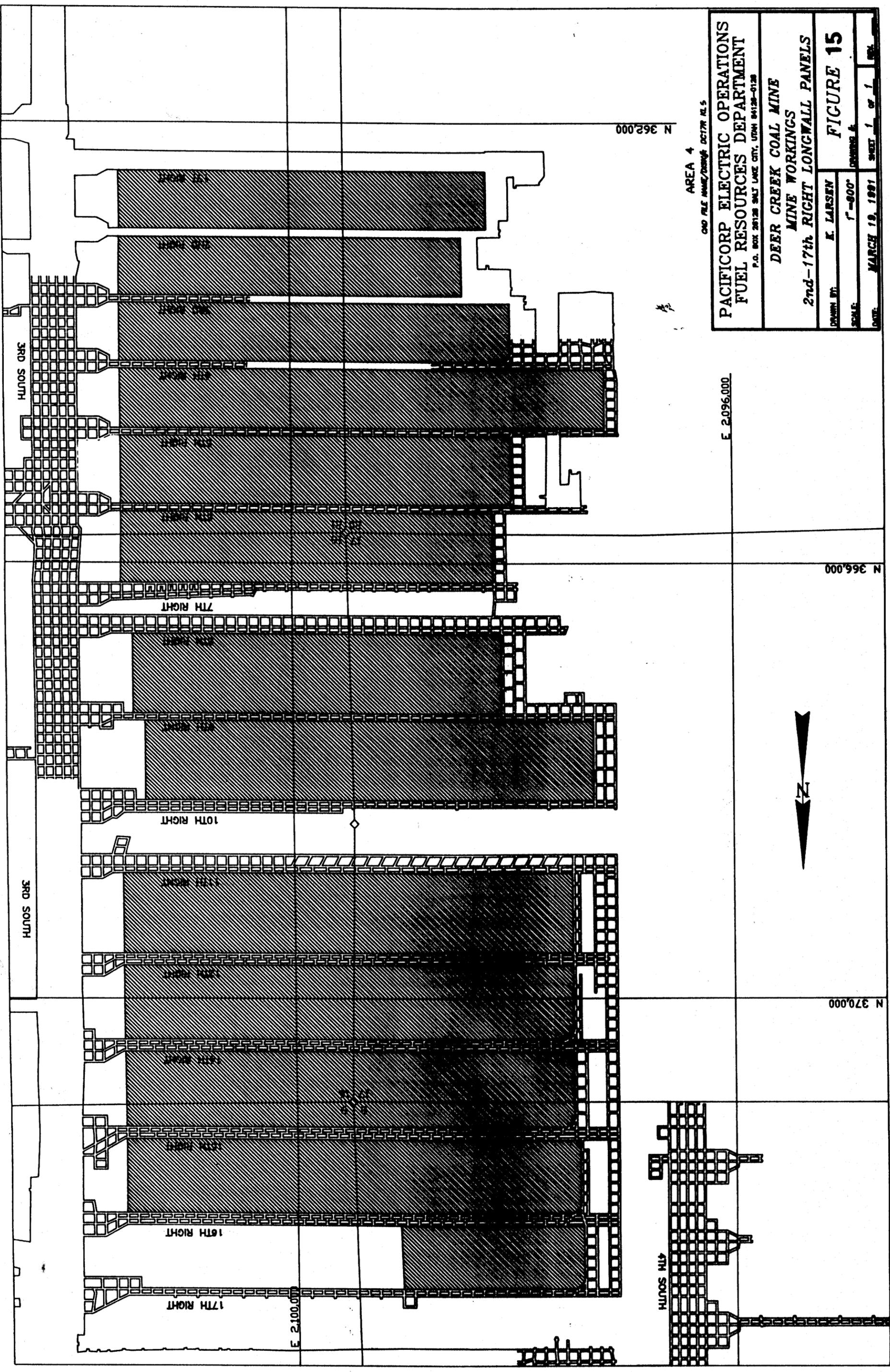
Maximum subsidence increased dramatically between 1994 and 1995 (8) feet to over thirteen (13) feet (Figure 16) due to the mining which occurred in the Hiawatha seam. The subsidence was virtually unchanged between 1995 and 1999 as shown in the profiles, Figures 17 and 18.

Surface fractures were identified in the field in late May of 1995. These fractures were located on Fee surface land and PacifiCorp filled in the fractures with a motor grader and reseeded the area. The location of the fractures are shown on figure 16. The revegetation in these areas is now established and no further fracturing has been identified.

The calculated angle-of-draw of the subsidence ranges from less than zero to 22 degrees. Several springs are located on East Mountain above these longwall panels and the 2nd through 5th Left panels located directly to the east (see Area 5). Fluctuations

in spring flow occur from year to year but seem to be related to variations in precipitation rather than mining. Flows are generally low in dry years and higher in wetter years (see Hydrologic Monitoring Report, 1999 and the Appendices to this report).

The left fork of the Grimes Wash drainage crosses the middle of the subsidence area. Stream monitoring has revealed no changes attributable to mining. This stream has been called Perennial by the US Forest Service, but our data indicates that it is ephemeral.



AREA 4  
CND FILE NAME/DESIGN: DCT7R AL 5

PACIFICORP ELECTRIC OPERATIONS  
FUEL RESOURCES DEPARTMENT

DEER CREEK COAL MINE  
MINE WORKINGS  
2nd-17th RIGHT LONGWALL PANELS

DRAWN BY:	E. LARSEN	DRAWING #:	FIGURE 15
SCALE:	1" = 800'	DATE:	MARCH 19, 1991
			SHEET 1 OF 1

E 2096.000

N 366.000

N 370.000



3RD SOUTH

3RD SOUTH

1100S N1/4

17TH RIGHT

16TH RIGHT

15TH RIGHT

14TH RIGHT

13TH RIGHT

12TH RIGHT

11TH RIGHT

10TH RIGHT

9TH RIGHT

8TH RIGHT

7TH RIGHT

6TH RIGHT

5TH RIGHT

4TH RIGHT

3TH RIGHT

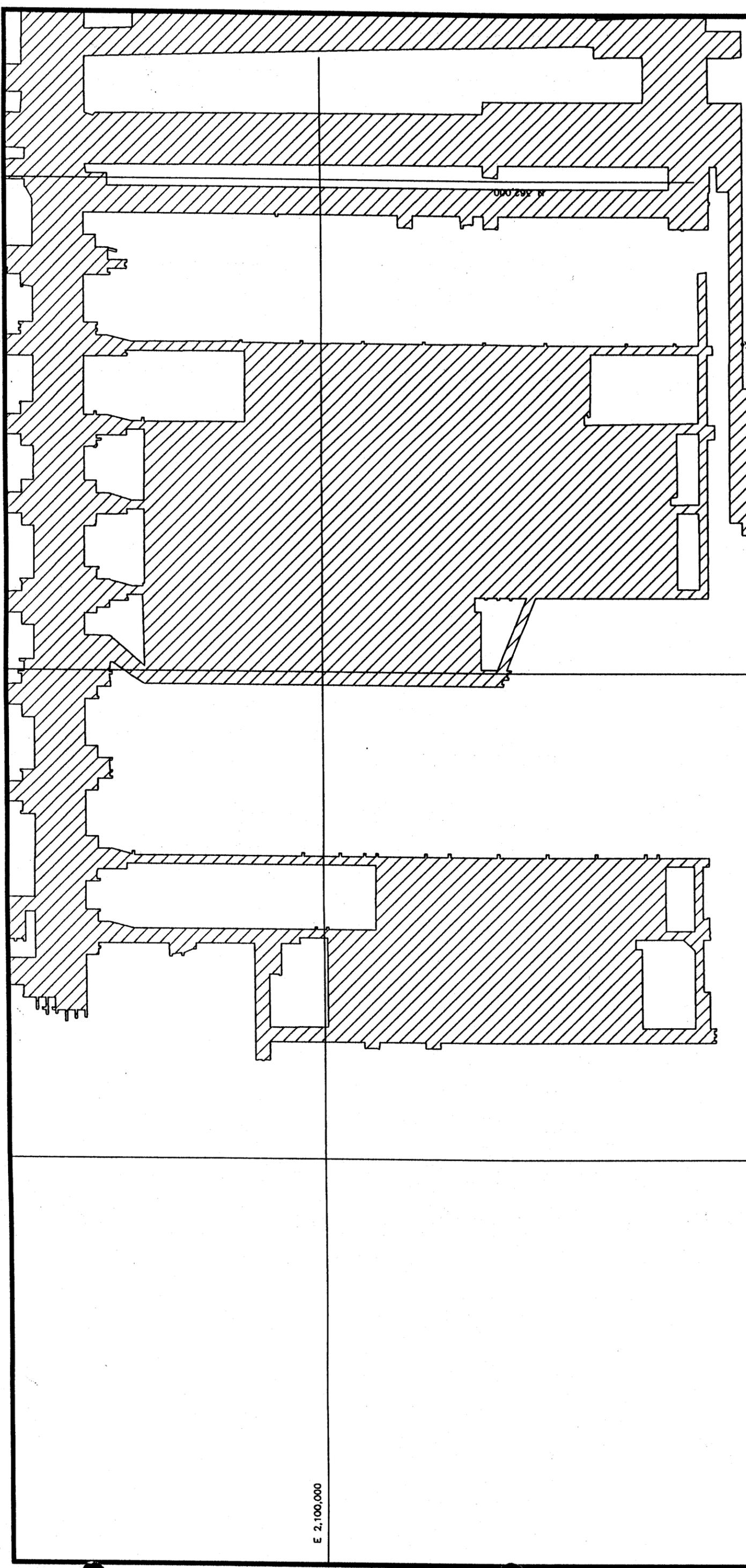
2TH RIGHT

17TH RIGHT

16TH RIGHT

E 2100.000

N 362.000



AREA 4  
 CAD FILE DISK\NAME:\SUBSIDE\1994\AREA4BIM.DWG



ONE UTAH CENTER  
 201 S. MAIN ST. SALT LAKE CITY, UT 84140

COTTONWOOD COAL MINE  
 MINE WORKINGS  
 2ND-5TH LEFT & 8TH-9TH LEFT PANELS

DRAWN BY: RODGER C. FRY

FIGURE 15A

SCALE: 1" = 800'

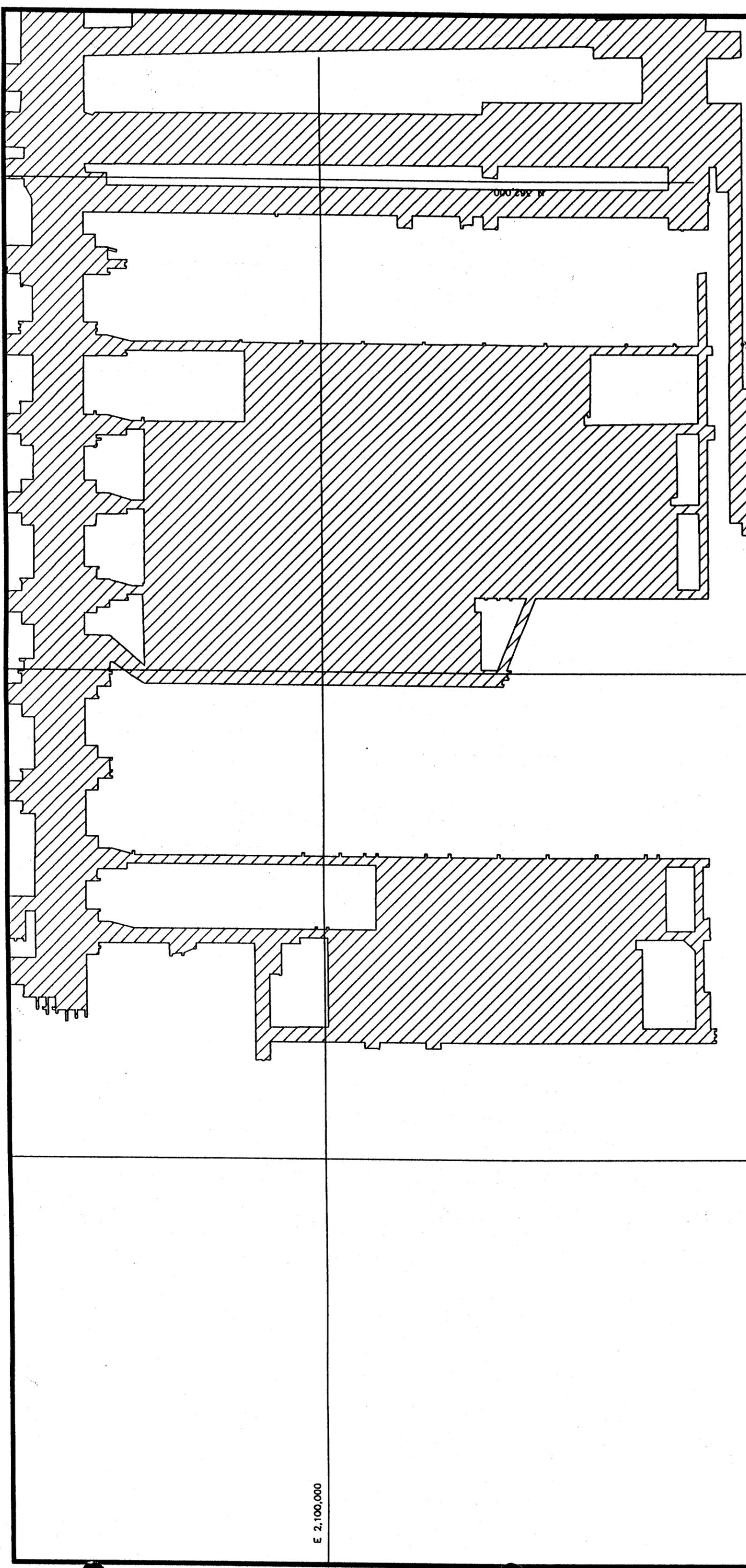
DATE: MARCH 31, 1995

DRAWING #

SHEET 1 OF 1

REV.:





AREA 4  
 CAD FILE DISK\NAME:\SUBSIDE\1994\AREA4BIM.DWG



ONE UTAH CENTER  
 201 S. MAIN ST. SALT LAKE CITY, UT 84140

COTTONWOOD COAL MINE  
 MINE WORKINGS  
 2ND-5TH LEFT & 8TH-9TH LEFT PANELS

DRAWN BY: RODGER C. FRY

FIGURE 15A

SCALE: 1" = 800'

DATE: MARCH 31, 1995

DRAWING #

SHEET 1 OF 1

REV.:



# Area 4 Subsidence Profile North - South

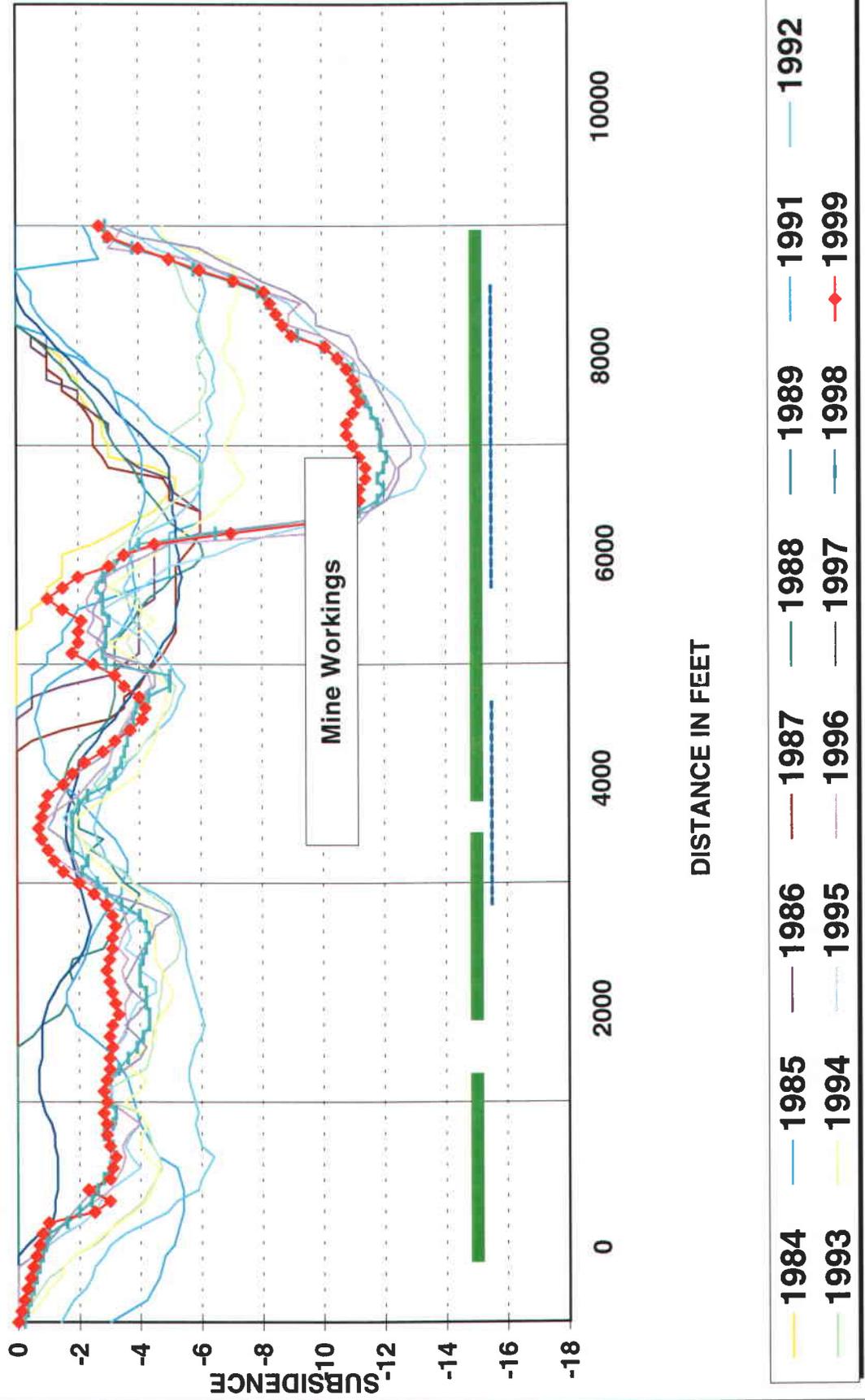


Figure 17

# Area 4 Subsidence Profile West - East

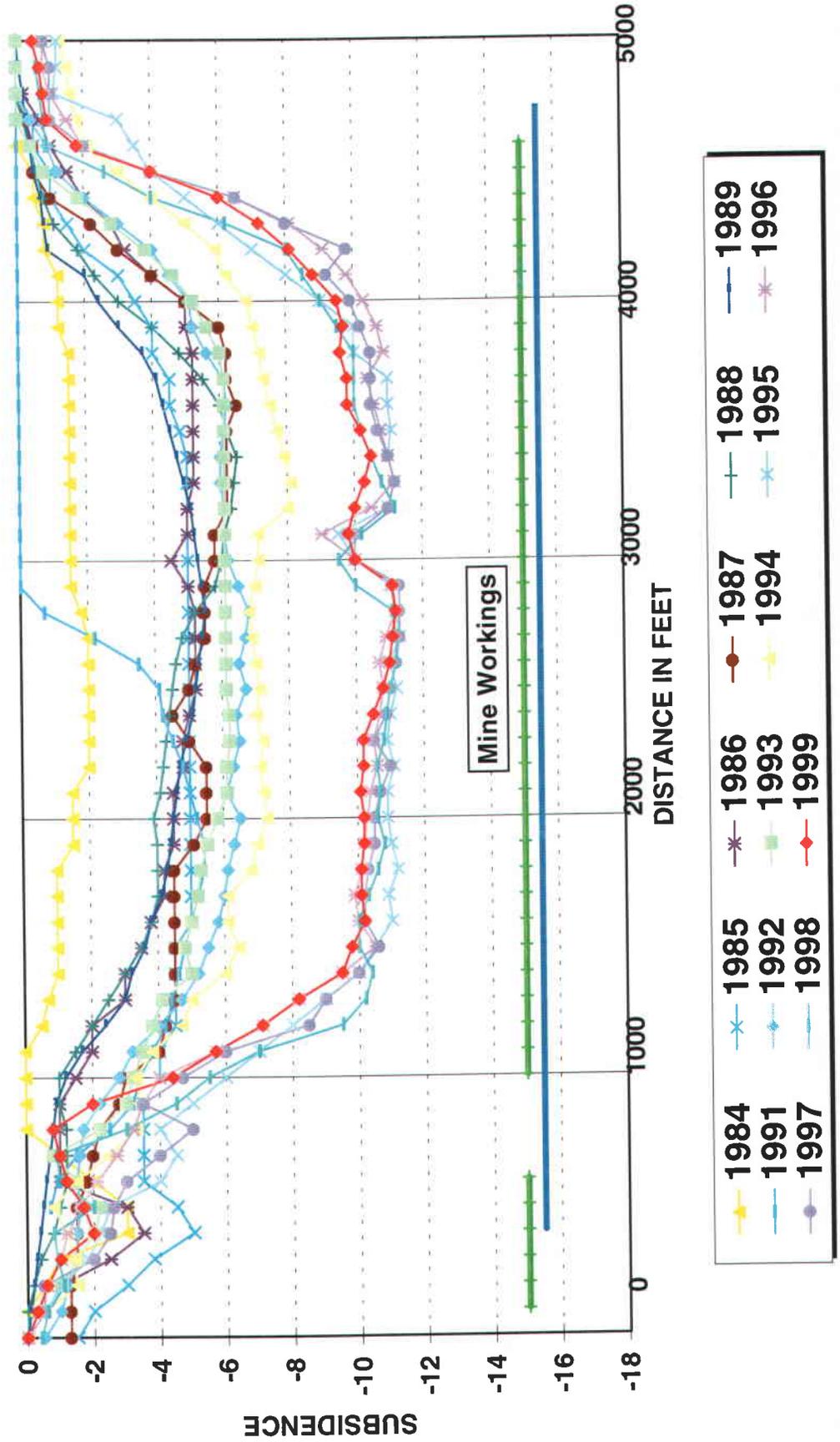


Figure 18

## Area 5

### Deer Creek 2nd through 5th Left Longwall Panels

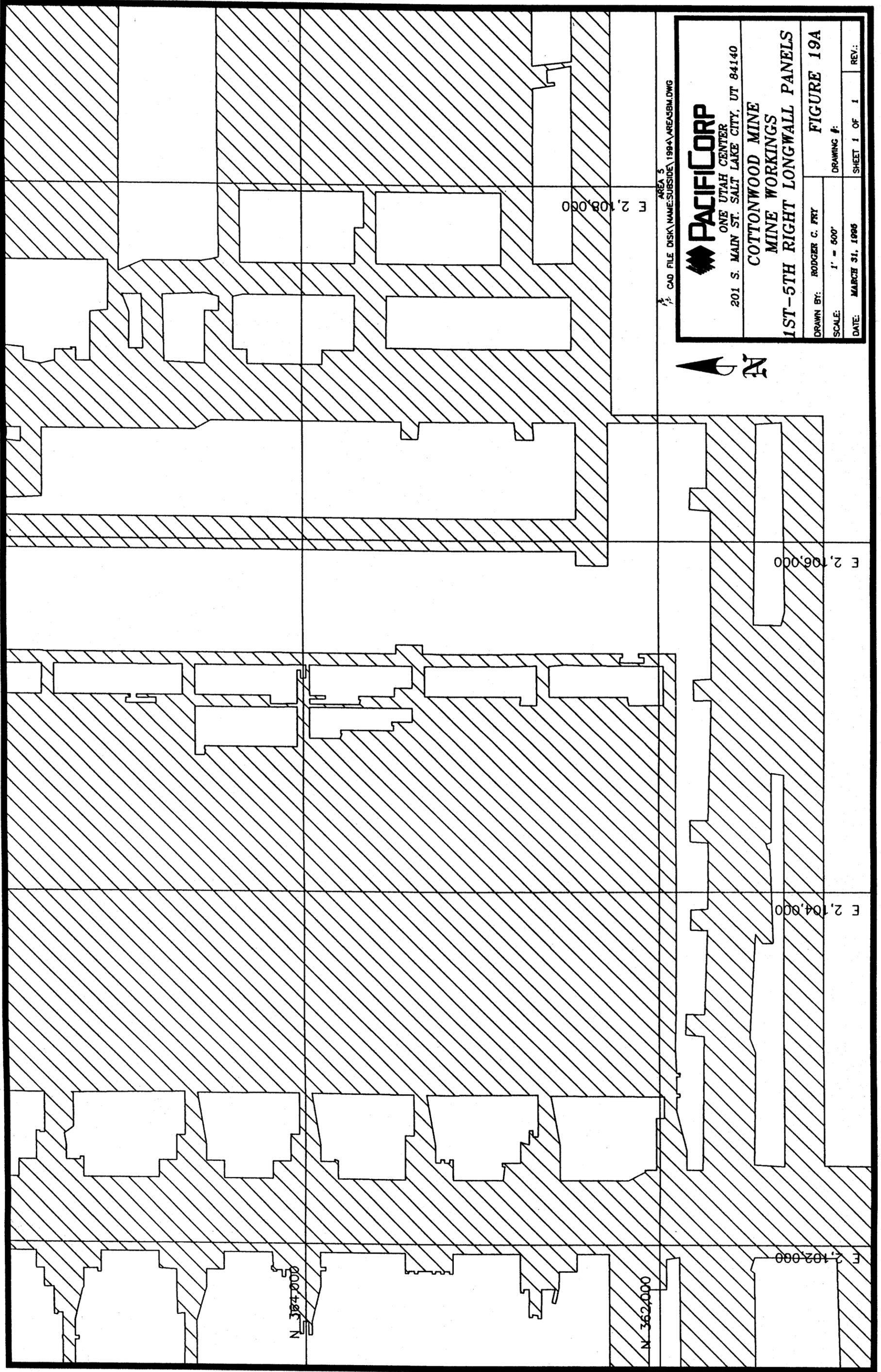
Photogrammetry revealed subsidence in Area 5 for the first time in 1984. Mining of the 2nd Left longwall panel in the Deer Creek Mine began in January 1983, and by October 1985 all four panels had been completed (Figure 19). In the Cottonwood Mine, longwall mining began in the 6th Right Longwall Panel in February 1993 and the last mining was completed in the 1st Right Longwall Panel in August 1994 completing all mining in this area (Figure 19A).

Maximum subsidence over the panels is slightly greater than thirteen (13) feet where both seams have been mined (Figure 20). The maximum subsidence showed a substantial increase between 1993 and 1994 but showed slight change between 1994 and 1998. The 1999 monitoring showed an increase in subsidence along the North-South profile line (figure 21) between 1,300 and 1,700. In this area, subsidence dropped from 12 feet to 15 feet in a localized area. This formed a bulls eye in the subsidence trough where the subsidence is equal to the amount of coal removed. It is likely that this bulls eye is an erroneous reading and will be verified using on the ground inspection and future monitoring. No surface disturbance has been identified over the panels.

As mentioned in the previous section, none of the springs located above the workings show any adverse effects due to mining.

Measured angle-of-draw is between zero and 13 degrees.





AREA 5  
 CAD FILE DISK NAME: SUBSIDE 1994\AREA5BM.DWG



ONE UTAH CENTER  
 201 S. MAIN ST. SALT LAKE CITY, UT 84140

COTTONWOOD MINE  
 MINE WORKINGS  
 1ST-5TH RIGHT LONGWALL PANELS

FIGURE 19A

DRAWN BY: RODGER C. FRY

SCALE: 1" = 500'

DATE: MARCH 31, 1995

SHEET 1 OF 1

REV.:



# Area 5 Subsidence Profile North - South

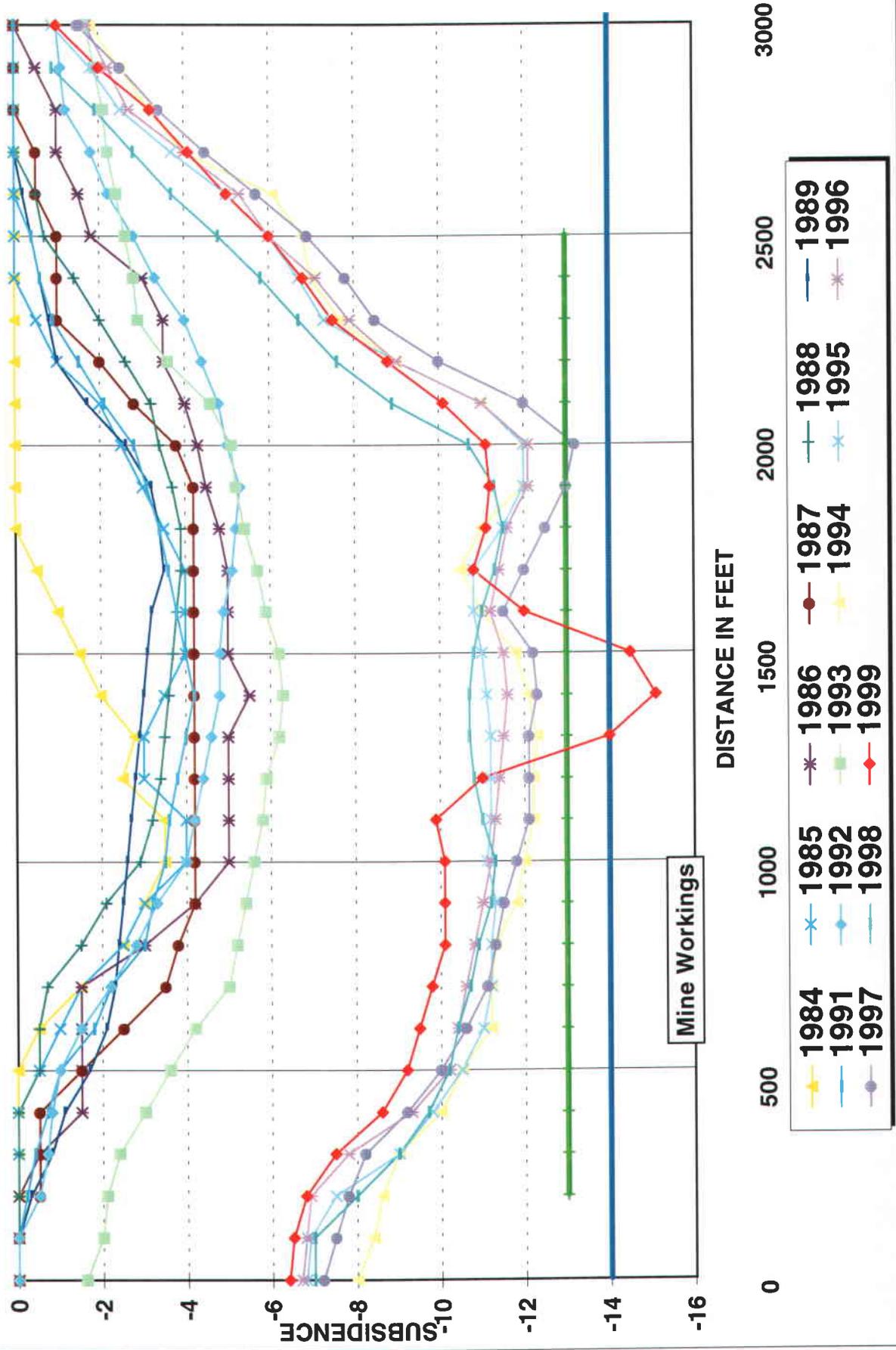


Figure 21

# Area 5 Subsidence Profile West - East

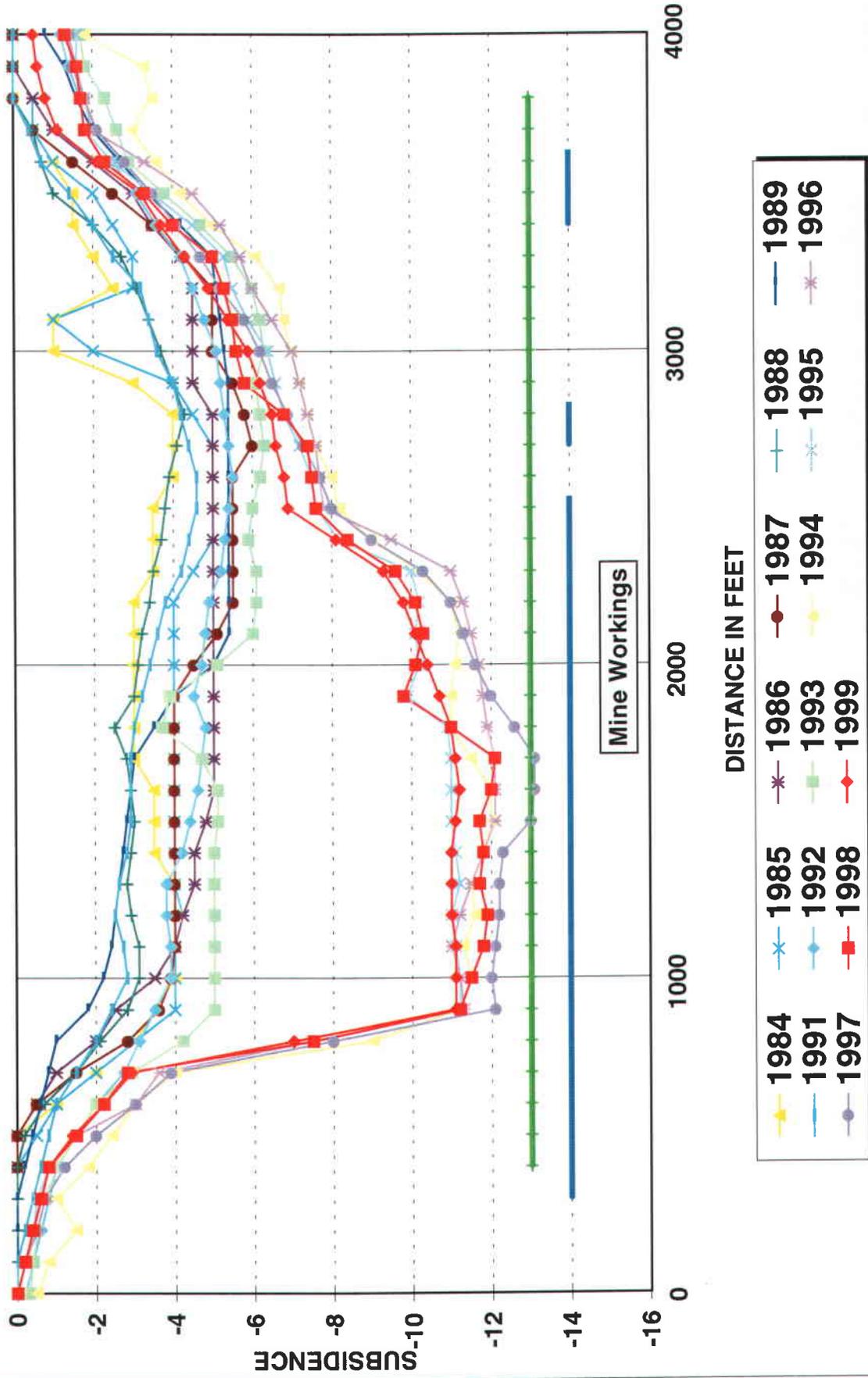


Figure 22

## Area 6

### Wilberg 1st and 2nd West Longwall Panels

Mining in the Wilberg 1st and 2nd West longwall panels was completed in June 1983 (Figure 23). This area of subsidence has now reached a maximum of between four and five feet over the Second West Longwall Panel (Figure 24). The subsidence in this area has been stable for the past four years. The subsidence profiles (Figures 25 and 26) show the change in subsidence since 1983.

Calculated angle-of-draw ranges from zero to 15 degrees where not influenced by other workings.

Four springs located just north of the area show no effect from the subsidence (see Hydrologic Monitoring Report, 1999).



# Area 6 Subsidence Profile

North - South

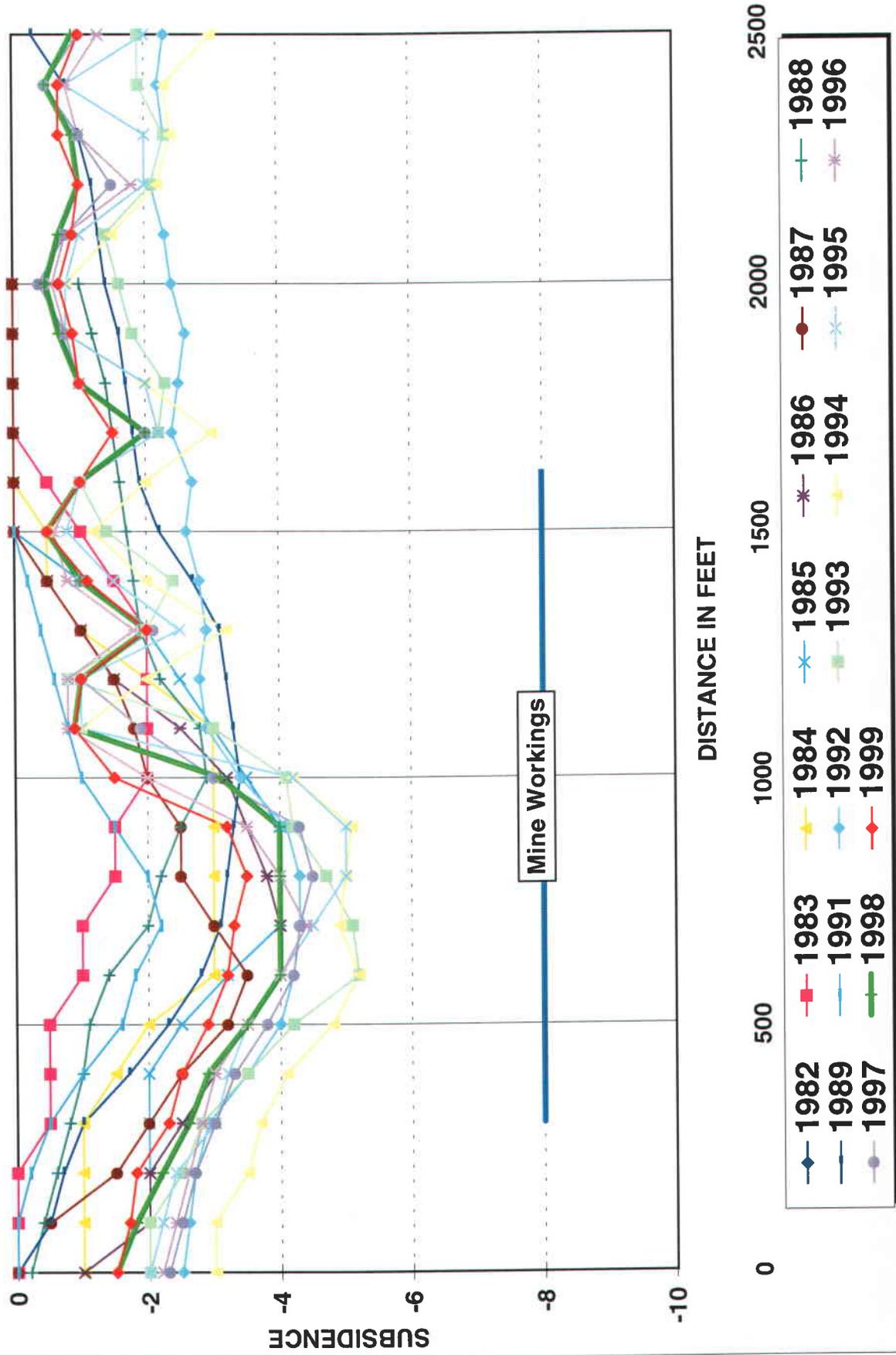


Figure 25

# Area 6 Subsidence Profile

West - East

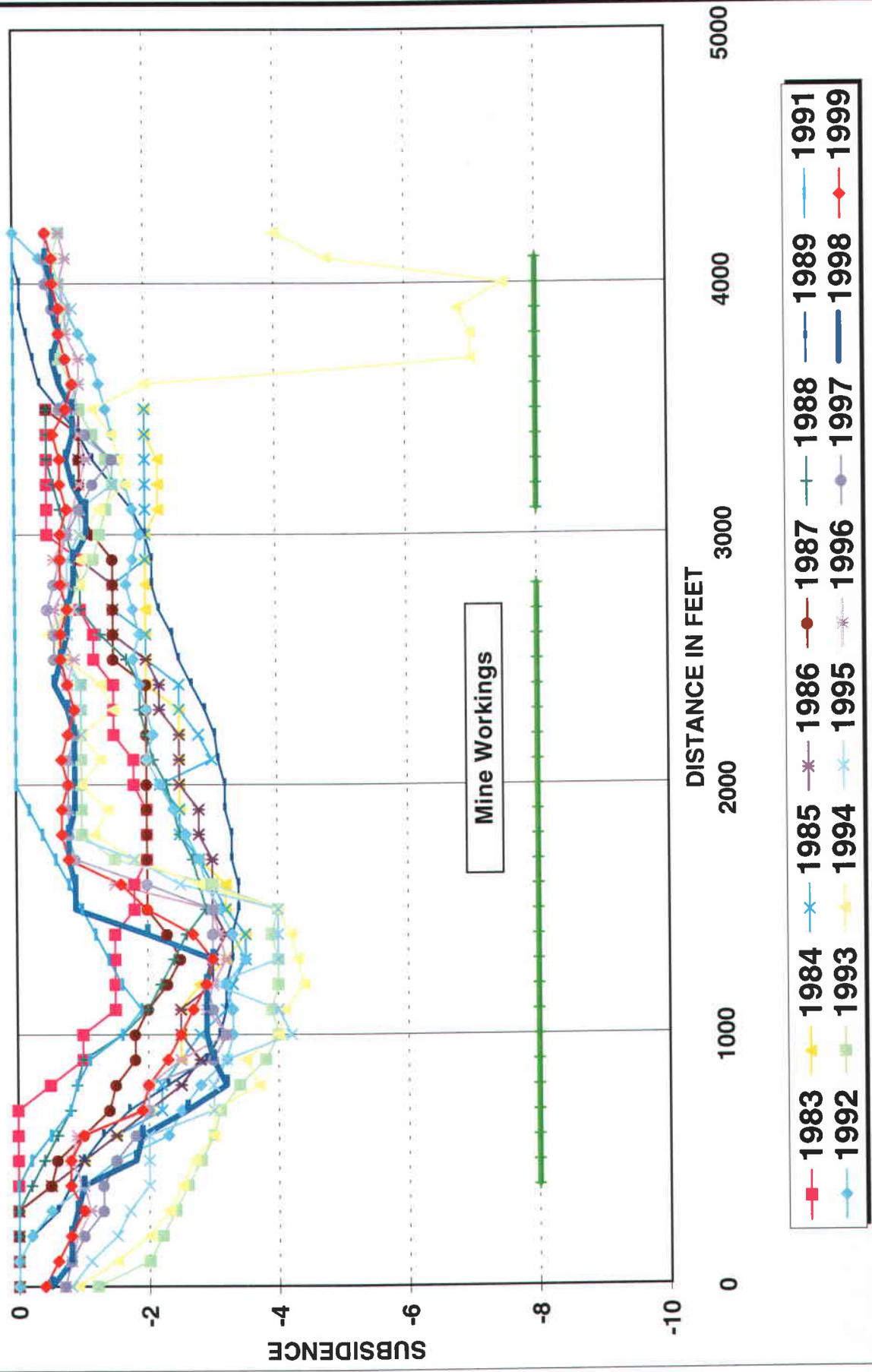


Figure 26

Area 7

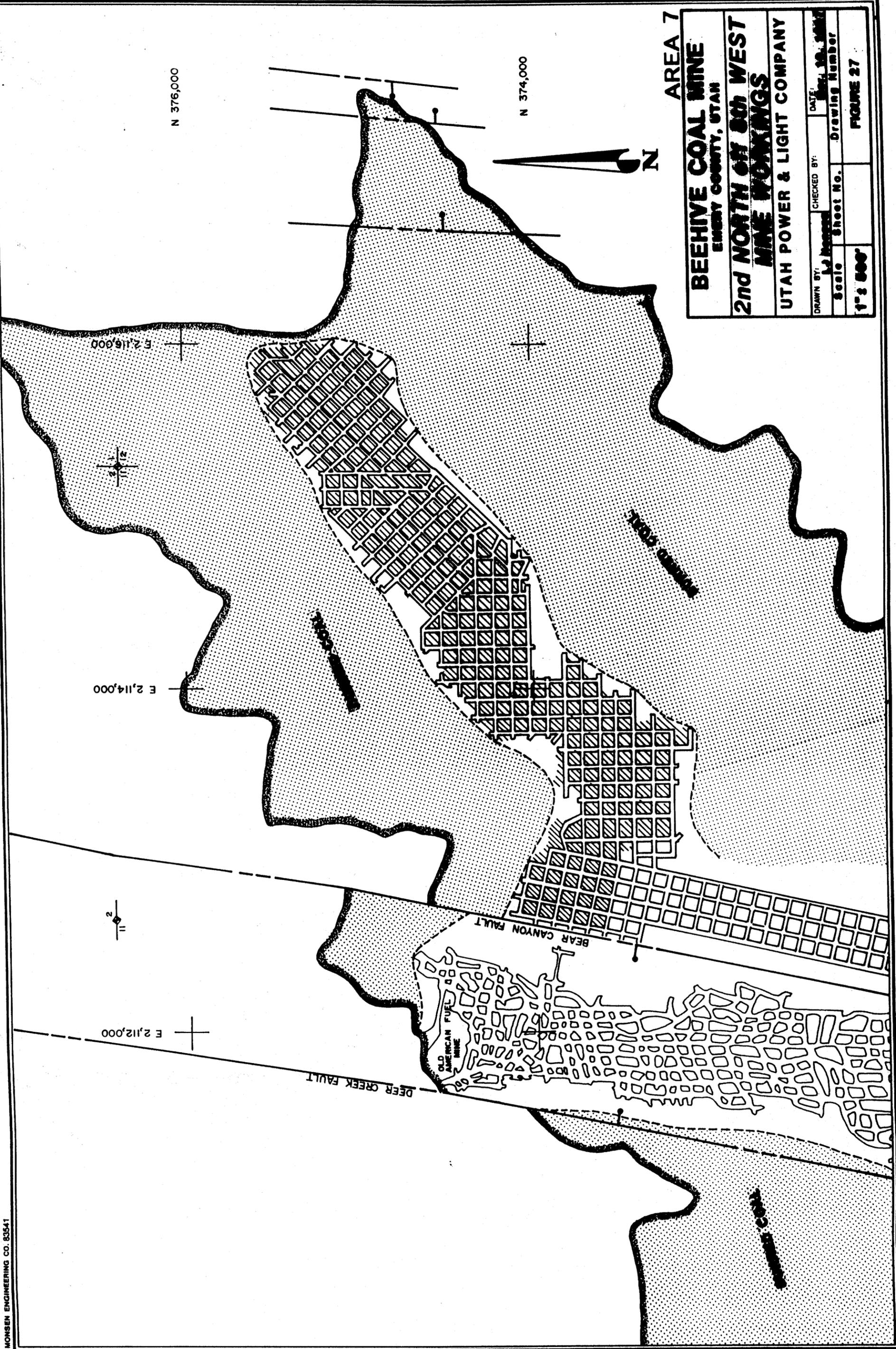
Beehive Mine 2nd North off 8th West

Pillar extraction mining in 2nd North was completed in 1983 and, as shown in Figures 27, 28, and 29, little additional subsidence has occurred over the workings since 1984. The workings are surrounded by burned coal.

Maximum subsidence is as much as seven (7) feet. In examining the area by helicopter and aerial photography, it is apparent that much of the elevation change measured was due to cliff failure and mass wasting on the steep slopes above the workings, where the rocks were highly fractured prior to mining. The profile, Figure 29, shows no measurable subsidence since 1991, this area is however, steep and rugged limiting the accuracy of the photogrammetric monitoring. Hence, the fluctuations in the reading are experienced from year to year.

It was not possible to get an accurate angle-of-draw because crushing of the surrounding clinker beds allowed subsidence to occur several thousand feet from the mine workings in some cases.

The subsidence has had no known influence on the hydrology in the area since they lack adequate recharge and are generally dry.



**AREA 7**

**BEEHIVE COAL MINE**  
EMERY COUNTY, UTAH

**2nd NORTH OF 8th WEST**  
**MINE WORKINGS**

UTAH POWER & LIGHT COMPANY

DRAWN BY:	CHECKED BY:	DATE:
J. J. Jensen		April 10, 1941
Scale	Sheet No.	Drawing Number
1" = 500'		FIGURE 27

# Area 7 Subsidence Profile Southwest - Northeast

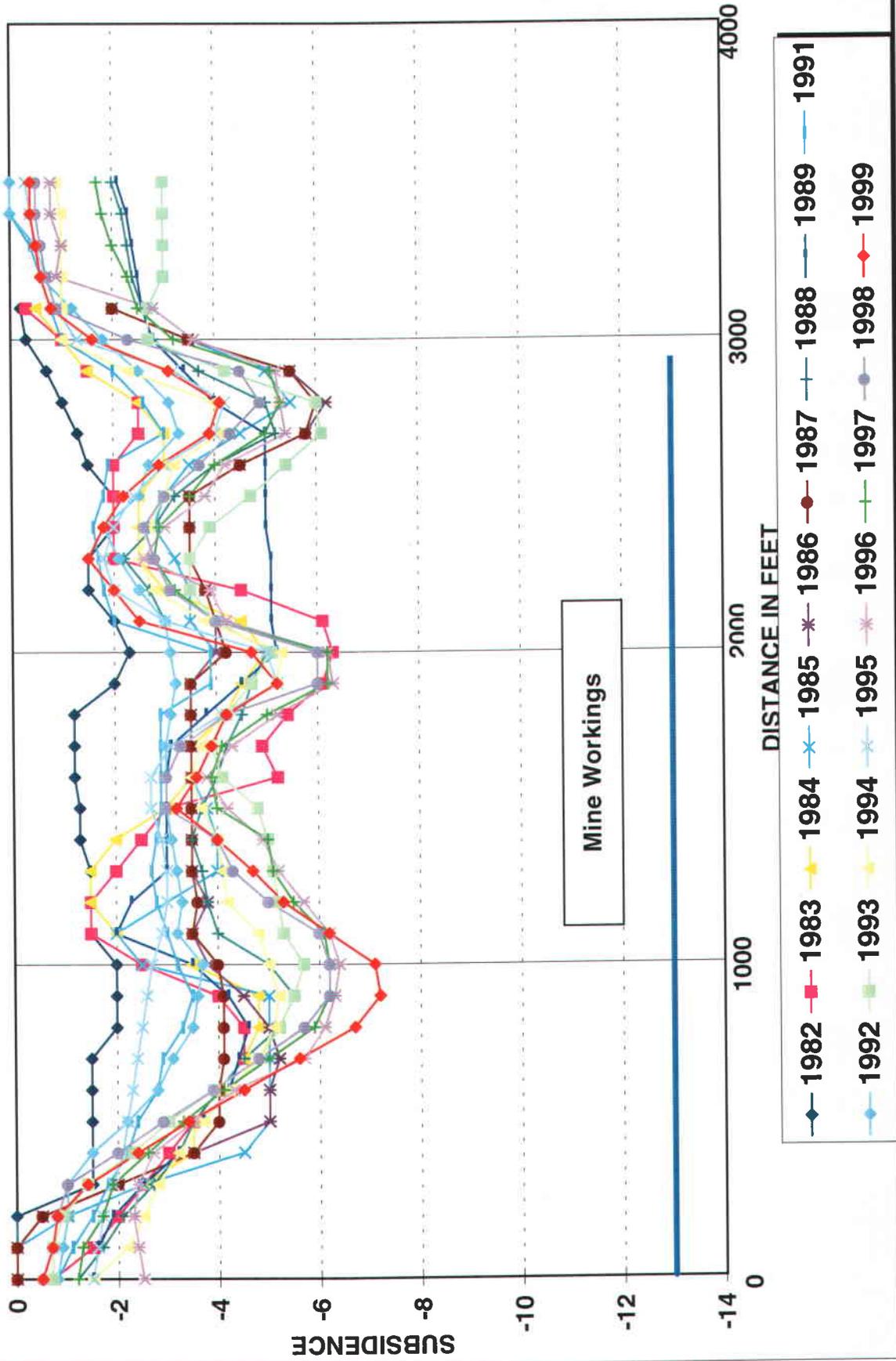


Figure 29

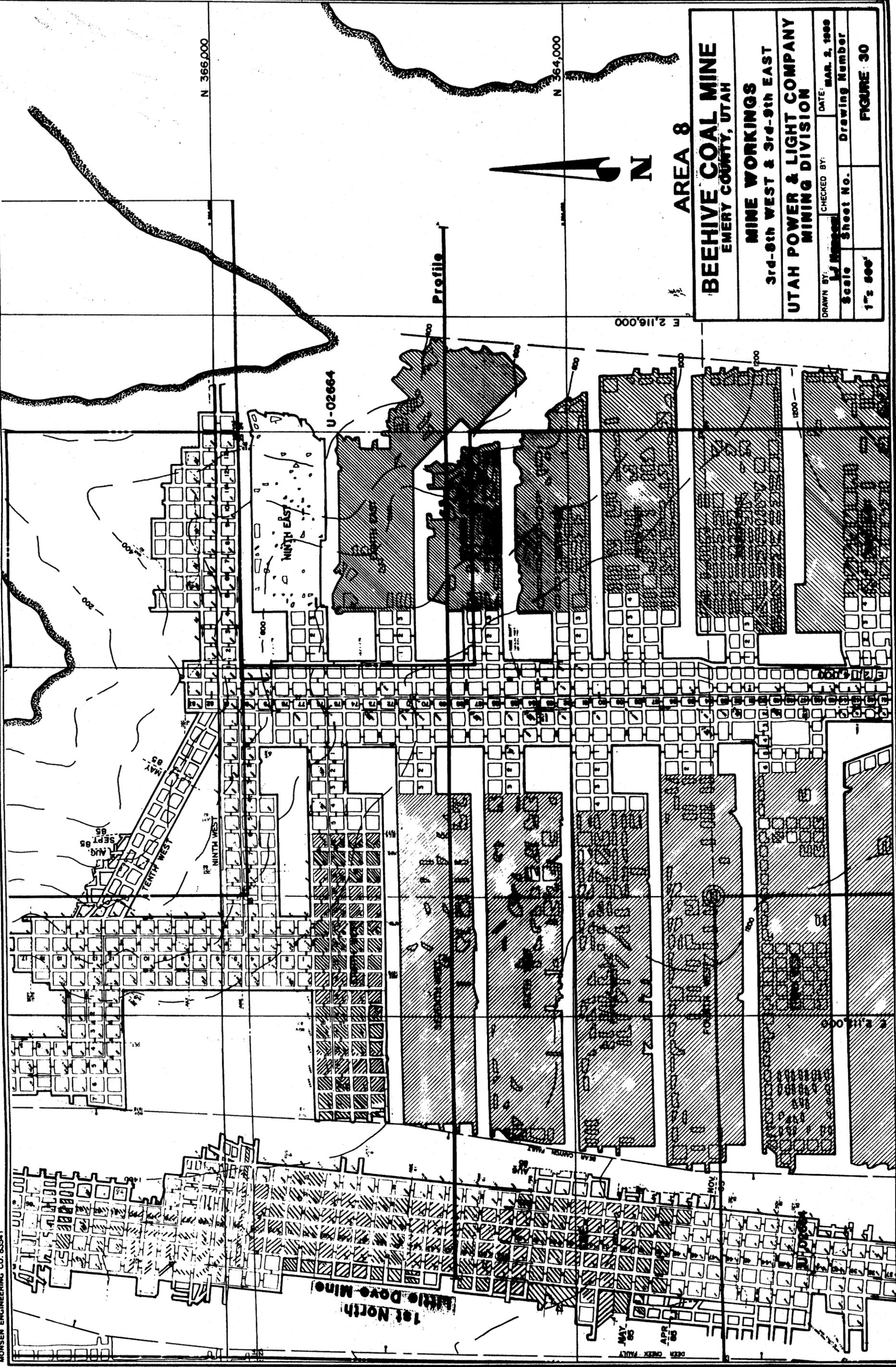
Area 8

Beehive 3rd Through 8th West and 3rd Through 9th East

Deseret 3rd Through 9th West and 1st Through 5th East

Some of the subsidence in Area 8 may have gone undetected because pillar extraction, and presumably subsidence, in part of the area was completed before the establishment of baseline survey data (Figures 30, 31, and 32). The west to east subsidence profile of the area depicted in Figure 33 indicates that subsidence up to slightly under seven (7) feet has occurred. The profile shows a fair amount of variability. This is due to the rugged terrain in the area. The profile indicates that no detectable change in subsidence has occurred in the past five years. Where not influenced by other workings, the angle-of-draw reached a maximum of 31 degrees on the eastern edge of the area.

The strata in this area is dry and the subsidence that has occurred has had no impact on the hydrology of the area.



AREA 8

<b>BEEHIVE COAL MINE</b> EMERY COUNTY, UTAH	
<b>MINE WORKINGS</b> 3rd-8th WEST & 3rd-9th EAST	
<b>UTAH POWER &amp; LIGHT COMPANY</b> MINING DIVISION	
DRAWN BY: <i>J. M. Mosen</i>	CHECKED BY: _____
DATE: MAR. 2, 1966	Drawing Number
Scale	Sheet No.
1" = 500'	<b>FIGURE 30</b>

Profile

U-02664

NORTH EAST

TENTH WEST

NINTH WEST

1st North Mine

DEEN CREEK FULTY  
APR 66  
MAY 66

E 2,116,000

N 366,000

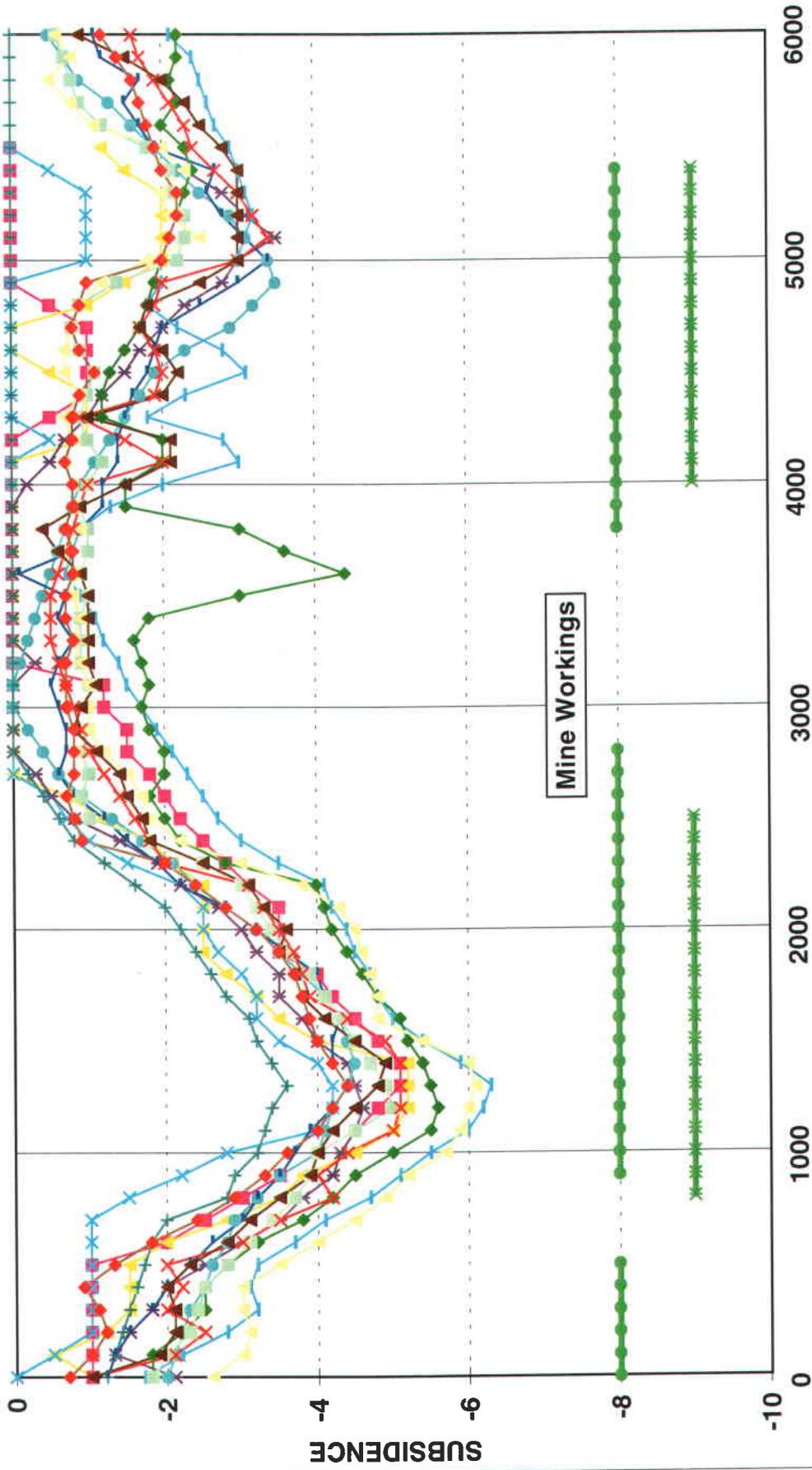
N 364,000

N



# Area 8 Subsidence Profile

West - East



DISTANCE IN FEET

- 1985 (red square)
- 1986 (yellow triangle)
- 1987 (blue asterisk)
- 1988 (purple asterisk)
- 1989 (teal circle)
- 1991 (light blue plus)
- 1992 (dark blue line)
- 1993 (green diamond)
- 1994 (light green square)
- 1995 (yellow triangle)
- 1996 (red asterisk)
- 1997 (brown triangle)
- 1998 (red diamond)
- 1999 (red diamond)

Figure 33

## Areas 9 and 10

### Little Dove 1st North and the old American Fuel Mine

The 1st North section of the Little Dove Mine and the American Fuel Mine workings are located in a graben formed by the Deer Creek and Bear Creek Canyon faults (see figures for Areas 7 and 8). In August 1982 the Little Dove workings, mining in a northerly direction, intersected the old workings of the American Fuel Mine about 1000 feet south of where available maps indicated they extend. Mining conditions in that area of Little Dove revealed that strata were highly stressed. In some cases pillars were crushed before they could be extracted. At that time pillar extraction mining was begun in 1st North and continued to the south with minor interruptions from 1982 through much of 1987.

To date the maximum observed subsidence over 1st North is about three to four feet, occurring over some of the most recently extracted pillars (see Subsidence Map in Appendix). No other notable subsidence has been detected over the remainder of 1st North.

Subsidence of over six (6) feet has been measured above the American Fuel Mine workings.

Any angle-of-draw calculation would be affected by both the surrounding mine workings and the faults on either side; therefore, no angle-of-draw was calculated for either the 1st North area of the Little Dove Mine or the old American Fuel Mine.

No fractures are known over the 1st North workings, but some cliff failure and

fractures are probably present over the American Fuel Mine on the cliffs and steep slopes.

Mining has had no known effect on the hydrology of the areas.

## Area 11

### Deer Creek C and D North Longwall Panels

### Cottonwood 11th Right Longwall Panel off 2 ½ North

### Cottonwood 6th & 7th Right Longwall Panel off of 2nd North

Longwall mining in the C North panel began in December 1984 and was terminated in April 1986 due to geologic complications. New setup entries were driven further south and mining resumed in September 1986; the panel was completed in March 1987. The D North longwall panel began production in July 1987, but after October 1987 production was limited due to poor coal quality. The panel was terminated in August 1988 at a length of 1750 feet. Pillar extraction mining in A North and A South was completed in June 1983 (Figure 34).

Mining in the 11th Right Panel in the Cottonwood Mine began in July of 1992 and was completed in September 1992 (Figure 35). The 10th Right Panel to the south was developed but couldn't be mined with longwall methods because of thin coal and poor coal quality. Mining began in the 7th Right Panel in February 1993 and by August 1993 mining in the 6th Right Panel had been completed.

Measurable subsidence to date has exceeded thirteen (13) feet in the area of multiple seam mining above the 6th and 7th Right Longwall Panels in the Cottonwood mine (Figures 36, 37, and 38). The maximum subsidence showed an increase between 1993 and 1994 but has been stable the past six years.

Fractures were discovered at the western end of coal extraction above the 7th Right

Longwall Panel. The fractures were first discovered on June 17, 1993. Mining of the longwall panel was completed on May 12, 1993. An aerial reconnaissance of the area on May 18, 1993 revealed no surface fractures at that time. This places the occurrence of the fractures between May 18, 1993 and June 17, 1993. Burnt Tree Springs is located approximately 800 feet to the southeast of the fractures. Measurements of the spring discharge throughout the summer of 1993 through 1999 indicated that the fracturing has had no effect on the spring. The angle-of-draw measured ranges from less than zero to 28 degrees.



E 2,102,000

E 2,104,000

N 372,000



AREA 11

CAD FILE NAME/DISK#: 905J811

PACIFICORP ELECTRIC OPERATIONS  
FUEL RESOURCES DEPARTMENT

P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

COTTONWOOD COAL MINE  
11TH RIGHT OFF 2 1/2 NORTH  
LONGWALL PANEL

FIGURE 35

DRAWN BY: J. GARRETT

DRAWING #

1" = 500'

DATE: MARCH 22, 1993

SHEET 1 OF 1 REV.

E 2,106,000

N 370,000

N 368,000

N 366,000

12 RIGHT

11 RIGHT

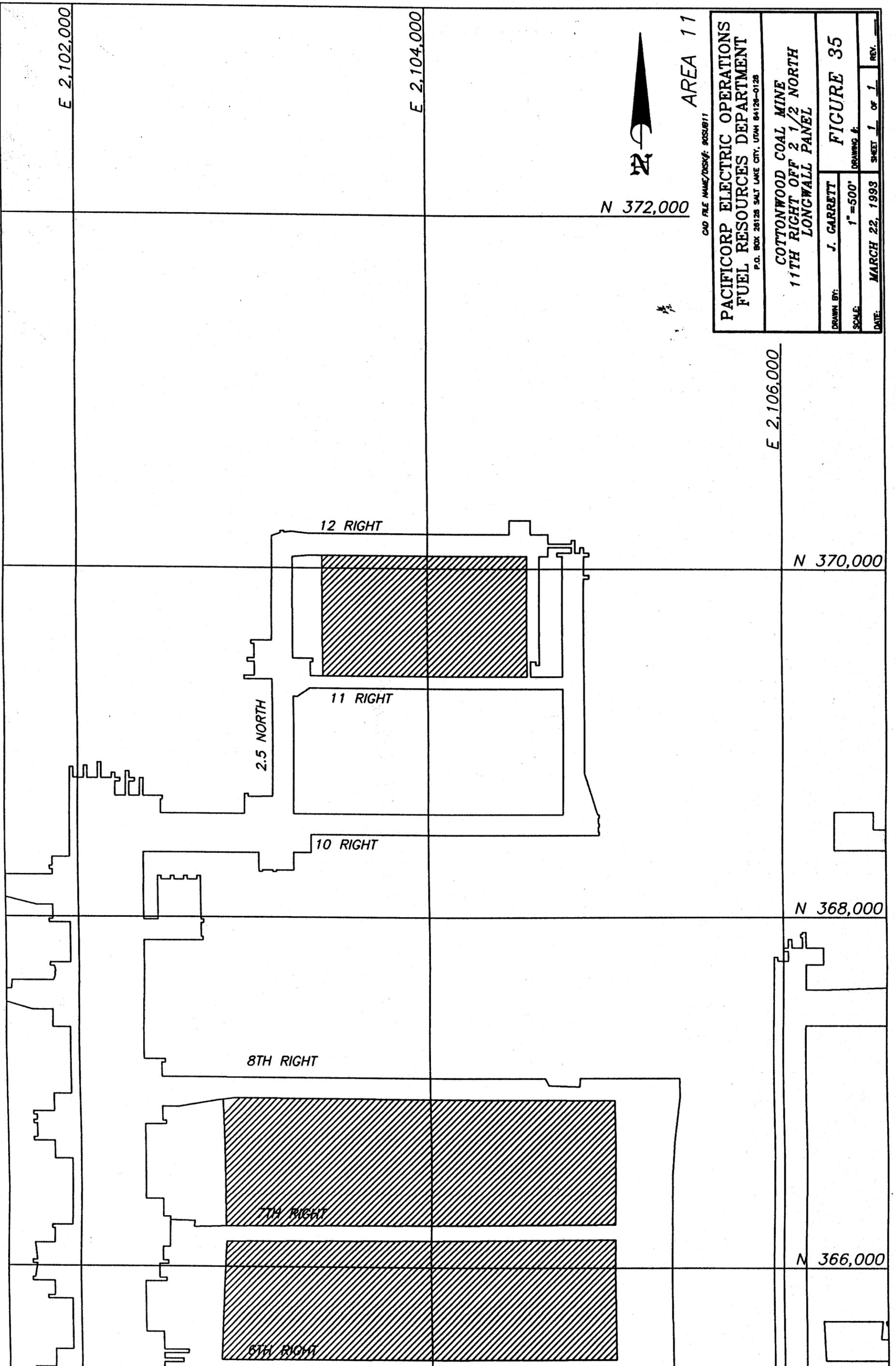
10 RIGHT

2.5 NORTH

8TH RIGHT

7TH RIGHT

6TH RIGHT



# Area 11 Subsidence Profile

North - South

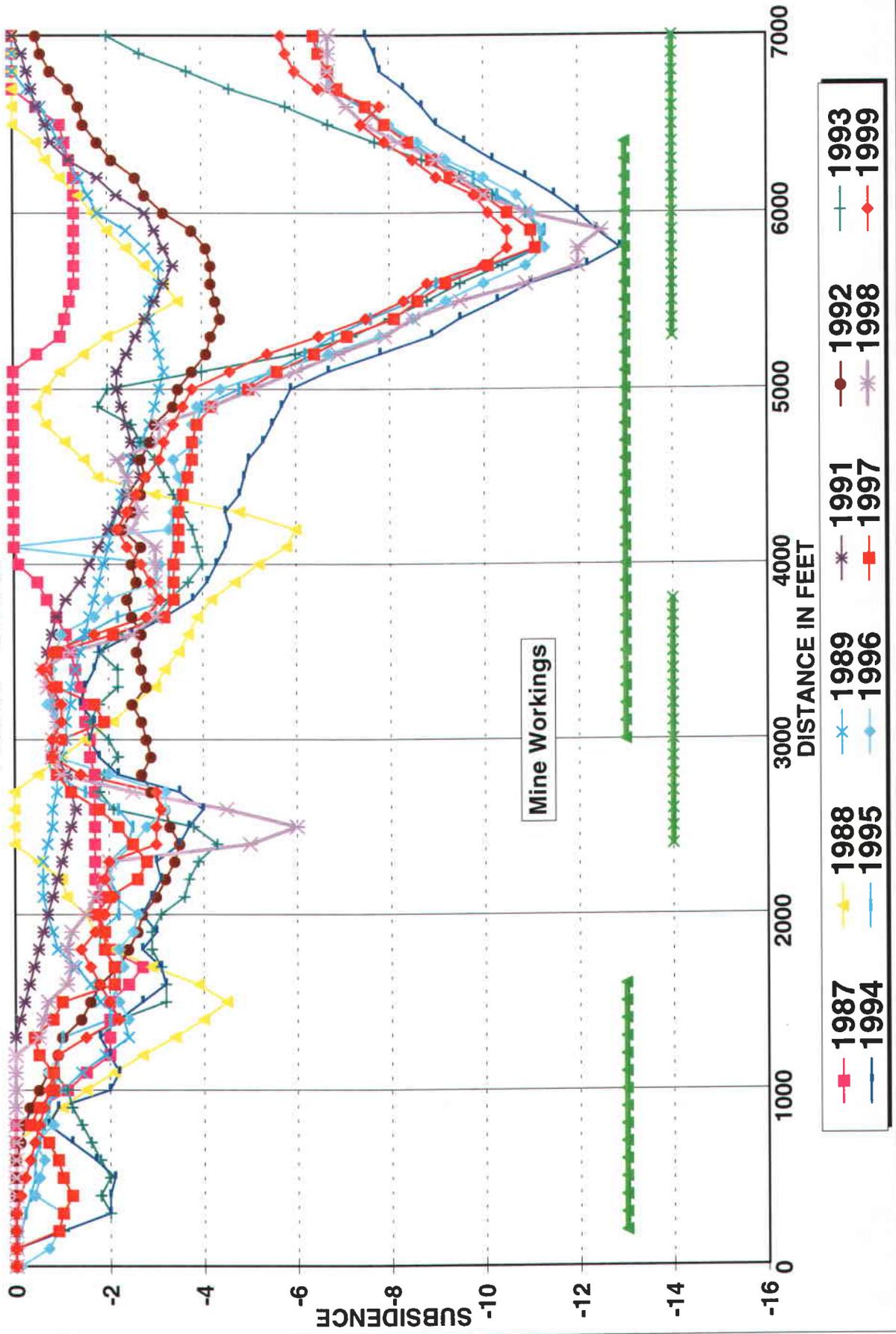


Figure 37

# Area 11 Subsidence Profile

West - East

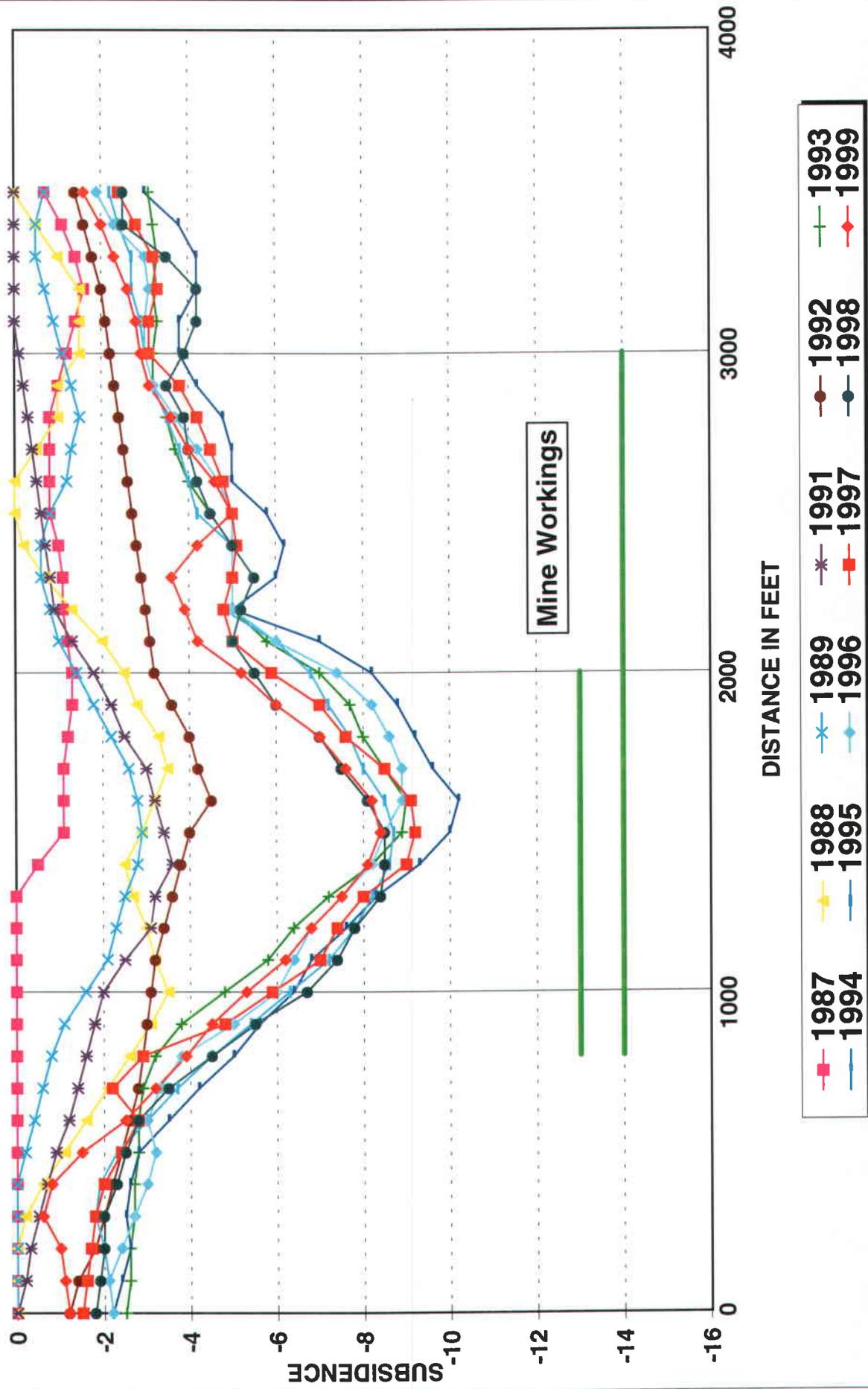


Figure 38

## Area 12

### Wilberg 2nd Left Longwall Panel

The 2nd Left longwall panel is located in the western portion of the Wilberg Mine (Figure 2). A block of coal measuring 2300 feet by 530 feet was extracted during 1981 and 1982. To date no measurable subsidence has occurred and no visible surface disturbance has been observed. Overburden ranges from 1500 to 1900 feet over the panel. It is somewhat surprising that no movement has been detected since subsidence has been observed in other instances where smaller blocks of coal were extracted and overburden was of similar thickness.

One spring is located approximately 800 feet northeast of the extracted workings on the surface. It has not been affected by mining.

## Area 13

### Des-Bee-Dove Southern Areas

Area 13, covering the southern portions of the Deseret, Beehive, and Little Dove Mines, was first monitored for subsidence in 1986. Some of the sections were mined before baseline survey data were established; therefore, subsidence measured over these sections will likely not represent what actually occurred. The 4th North section in the Little Dove Mine was completed in February 1987 (Figures 39 and 40).

Maximum subsidence over the area as of August 1998 was about three (3) feet over the second and third north sections of the Little Dove Mine (Figures 41, 42, and 43). No change in subsidence has occurred in the past four years.

The subsidence profiles, figures 42 and 43 show subsidence yearly since 1986. These profiles show that the readings in 1993 and 1994 are somewhat lower than in 1995, 1996, 1997 or in previous years. This is most likely a problem with the aerial triangulation because a comparison of the survey monuments in the area show no subsidence change in that time period.

No visible surface disturbance of any kind has been found.

There are no known springs over the workings, and mining is not expected to have any effect on the hydrology of the area.

U-1358



AREA 13

**Beehive & Little Dove Coal Mines**  
 EMERY COUNTY, UTAH

**SOUTHERN AREAS**  
**MINE WORKINGS**

**UTAH POWER & LIGHT COMPANY**  
**MINING DIVISION**

DATE: MAR. 6, 1988  
 DRAWN BY: LJ  
 CHECKED BY:  
 Scale: Sheet No. Drawing Number  
 1" = 600' FIGURE 39

MAIN WEST

FOURTH NORTH

THIRD NORTH

SECOND NORTH

FIRST NORTH

SECOND EAST

FIRST EAST

THIRD EAST

FEE

Beehive Mine Portal

Little Dove Mine Portal

DEER CREEK FRONT

N 362,000  
E 2,116,000

N 360,000

N 358,000

E 2,112,000

23  
26

22 23  
27 26

23 24  
26 25

U-1358

E 2,110,000

22 23  
27 28

DEER CREEK FAN

U-02664

Profile

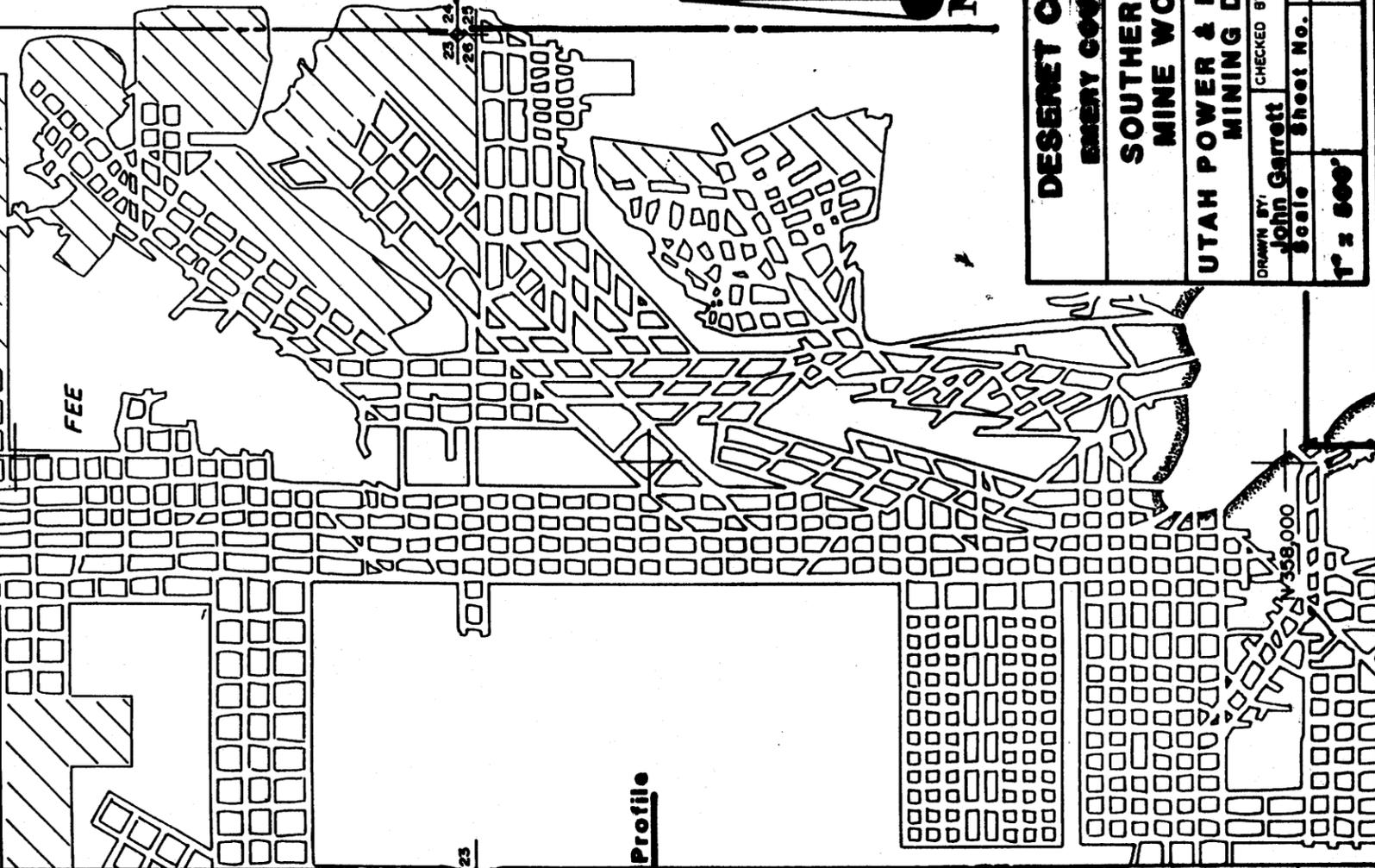
Profile

E 2,112,000

23 23

FEE

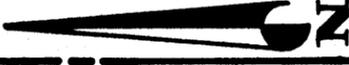
E 2,114,000



N 362,000

U-02664

N 360,000



AREA 13

DESERT COAL MINE

EMERY COUNTY, UTAH

SOUTHERN AREAS  
MINE WORKINGS

UTAH POWER & LIGHT COMPANY  
MINING DIVISION

DRAWN BY: John Garrett

CHECKED BY:

DATE: MAR. 2, 1989

Scale Sheet No. Drawing Number

1" = 500'

FIGURE 40

# Area 13 Subsidence Profile

North - South

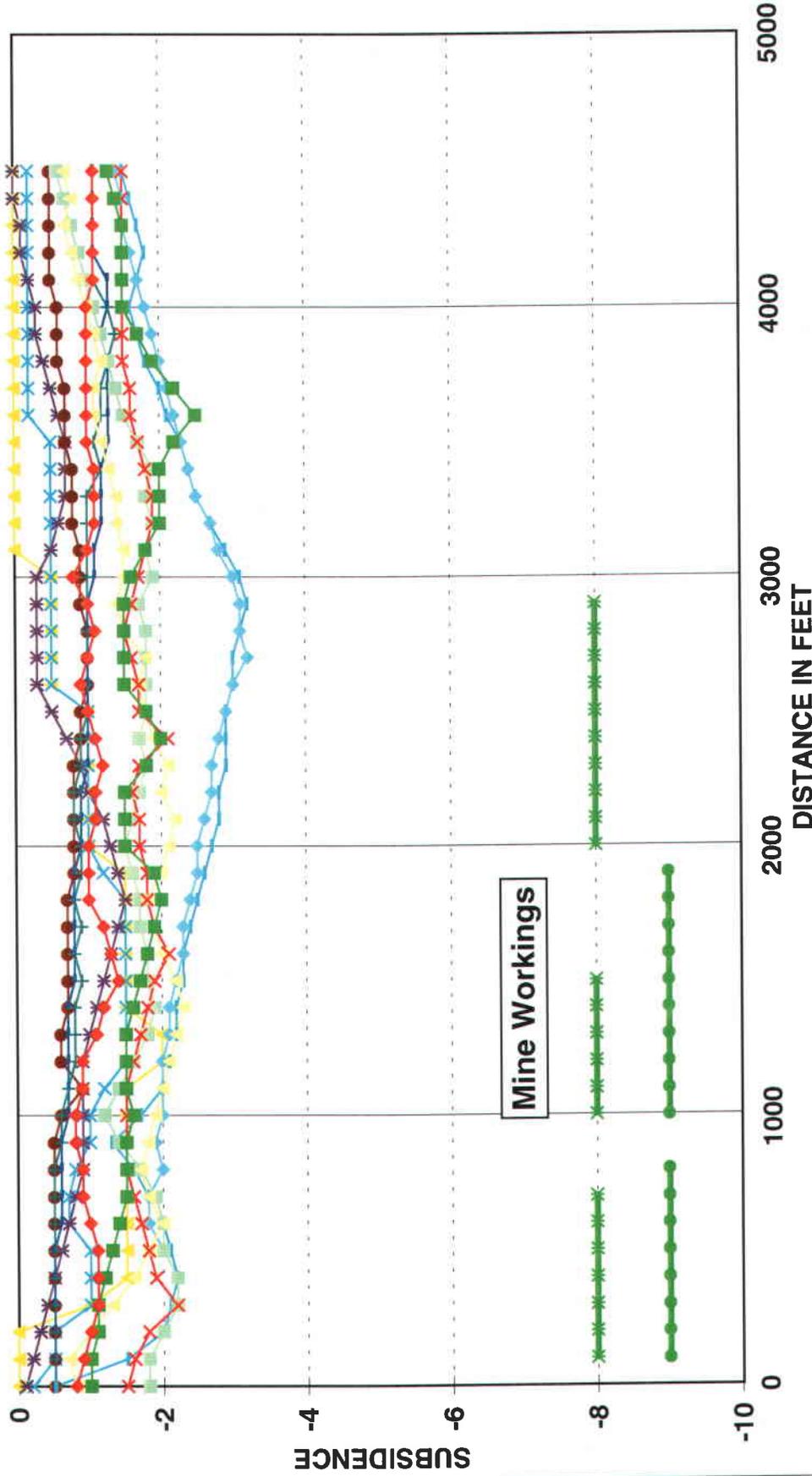


Figure 42

# Area 13 Subsidence Profile

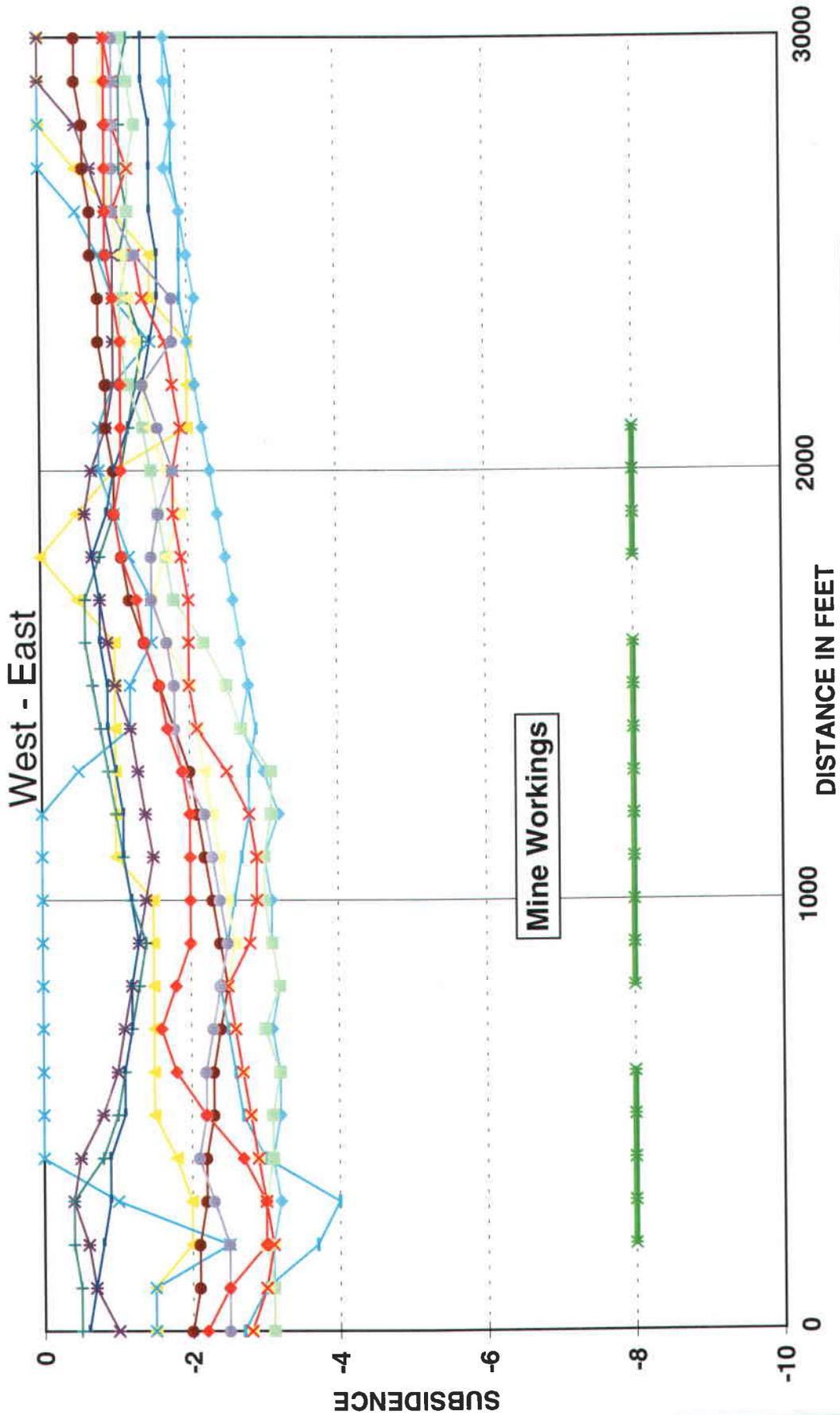


Figure 43

## Area 14

### Cottonwood 6th and 7th East Longwall Panels

Subsidence in Area 14 was first monitored and detected in 1987. Mining began in the 6th East panel in September 1986 and continued until the panel was completed in March 1987. Mining in the 7th East panel began in April 1987, and the panel was finished in September 1987 (Figure 44).

Topography consists of very steep south facing slopes and cliffs with slopes covered by a few scattered pinon, juniper, mountain brush, and grasses. Overburden ranges from 200 to near 1,400 feet.

The Castlegate Sandstone forms a 200-foot high escarpment along the north side of Newberry Canyon with numerous naturally occurring joints and fractures. Stress caused by removal of coal was transferred to the fractures resulting in brittle failure of the cliff face (spalling) in some places. Talus from the spalling has accumulated on the steep slopes below the cliffs on older natural talus slopes. The newer debris remains mostly above the coal outcrop level and reaches the canyon floor in only one location. Surface cracks have been observed and mapped along the ridge above the cliff. The cracks are discontinuous and extend for approximately 2,000 feet parallel to the northern edge of the 6th East longwall panel. A few cracks are also found directly on top of the Castlegate Sandstone escarpment. Maximum subsidence to date is over seven (7) feet above the western end of the 7th East Longwall Panel and five (5) feet over the eastern end of 6th East along the Pleasant Valley Fault (Figures 45, 46, and 47). Because this area has rugged and steep

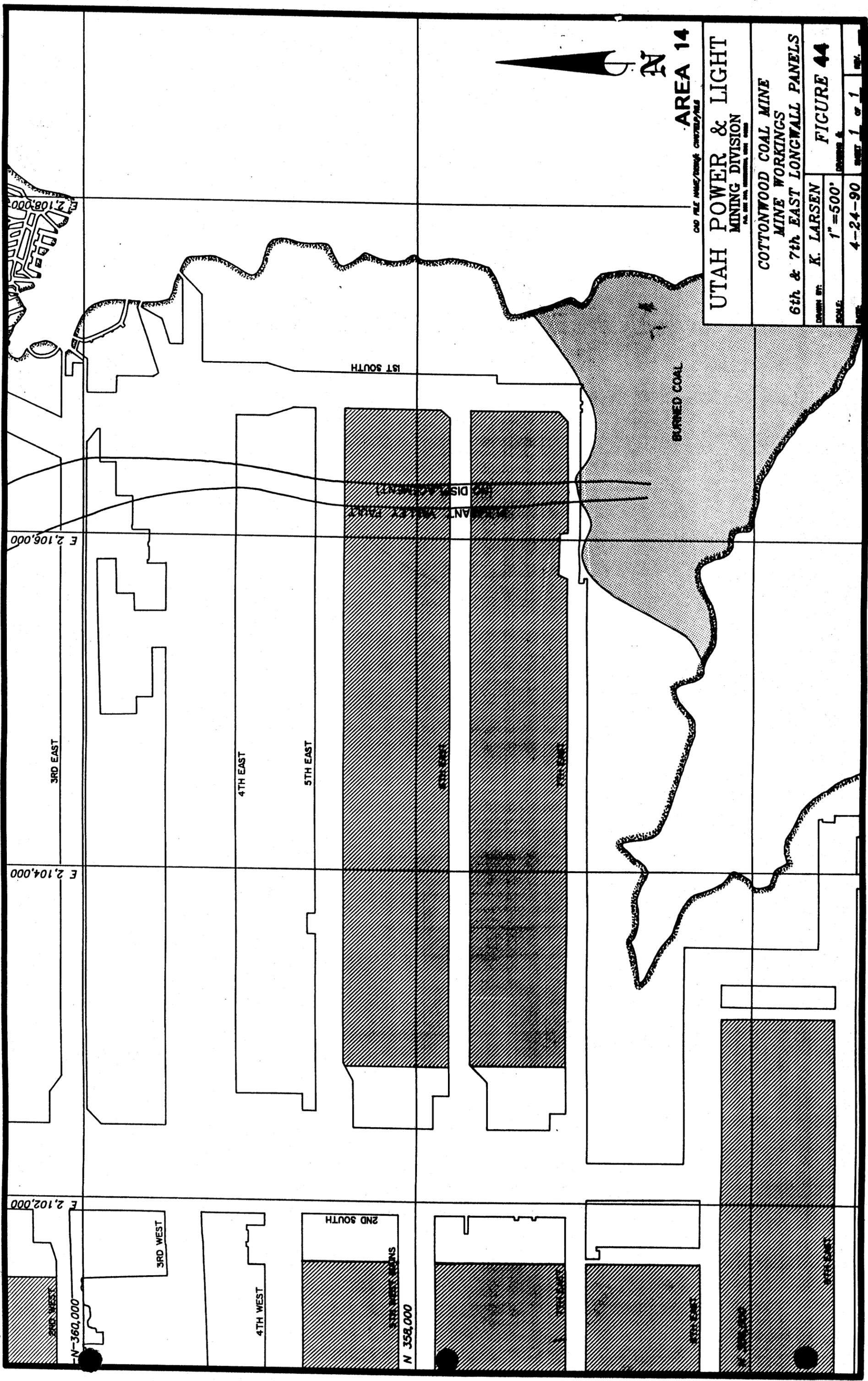
terrain, it is the most difficult to achieve consistent results using the photogrammetric monitoring. As can be seen on the subsidence map (Figure 45) and the profiles (Figures 46 and 47) the subsidence appears to vary substantially from one location to another and change up and down in time. This is because the photogrammetric monitoring is difficult in this type of terrain. The "bulls-eyes" of subsidence shown in 1996 are still present in the 1999 data. The aerial reconnaissance on June 29, 1999 showed no visible indication of change in these areas. It should be expected that inaccuracies in the reading will occur in this area because of the rugged terrain. Several survey targets were established in this area on the Castlegate cliff and have been surveyed since their emplacement from 196 through 1997. This monitoring shows no changes in the last five years of the monitoring period. The angle-of-draw was not calculated to the west, south and east because of the steep slopes, burned coal, and other workings surrounding the 6th and 7th East panels. The angle of draw on the north side of the 6th East Panel is 25 degrees.

There are no springs in the vicinity of Area 14. The strata are generally dry; thus, mining is expected to have no adverse impact on the hydrology.

Wildlife in the area includes deer, elk, nesting golden eagles in spring and summer, wintering bald eagles, hares, rabbits, grouse, and other species. Grazing cattle can also be found along the ridge top in the summer months.

The major impacts associated with subsidence and resulting cliff failure, surface cracking, and talus deposition in Area 14 are 1) possible loss of golden eagle nests and/or nest sites, 2) disruption of grazing and hunting land use, and 3) loss of wildlife habitat.

Prior to longwall mining in the area an eagle monitoring plan was developed and implemented. It went into effect in February 1986 and is an ongoing program. The purpose of the plan is to collect data whereby the impacts of subsidence and cliff spalling upon eagle nesting can be assessed. The report entitled "Assessment of Mining Related Impacts in Newberry Canyon" submitted to the Utah Division of Oil, Gas and Mining discusses all mining related impacts in Area 14 and includes the eagle monitoring plan as an appendix.



AREA 14

CAD FILE NAME/USER# CENTER/PLG

UTAH POWER & LIGHT  
MINING DIVISION

COTTONWOOD COAL MINE  
MINE WORKINGS  
6th & 7th EAST LONGWALL PANELS

DRAWN BY: K. LARSEN  
SCALE: 1" = 500'

FIGURE 44

DATE: 4-24-90  
SHEET 1 of 1

1ST SOUTH

SERRANANT (MILL ET FAULT)  
(NO DISPLACEMENT)

BURNED COAL

3RD EAST

4TH EAST

5TH EAST

6TH EAST

7TH EAST

E 2,104,000

E 2,106,000

E 2,108,000

E 2,102,000

N 360,000

N 358,000

3RD WEST

4TH WEST

2ND SOUTH

5TH WEST WORKINGS

6TH WEST

7TH WEST

8TH WEST

# Area 14 Subsidence Profile

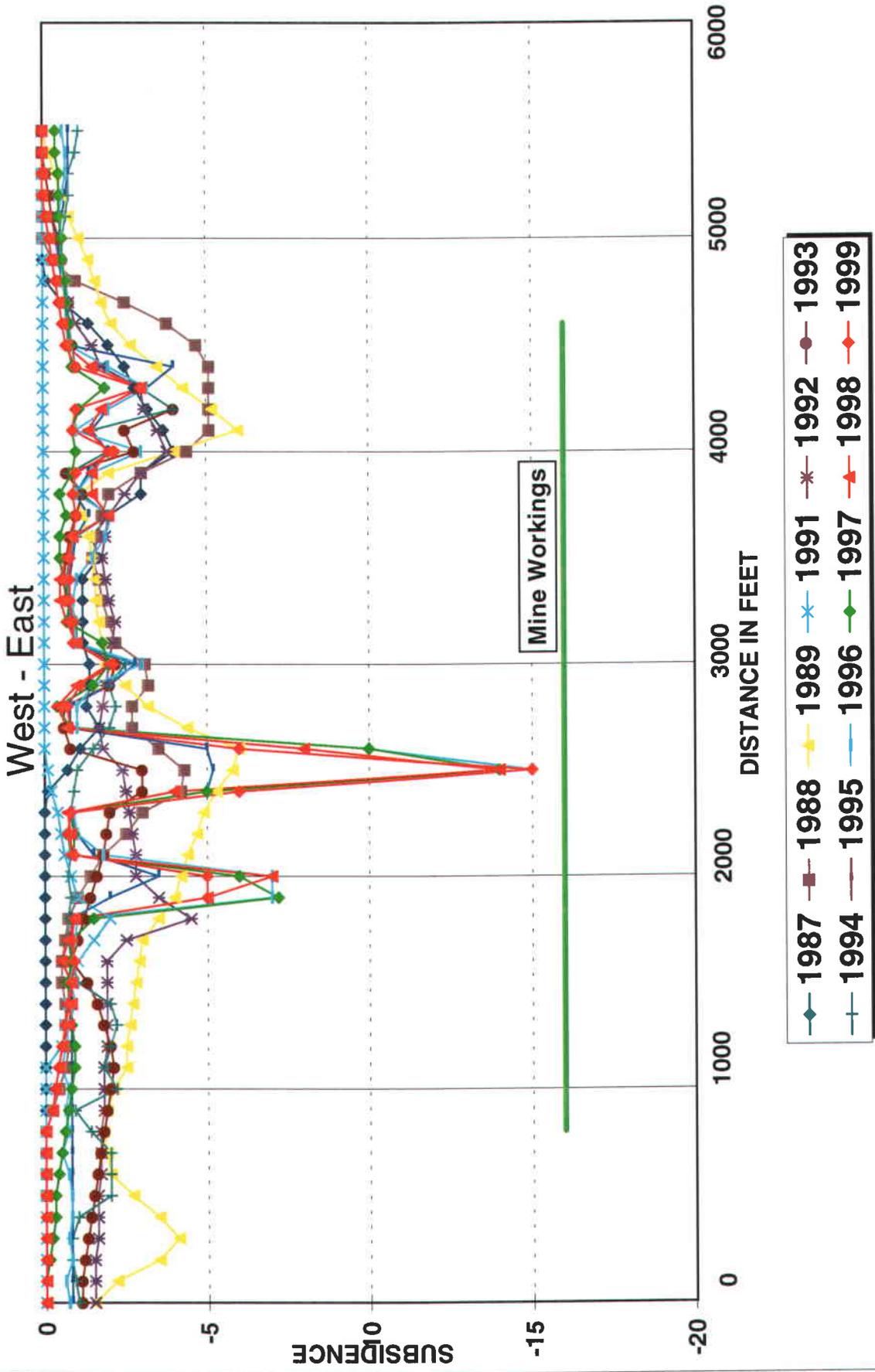


Figure 46

# Area 14 Subsidence Profile

North - South

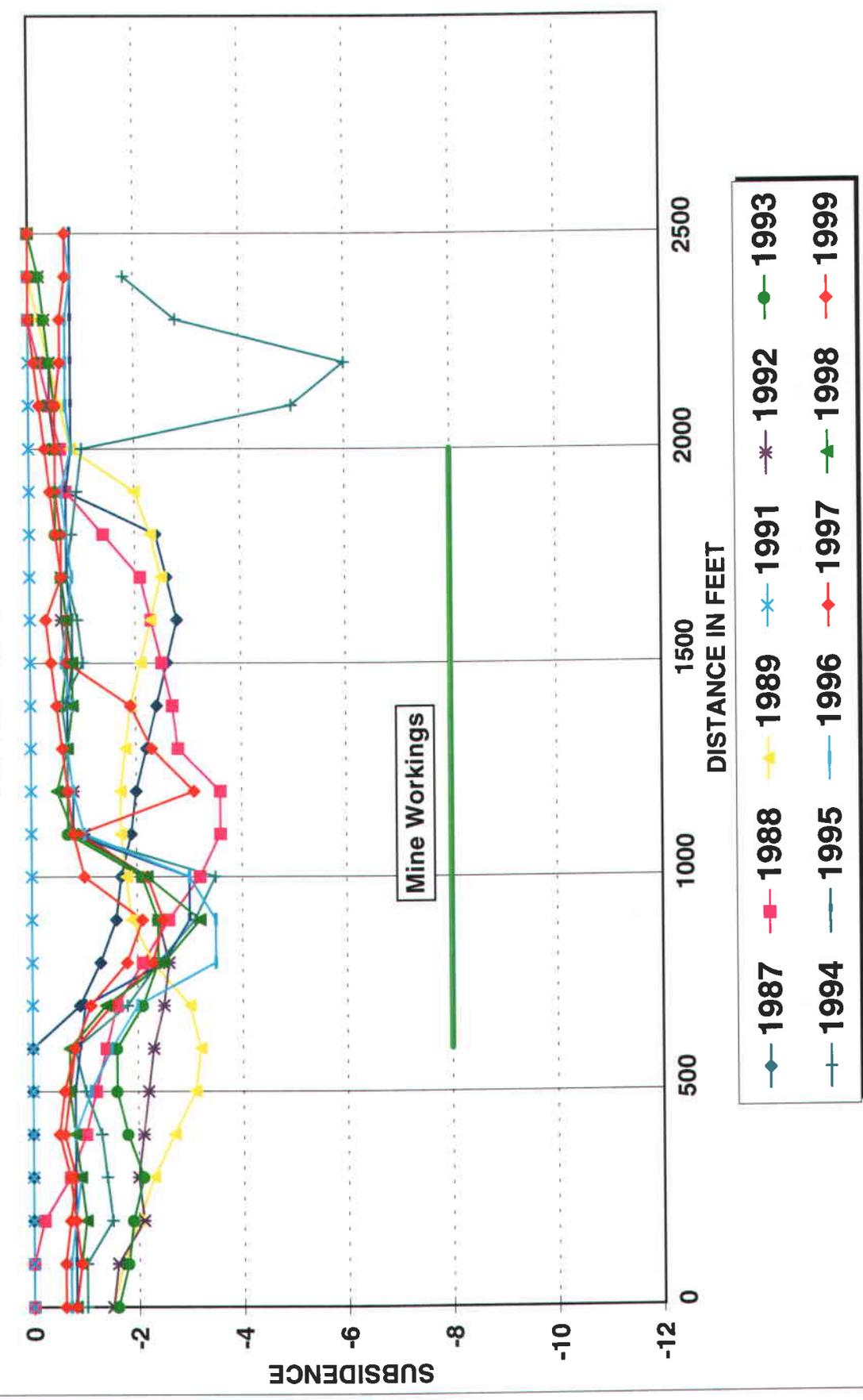


Figure 47

## Area 15

### Cottonwood 9th and 12th West Longwall Panels

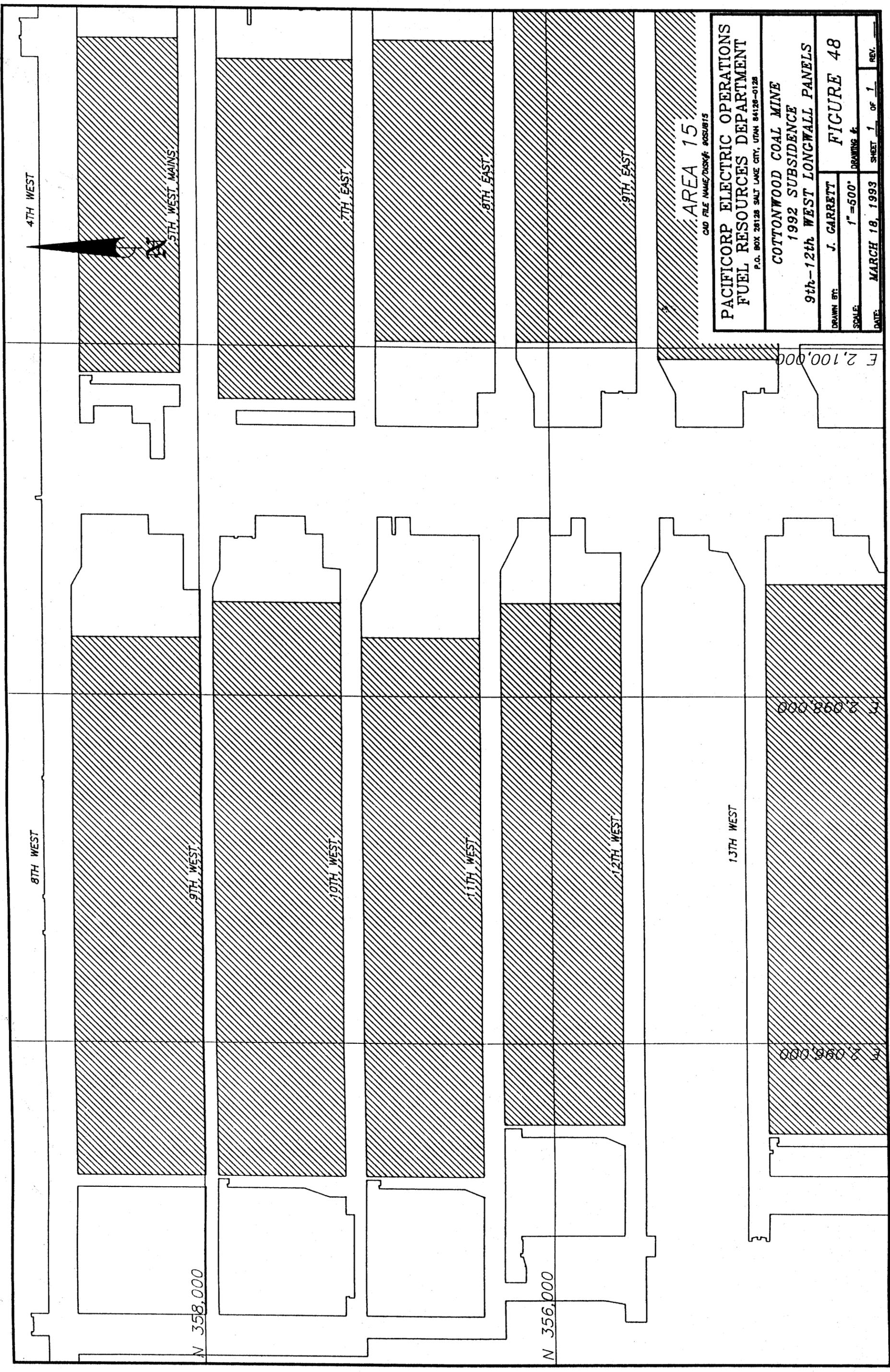
Subsidence in 9th and 10th West was first monitored and detected in 1988 when longwall extraction began there. The 9th through 12th West panels were all completed by the fall of 1989 (Figure 48).

The surface above these panels is comprised mainly of steep to moderate slopes with a small flat area forming the top of East Mountain on the area's eastern edge. Overburden ranges from 800 feet to over 2000 feet.

Maximum measured subsidence in 1999 is slightly over four feet which is similar to that which was measured since 1995 above 11th West (Figures 49, 50, and 51). This area has experienced no additional subsidence in the past eight years.

Calculated angle-of-draw is less than zero on the south and east and reaches 20 degrees on the west.

There are no known springs in the area.



4TH WEST

5TH WEST MAINS

7TH EAST

8TH EAST

9TH EAST

AREA 15

CAD FILE NAME/DISK# 905UB15

PACIFICORP ELECTRIC OPERATIONS  
FUEL RESOURCES DEPARTMENT

P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

COTTONWOOD COAL MINE  
1992 SUBSIDENCE

9th-12th WEST LONGWALL PANELS

DRAWN BY: J. GARRETT

SCALE: 1" = 500'

DATE: MARCH 18, 1993

FIGURE 48

DRAWING #

SHEET 1 OF 1

REV.

8TH WEST

9TH WEST

10TH WEST

11TH WEST

12TH WEST

13TH WEST

N 358,000

N 356,000

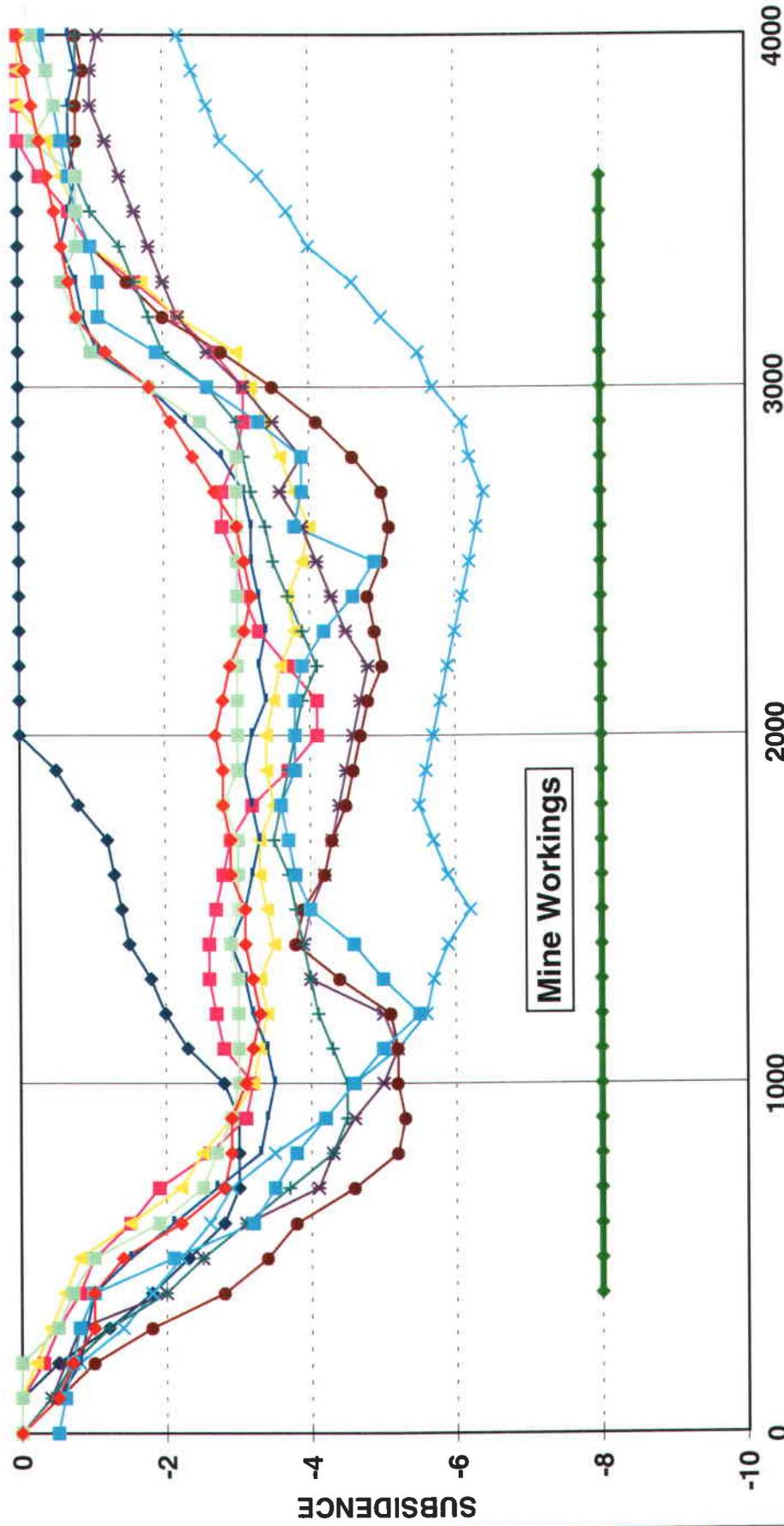
E 2,098,000

E 2,096,000

E 2,100,000

# Area 15 Subsidence Profile

North - South



Mine Workings

- 1988
- 1991
- 1992
- 1993
- 1994
- 1995
- 1996
- 1997
- 1998
- 1999

Figure 50

# Area 15 Subsidence Profile West - East

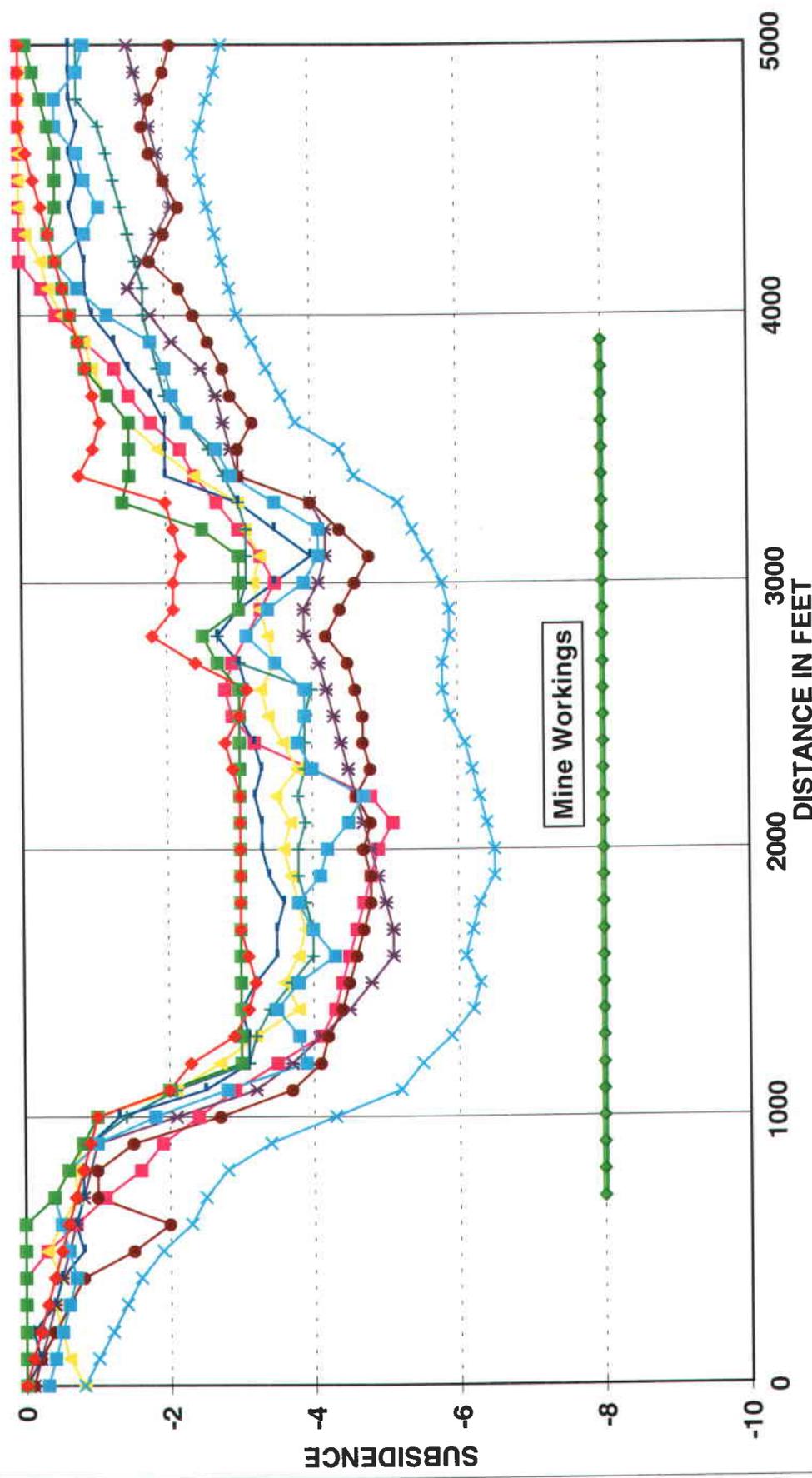


Figure 51

## Area 16

### Cottonwood 8th Through 11th East Longwall Panels

Mining in Area 16 began in the 8th East panel in June of 1989, and ended in the 8th East panel in May, 1992 (Figure 52).

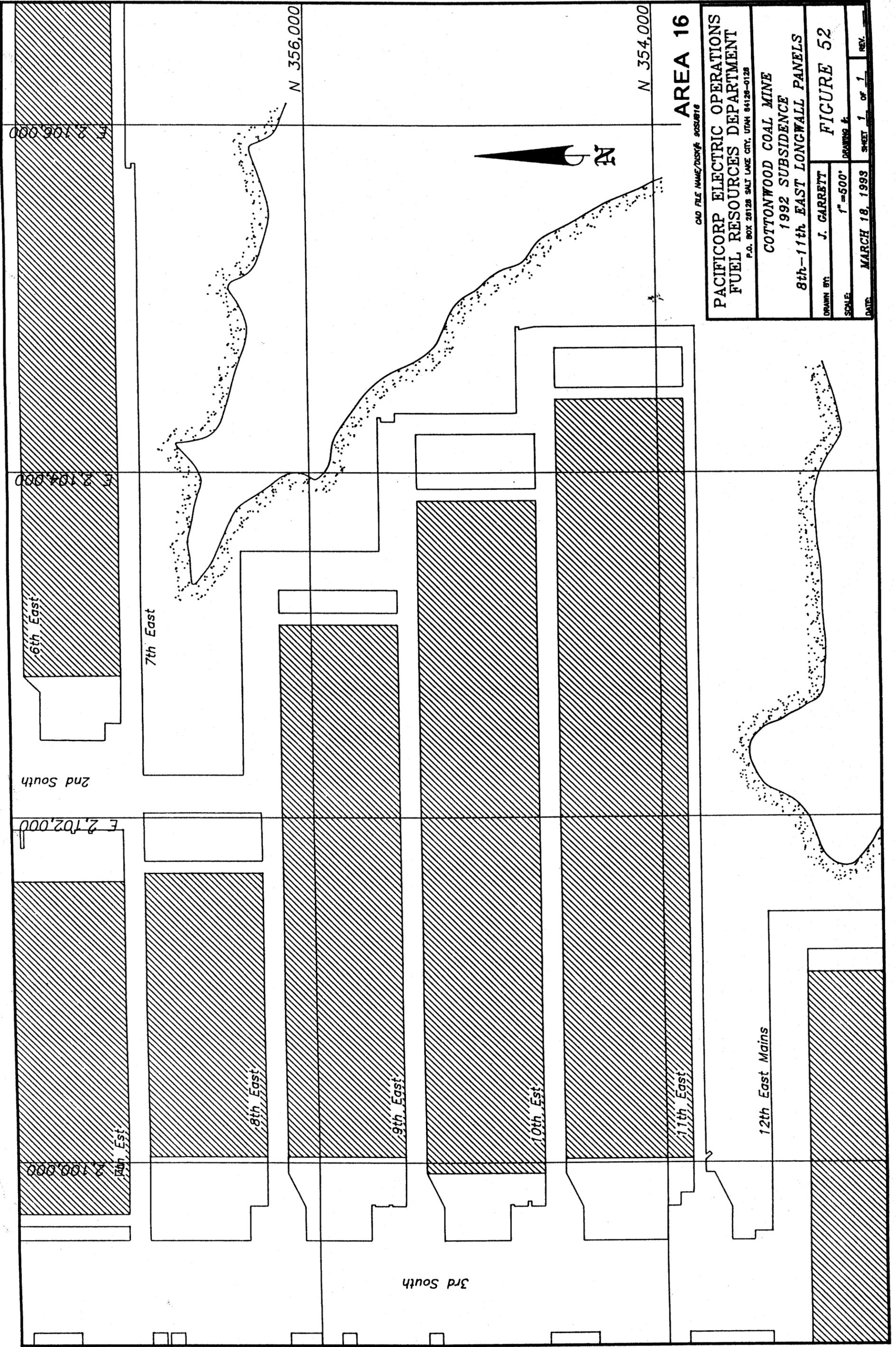
Topography in Area 16 is very similar to that of Area 14 with cliffs and very steep slopes covered by a few scattered pinon, juniper, mountain brush, and grasses. Overburden ranges from near 100 feet at the outcrop to about 1,800 feet.

As with Area 14 cliff spalling has occurred in places and the resulting talus has accumulated on the slopes below the cliffs. No surface cracks have been observed to date.

Maximum subsidence observed in 1999 is similar to the 1997 measurement that exceeded five (5) feet and occurs over the 11th East panel where the overburden is less than 600 feet (Figure 53, 54, and 55). Figure 53 shows several "bulls-eyes" in the area of the Castlegate cliff which are in very steep and rugged areas. The photogrammetric method is not reliable in these areas and it is not felt that the areas have subsided to the extent shown on figure 53. This is supported by the fact that subsidence survey targets placed along the cliff in 1986 have shown no movement in recent years.

The angle-of-draw was not calculated because the steep slopes and other adjacent workings make accurate measurement difficult.

There are no known springs in the area. Strata on both the surface and in underground mine workings are typically very dry; therefore, mining is not expected to affect the hydrology.



N 356,000

N 354,000

**AREA 16**

CAD FILE NAME/DISK# 90528716

**PACIFICORP ELECTRIC OPERATIONS  
FUEL RESOURCES DEPARTMENT**  
P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

**COTTONWOOD COAL MINE  
1992 SUBSIDENCE  
8th-11th EAST LONGWALL PANELS**

DRAWN BY: **J. GARRETT**  
SCALE: **1" = 500'**

**FIGURE 52**

DATE: **MARCH 18, 1993**  
SHEET **1** OF **1**  
REV.

# Area 16 Subsidence Profile

## North - South

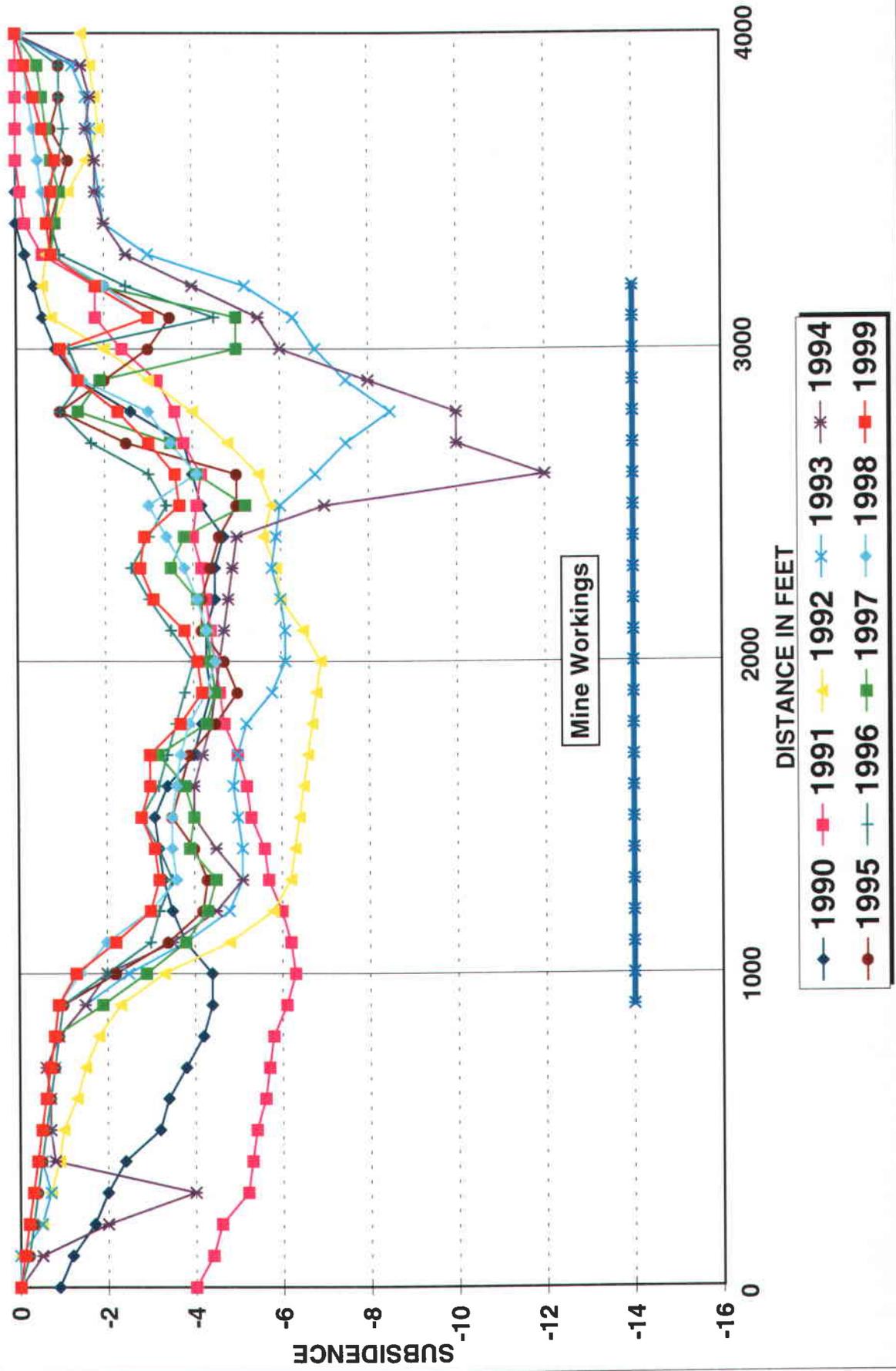


Figure 54

# Area 16 Subsidence Profile West - East

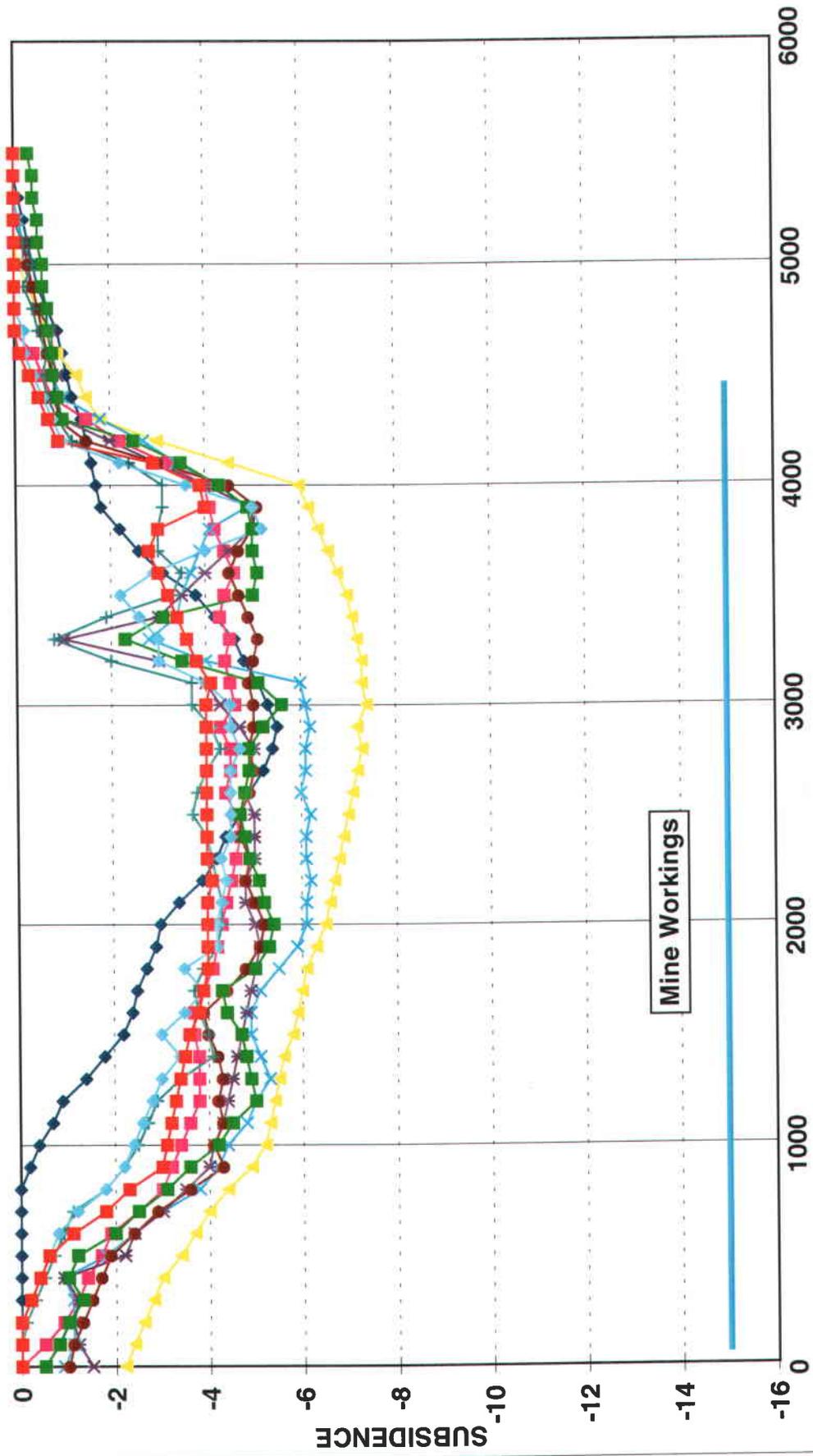


Figure 55

## Area 17

### Cottonwood 13th Through 16th West Longwall Panels

Mining in the 16th West longwall panel began in October 1990 and the panel was completed in March 1991. Mining in the area was finished in March, 1992 with the completion of the 13th West longwall panel (figure 56). The topography over these longwall panels is characterized by steep slopes covered with conifer and aspen trees which extend up from the cliffs which surround the east, south and west sides of the panels. The panels are covered by overburden ranging from 800 feet at both the west and east end of the panels to over 1,800 feet in the center of the panels.

The measured subsidence exceeds six (6) feet in an area above the 16th west panel which is slightly less than measured in 1997 but similar to the 1998 measurement. The subsidence zone follows a narrow east-west trending trough centered above the two longer panels and then extends north above the 14th and 13th west longwall panels (figures 57, 58, and 59). No surface fractures have been observed in the area above these longwall panels. Subsidence in this area has been stable for over seven years.

On the south side of the subsidence zone, the angle of draw is less than 10 degrees.

No springs are located above this area and the strata is not saturated. Therefore, it is not likely that this subsidence will have any effect on the hydrology of the area.



AREA 17

CAD FILE NAME/NUMBER: 95L81619

PACIFICORP ELECTRIC OPERATIONS  
FUEL RESOURCES DEPARTMENT

P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

COTTONWOOD COAL MINE  
13th - 16th WEST LONGWALL PANELS

DRAWN BY: J. GARRETT

SCALE: 1"=500'

DATE: MARCH 16, 1993

FIGURE 56

DRAWING #

SHEET 1 OF 1

REV.

E 2,102,000

E 2,100,000

E 2,098,000

E 2,096,000

12TH WEST

13TH WEST

14TH WEST

15TH WEST

16TH WEST

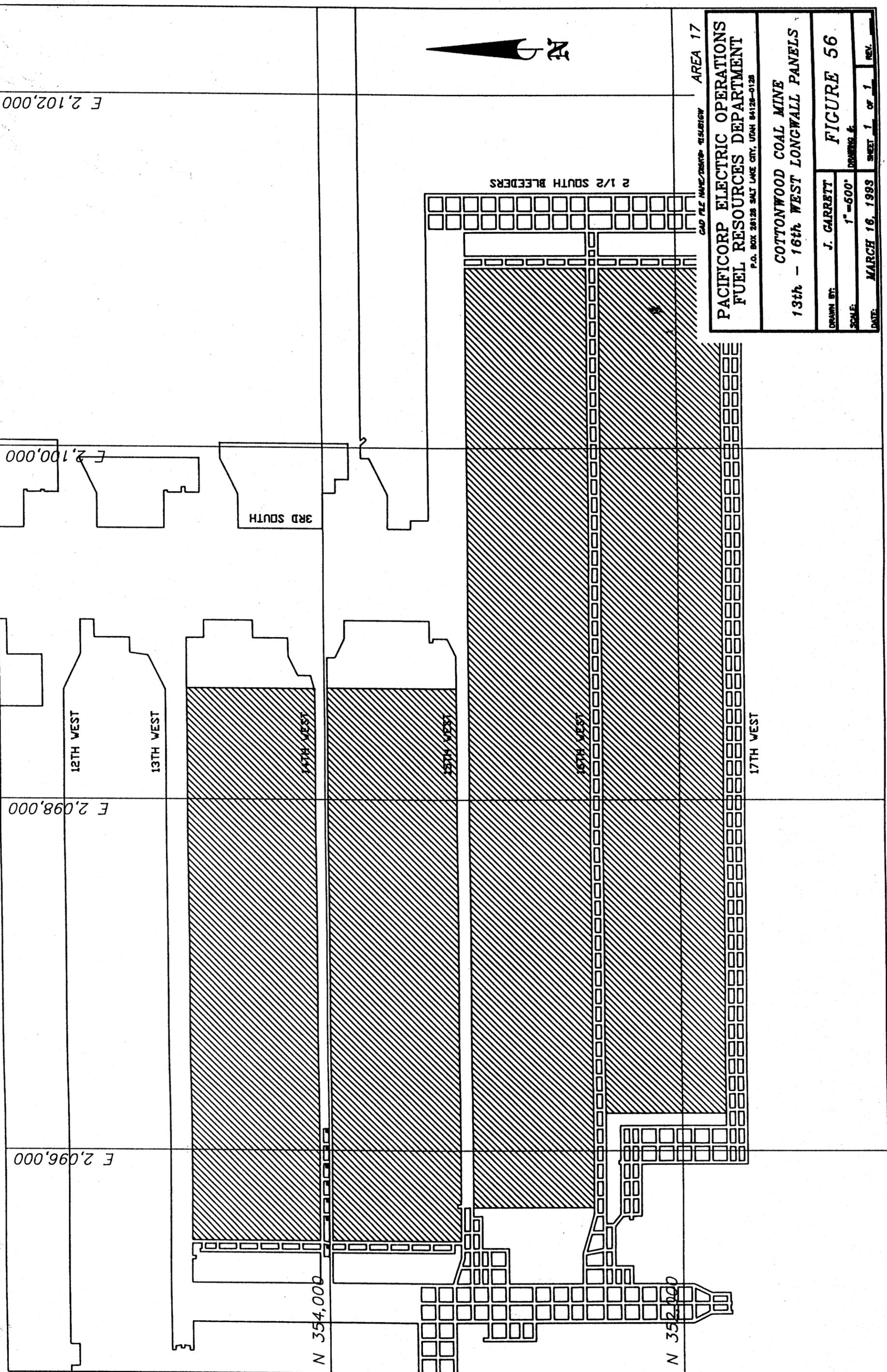
17TH WEST

3RD SOUTH

2 1/2 SOUTH BLEEDERS

N 354,000

N 352,000



# Area 17 Subsidence Profile West - East

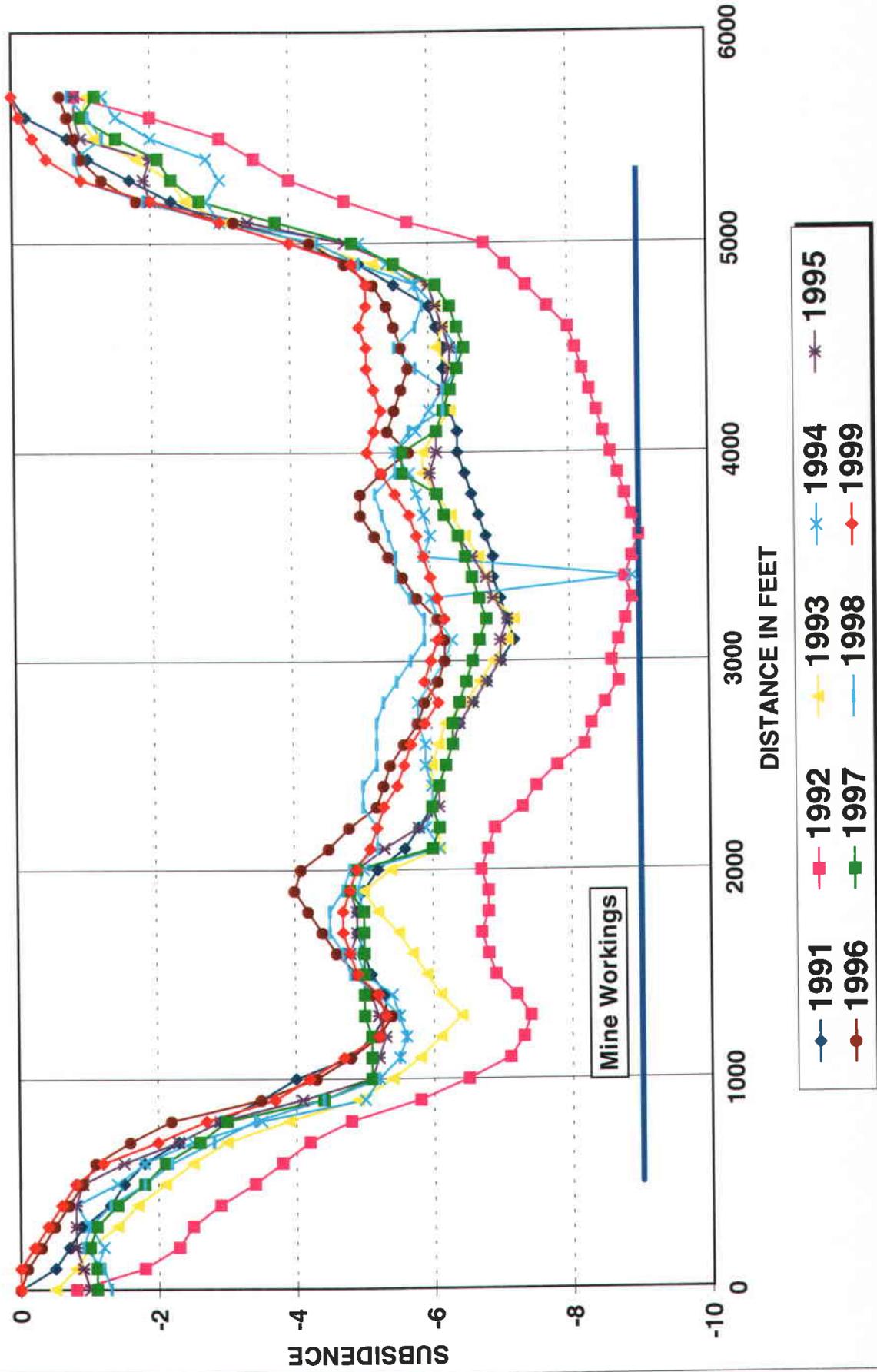


Figure 58

# Area 17 Subsidence Profile North - South

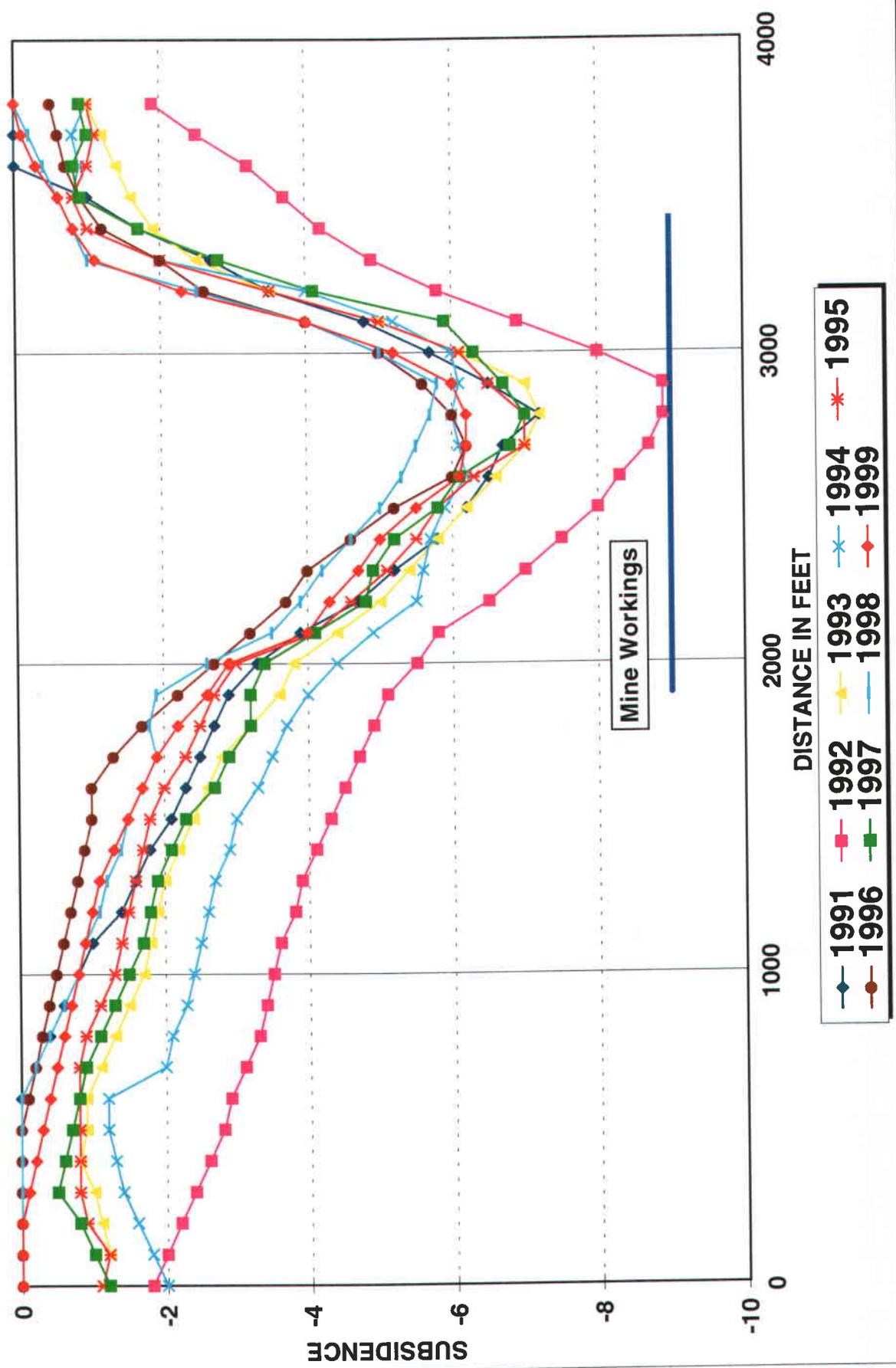


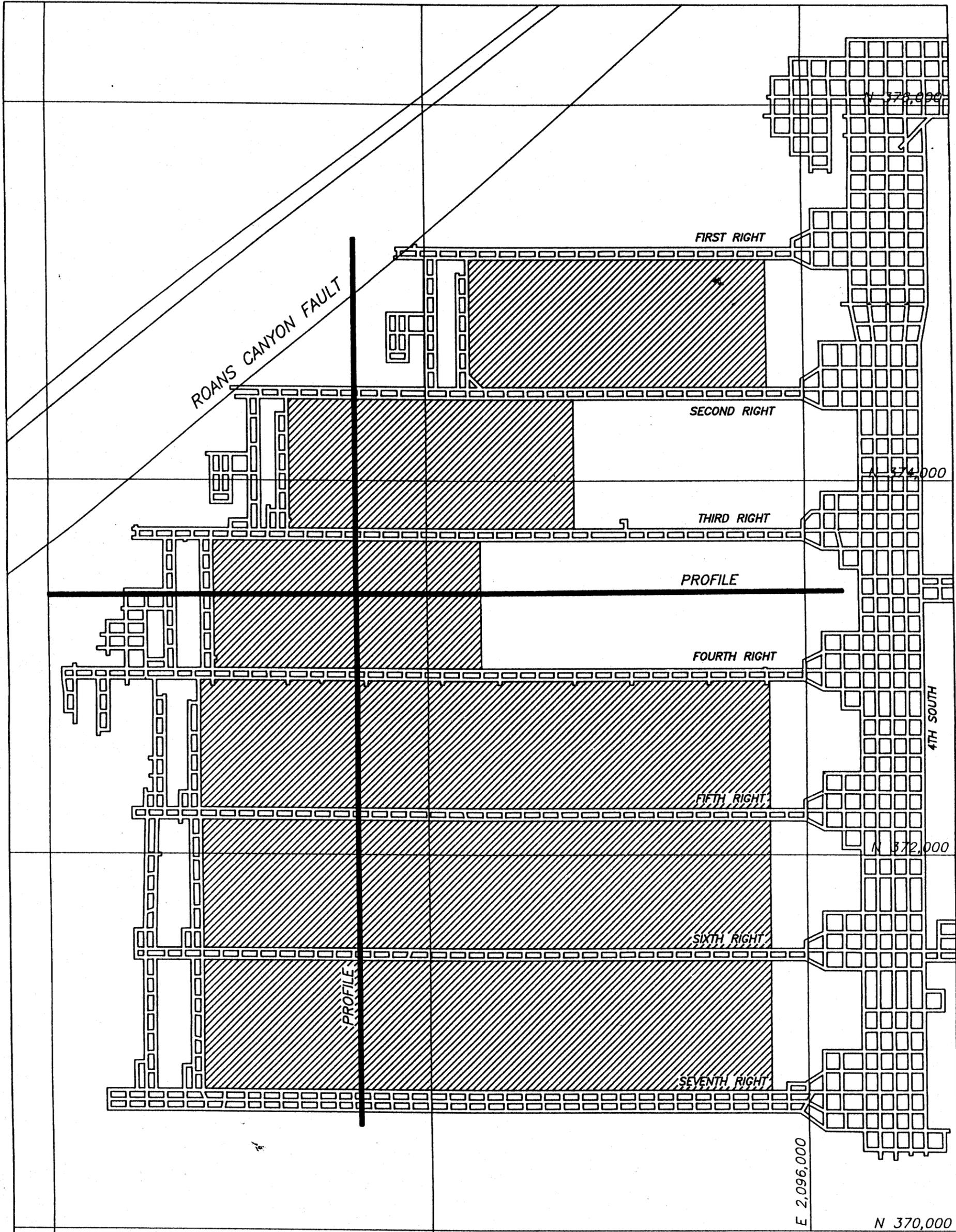
Figure 59

## Area 18

### Deer Creek Mine 2nd through 7th Right Longwall Panels

Longwall mining in this area was completed in May, 1992 with the extraction of six adjacent longwall panels (figure 60). The 3rd and 4th Right panels were terminated short of the entire panel due to geologic complications. The land surface in the area of these panels contains steep slopes covered by conifer and aspen trees, and sagebrush. The longwall panels have overburden ranging from 1,800 feet on the west end of the panels to 2,000 feet on the east side of the panels.

Subsidence in this area has reached a maximum of nearly seven (7) feet, which is slightly less than measured in 1997 but similar to the 1998 measurement (Figures 61, 62, and 63). The subsidence zone is a broad trough running in a north - south direction. This area is overlain by several springs. Monitoring of these springs has shown no change in the quality or quantity of water discharged from them (see appendix and the 1999 Hydrologic Monitoring report).



E 2,092,000

E 2,094,000

E 2,096,000

N 370,000

N 372,000

N 374,000

N 376,000

4TH SOUTH

ROANS CANYON FAULT

FIRST RIGHT

SECOND RIGHT

THIRD RIGHT

PROFILE

FOURTH RIGHT

FIFTH RIGHT

SIXTH RIGHT

SEVENTH RIGHT

PROFILE



CAD FILE NAME/DISK#: 91SUB7R

AREA 18

PACIFICORP ELECTRIC OPERATIONS  
FUEL RESOURCES DEPARTMENT

P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

DEER CREEK MINE  
2nd-7th RIGHT LONGWALL PANELS

DRAWN BY: J. GARRETT

FIGURE 60

SCALE: 1"=500'

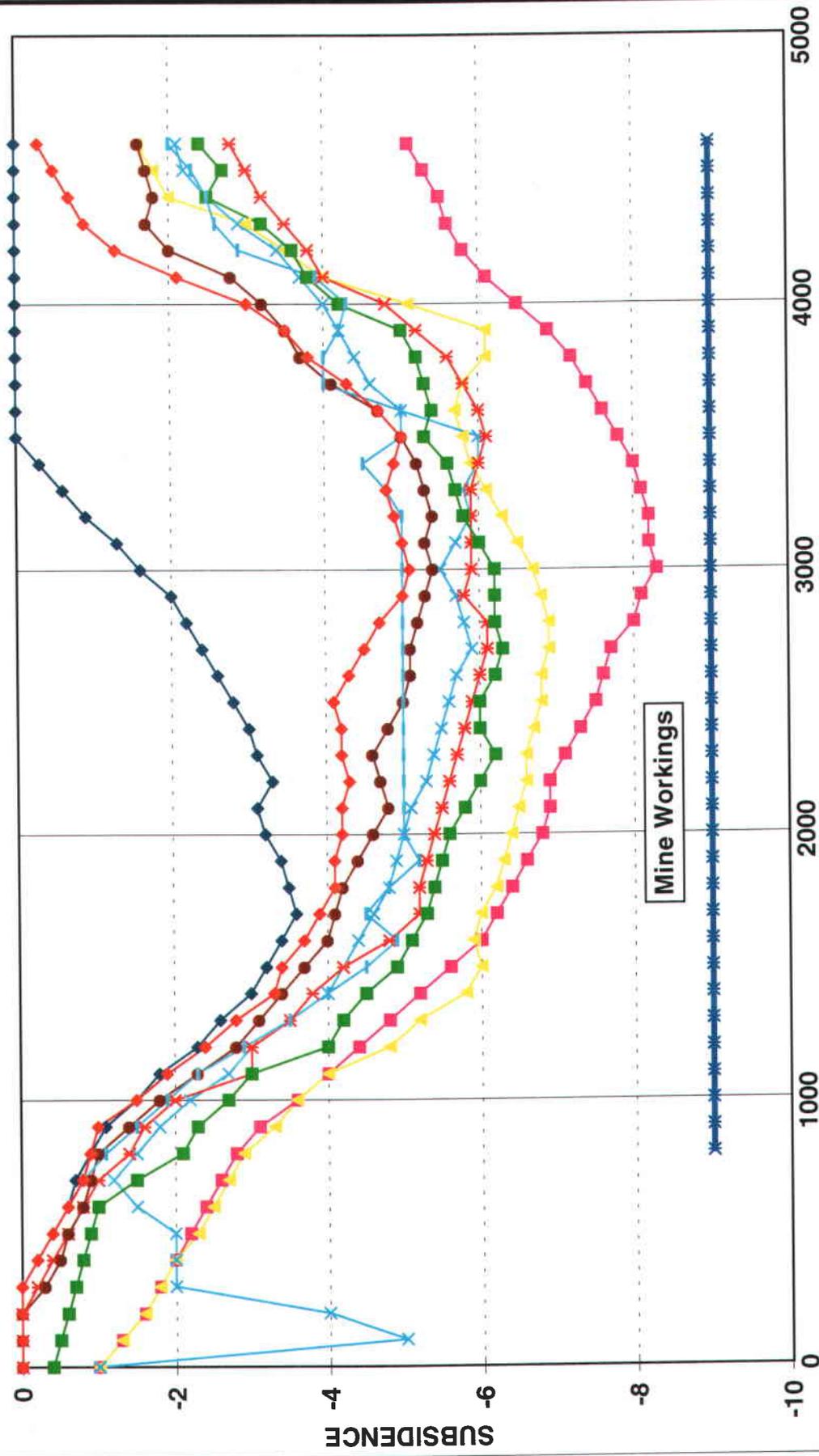
DRAWING #:

DATE: MARCH 16, 1993

SHEET 1 OF 1

REV.

# Area 18 Subsidence Profile North - South



- ◆ 1991
- ◆ 1992
- ◆ 1993
- ◆ 1994
- ◆ 1995
- ◆ 1996
- ◆ 1997
- ◆ 1998
- ◆ 1999

Figure 62

# Area 18 Subsidence Profile West - East

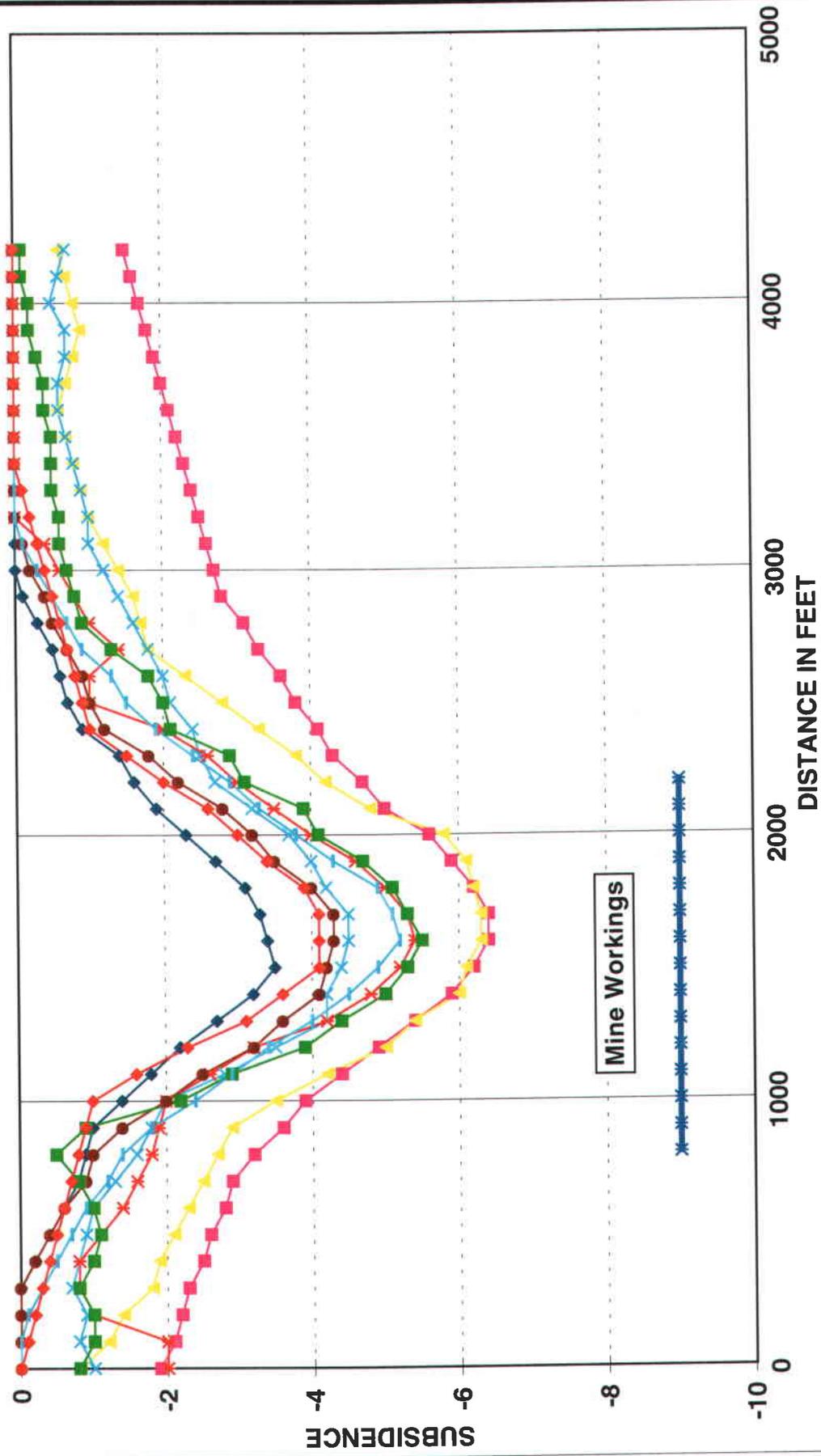


Figure 63

## Area 19

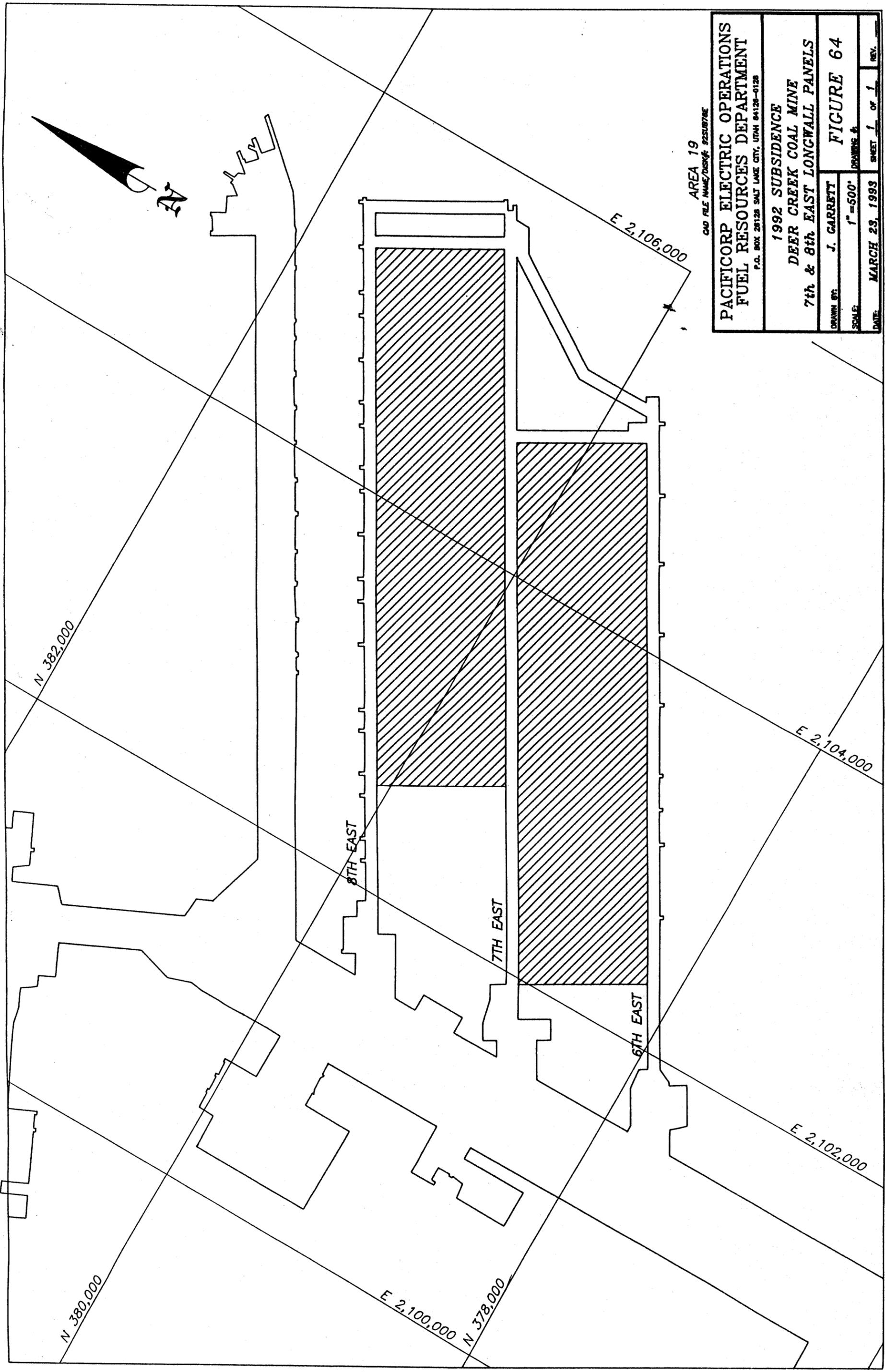
### Deer Creek 7th and 8th East Longwall Panels off 3rd North

Mining in the 7th East Longwall Panel began in May, 1992 and by January 1993 mining was completed in the 8th East Longwall Panel (Figure 64).

The land surface above these two panels is very rugged. The longwall panels are located beneath a ridge located between the left and right forks of Meetinghouse Canyon. The area is covered by sagebrush on the south facing slopes and dense stands of spruce trees on the north facing slopes. The overburden in the area of these panels ranges from 400 feet on the north to over 1,800 feet on the south.

Subsidence in this area has increased from slightly over one foot in 1992 to over four feet in 1993 but has been stable between 1993 and 1999 (Figures 65 and 66).

This area is overlain by a few springs. Monitoring of these springs has shown no change in the quality or quantity of water discharged from them (see appendix and the 1999 Hydrologic Monitoring Report).



AREA 19  
 CAD FILE NAME/DSK/F: 925UB79E

PACIFICORP ELECTRIC OPERATIONS  
 FUEL RESOURCES DEPARTMENT

P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

1992 SUBSIDENCE  
 DEER CREEK COAL MINE  
 7th & 8th EAST LONGWALL PANELS

DRAWN BY: J. GARRETT

FIGURE 64

SCALE: 1" = 500'

DRAWING #

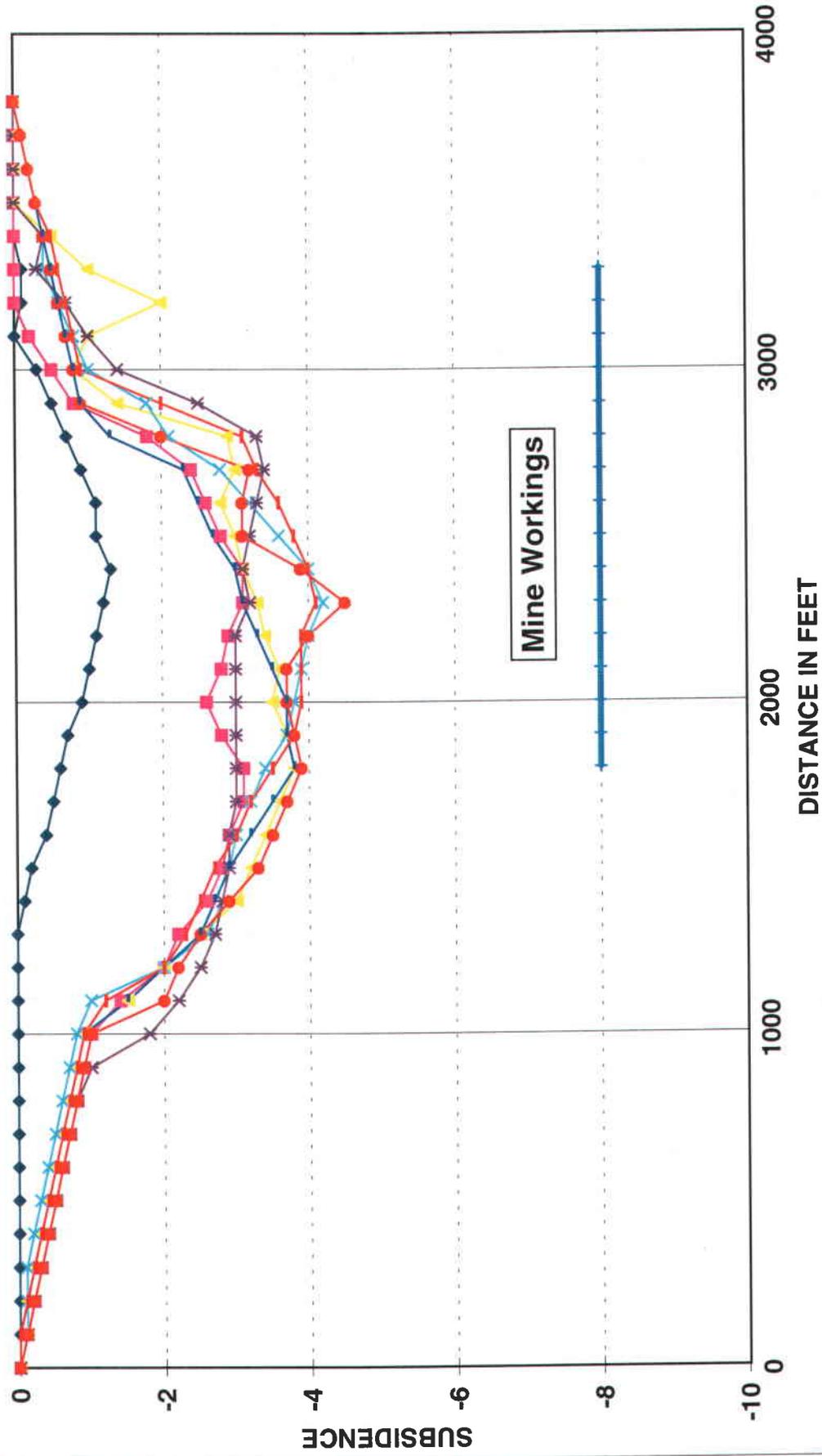
DATE: MARCH 23, 1993

SHEET 1 of 1

REV.

# Area 19 Subsidence Profile

West - East



- 1992 (Blue diamonds)
- 1993 (Red squares)
- 1994 (Yellow triangles)
- 1995 (Cyan crosses)
- 1996 (Purple asterisks)
- 1997 (Blue dashes)
- 1998 (Red circles)
- 1999 (Red dashes)

Mine Workings

Figure 66

## Area 20

### Deer Creek 1st & 2nd Left Longwall Panels off 3 ½ South

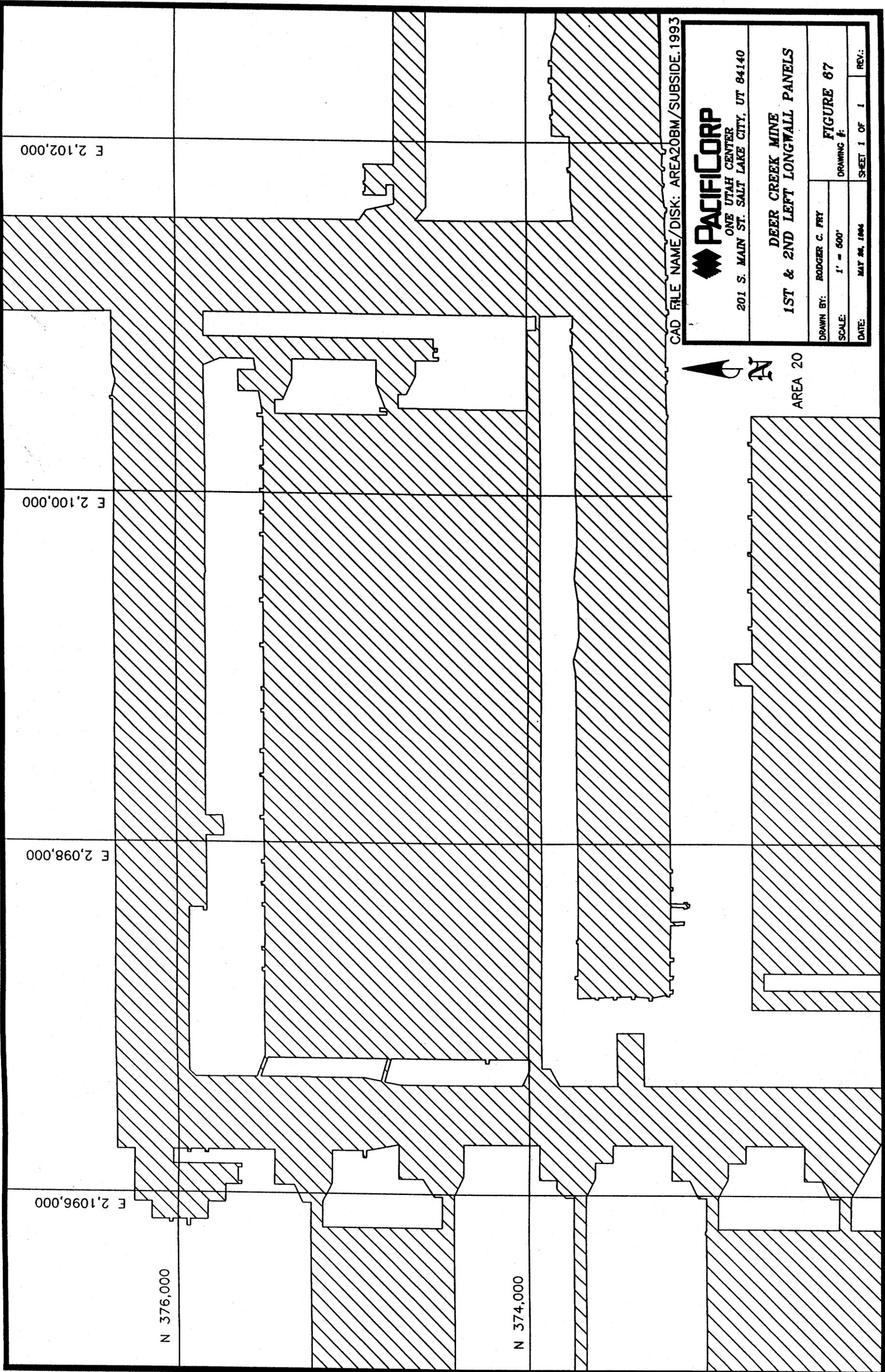
Mining in the 2nd Left Longwall Panel began in February 1993 and was completed in June 1993. Mining then started in the 1st Left Longwall Panel in July 1993 and was completed in November of 1993 (Figure 67).

These longwall panels are overlain by moderately steep slopes that are heavily covered with aspen and spruce trees. The overburden above these panels range from 1,400 feet at their east end to over 2,000 feet above their west end.

The monitoring detected a maximum of slightly over four (4) feet of subsidence in 1999 which is similar to that measured in 1997 and 1998 but less than the maximum of slightly over six (6) feet of subsidence above the 2nd Left Longwall Panel measured in 1996.

The 1996 reading showed an increase from the maximum of slightly over four feet that was measured in 1995 and a foot greater than that measured in 1994 which showed a maximum of five feet of subsidence (Figures 68 and 69). It is believed that subsidence in this area is substantially complete. All of the subsidence detected falls within the bounds of the longwall area. Therefore; the angle of draw in this area is considered to be steeper than 10°.

These longwall panels are overlain by several springs. Monitoring of the springs revealed no impacts due to the subsidence.



CAD FILE NAME/DISK: AREA20BM/SUBSIDE.1993

	
ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140	
DEER CREEK MINE 1ST & 2ND LEFT LONGWALL PANELS	
DRAWN BY: RODGER C. FRY	FIGURE 67
SCALE: 1" = 600'	DRAWING #:
DATE: MAY 26, 1994	SHEET 1 OF 1
REV.:	



AREA 20

# Area 20 Subsidence Profile

West - East

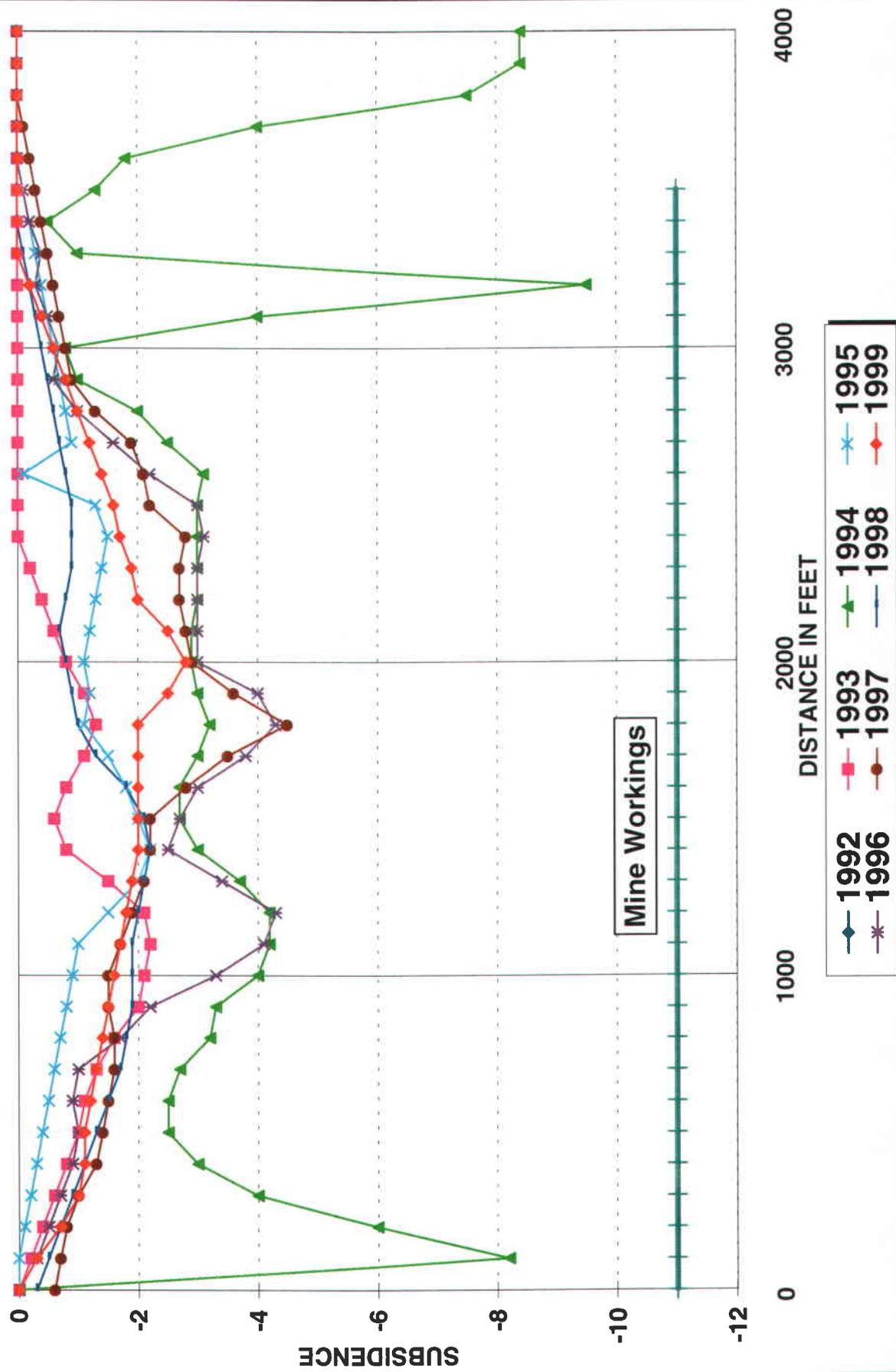


Figure 69

## Area 21

### Deer Creek Mine 2nd East Through 7th East Longwall Panels

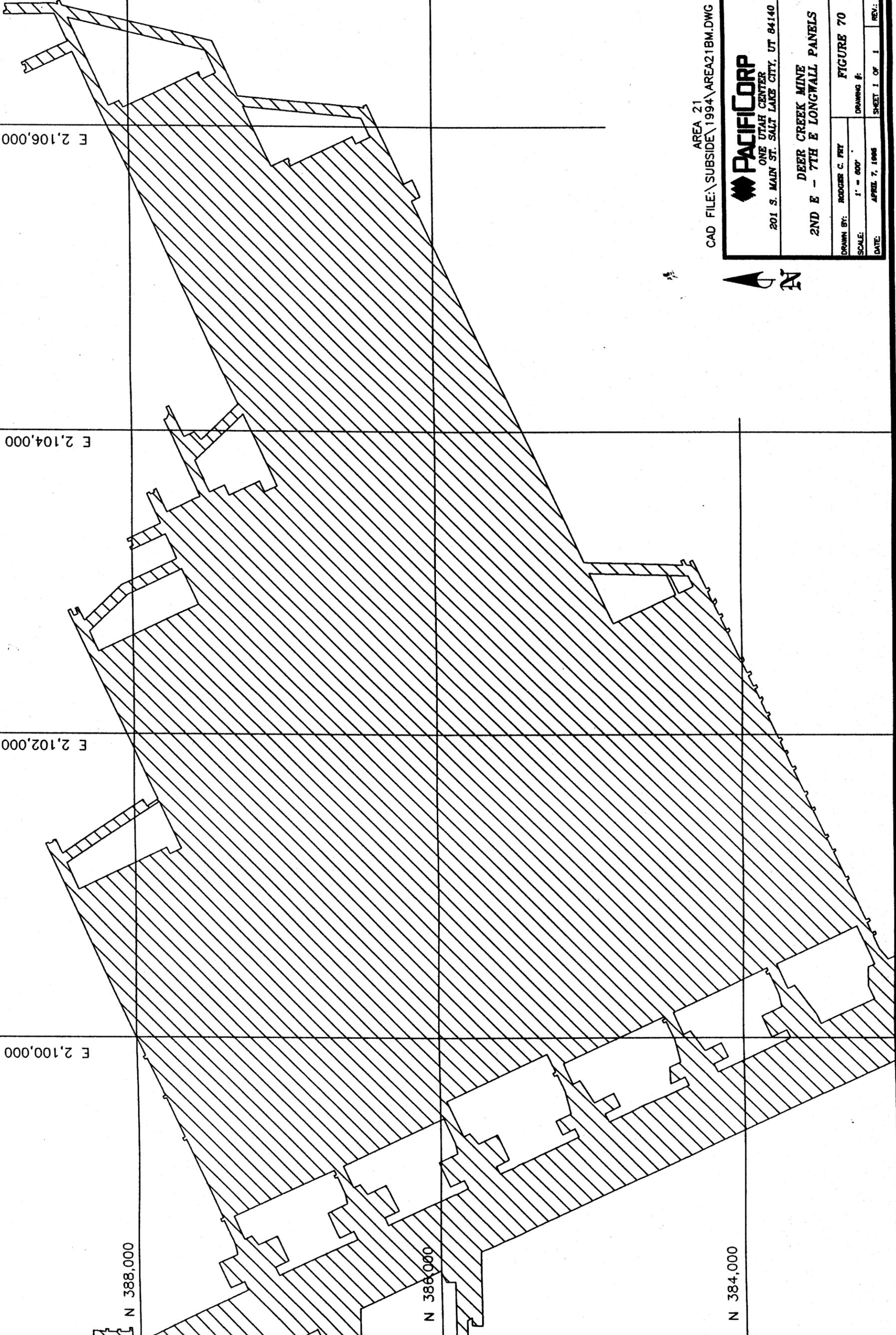
Mining in the 2nd East Longwall panel began in November of 1993 and by the End of August 1995 longwall mining had removed all of the 2nd through 5th East Longwall Panels and the eastern 1,100 feet of the 6th East Longwall Panel (Figure 70). Mining in this area, including the remainder of the 6th East and all of the 7th East Longwall Panels, was completed in January 1996.

The topography in this area is fairly rugged. A ridge along the south side of Rilda Canyon is located through the center of the area. The slopes leading down from this ridge to Rilda Canyon on the north are heavily vegetated with conifer trees. Overburden in this area ranges from less than 200 feet in the north to greater than 1,800 feet beneath the ridge top.

Subsidence detected in 1994 had reached a maximum of over four (4) feet above the 2nd East Longwall Panel (Figures 71, 72 and 73). Subsidence over the 3rd East longwall panel was not detected because this panel is longer than the 2nd East panel and subsidence doesn't usually occur until two panel widths have been mined. In 1995, subsidence had progressed to where most of the areas underlain by the 2nd through 6th East Longwall Panels had subsided between 5 and 6 feet. In 1996, the maximum subsidence that was measured had not increased from that measured in 1995 but an increase in subsidence was noted on the north end of figure 72 and on the western end of figure 73. This is in the area of the 6th and 7th East Longwall Panels that were the last to be extracted. The 1999

monitoring indicated that subsidence has been stable for the past three years with the exception of an area along the North-South profile line at 1,500 feet that showed an increase to seven feet of subsidence. An increase of approximately one foot from 1998. During the helicopter reconnaissance in 1995, several fractures were identified and several areas were noted where boulders had rolled from the Castlgate cliff. These are shown on figure 71. The area of subsidence is completely contained within the mining area; Therefore, the angle of draw is near vertical.

Several springs are located above these longwall panel. However, hydrologic monitoring has not detected any change to the spring flow that is attributable to mining (see 1999 Hydrologic Monitoring Report).



AREA 21  
CAD FILE:\SUBSIDE\1994\AREA21BM.DWG



ONE UTAH CENTER  
201 S. MAIN ST. SALT LAKE CITY, UT 84140

DEER CREEK MINE  
2ND E - 7TH E LONGWALL PANELS

DRAWN BY: RODGER C. FREY	FIGURE 70
SCALE: 1" = 600'	DRAWING #:
DATE: APRIL 7, 1996	SHEET 1 OF 1
	REV:



# Area 21 Subsidence Profile

North - South

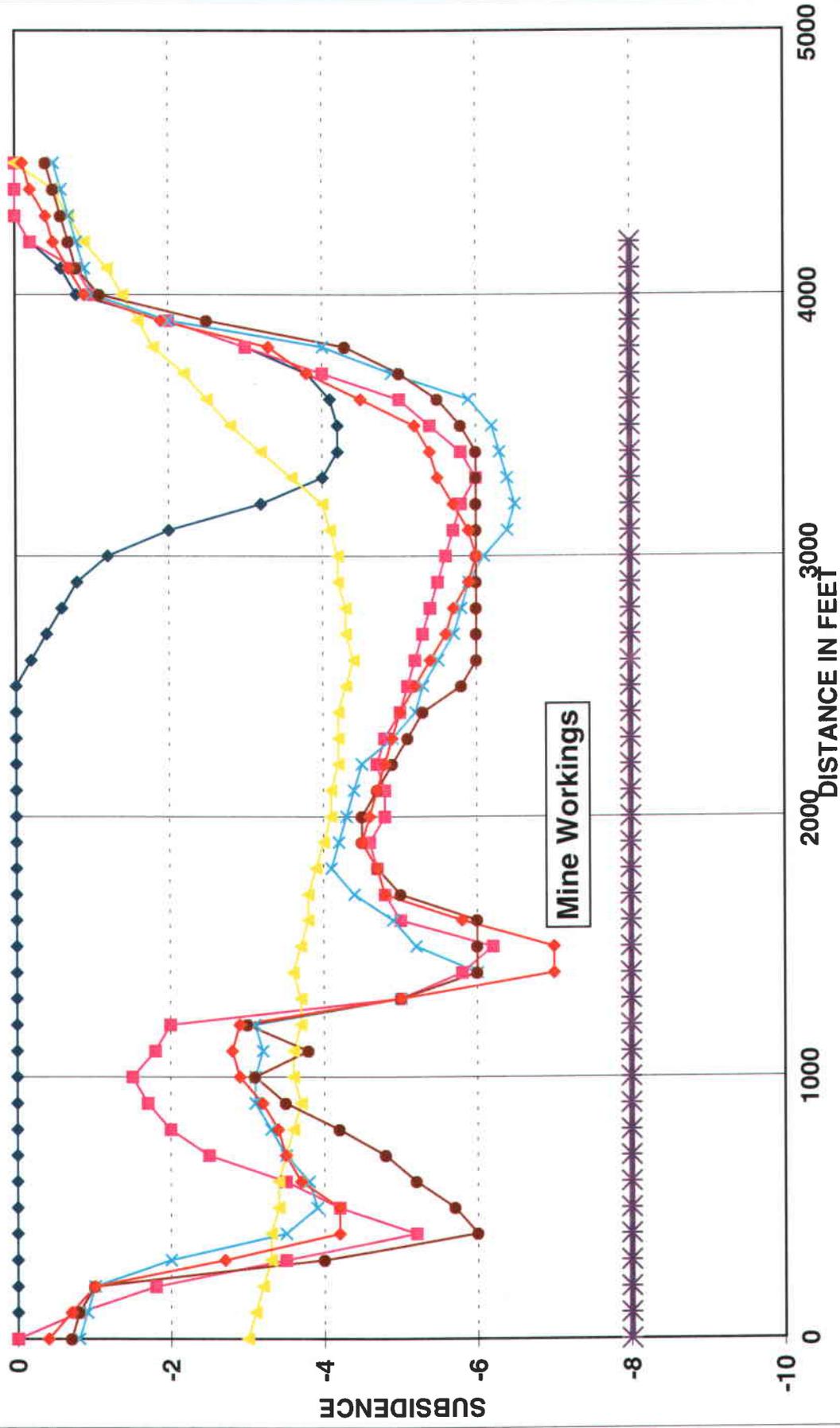


Figure 72

# Area 21 Subsidence Profile West - East

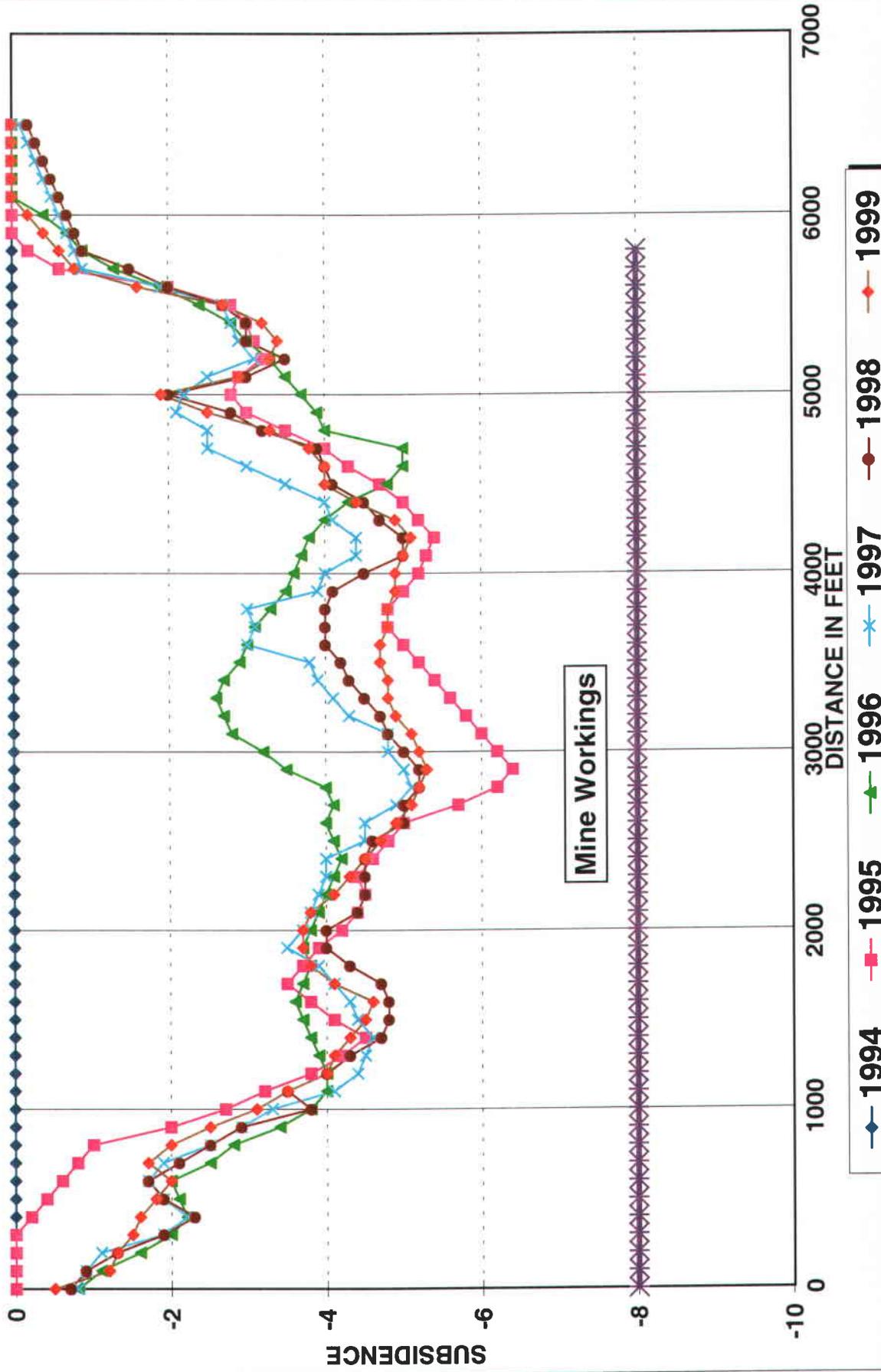


Figure 73

## Area 22

### Deer Creek Mine 2nd through 8th West Longwall Panels off 3rd North

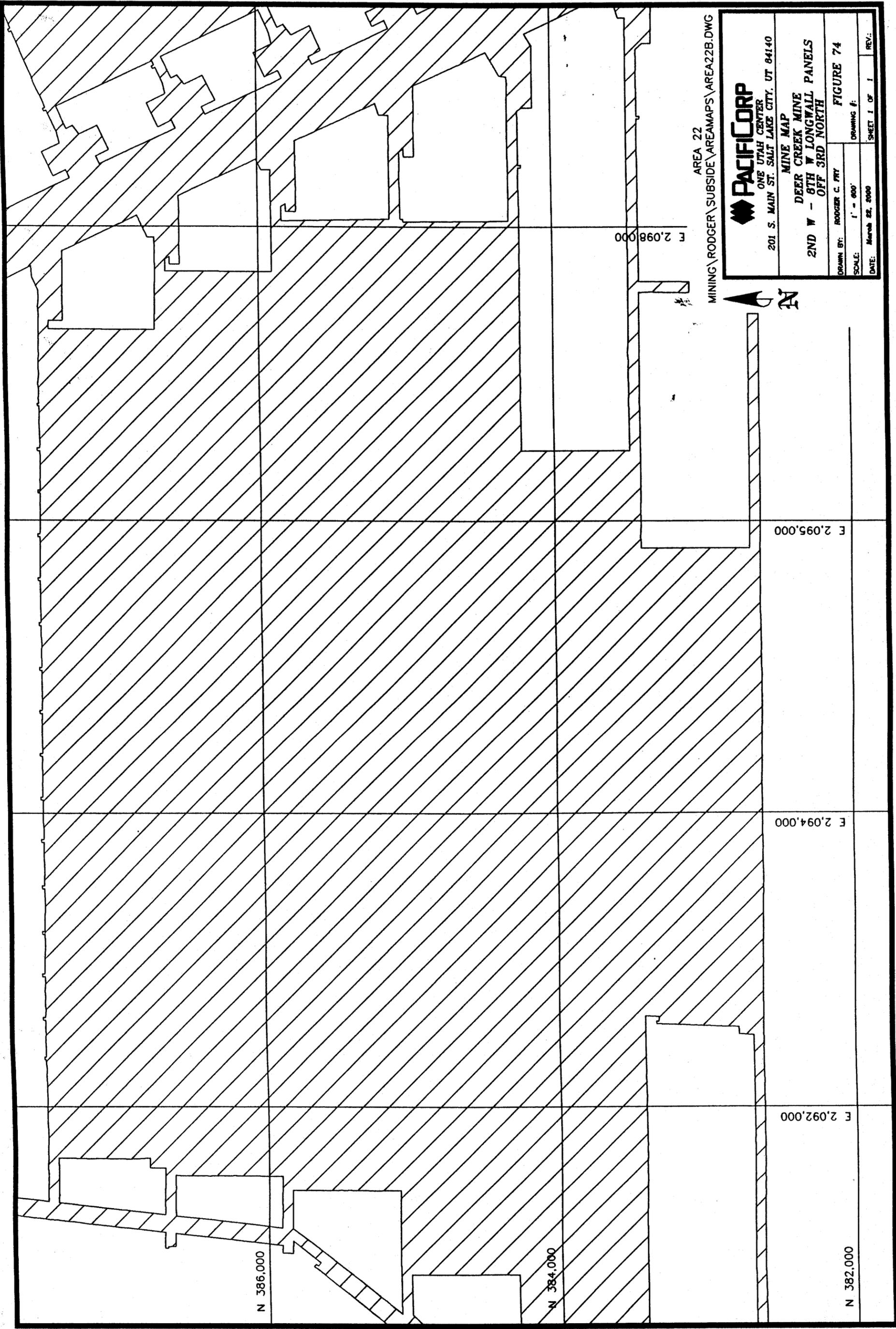
Longwall Mining began in the 8th West Longwall Panel in February 1996 and the entire panel was mined by July 1996. Mining then moved to the 7th West Longwall Panel in July 1996 was completed in January 1997. Mining then started in the 6<sup>th</sup> west panel in January 1997 and this panel was completed in July 1997. Mining in the 5<sup>th</sup> west panel began in July 1997 and was completed in February 1998. Mining in the 4<sup>th</sup> west panel began in March 1998 and was completed in November 1998. The 3<sup>rd</sup> west panel was not mined in its entirety. The western 2,000 feet of the panel was not longwall mined because of inferior quality coal. The central 3,200 feet was mined between November 1998 and January 1999. A faulted area was then not mined and the longwall equipment mined the eastern 1,500 feet of the panel between January 1999 and April 1999 when mining in this area was completed.

This area is located on the southern side of Rilda Canyon in an area where the terrain is very rugged. Several north-south side tributaries to Rilda Canyon are located in the area and form a series of canyons and steep ridges along the flanks of Rilda Canyon. Elevations range from 8,000 feet at the coal outcrop to 9,900 feet along the ridge tops. The area is heavily vegetated with spruce trees, aspen trees at the higher elevations and pinion-junipers at the lower elevations.

The subsidence monitoring showed an increase in subsidence in 1999 over previous years as would be expected. As mining progressed into the southern panels, the subsidence

trough propagated southward as well. The maximum subsidence above the northern panels remained unchanged which shows stability has been reached in those areas. The topography in this area is fairly rugged which limits the resolution of the photogrammetric monitoring (see figures 75, 76 and 77).

Several springs are located in the area and have been catalogued and are being monitored (see 1999 Annual Hydrologic Monitoring Report).



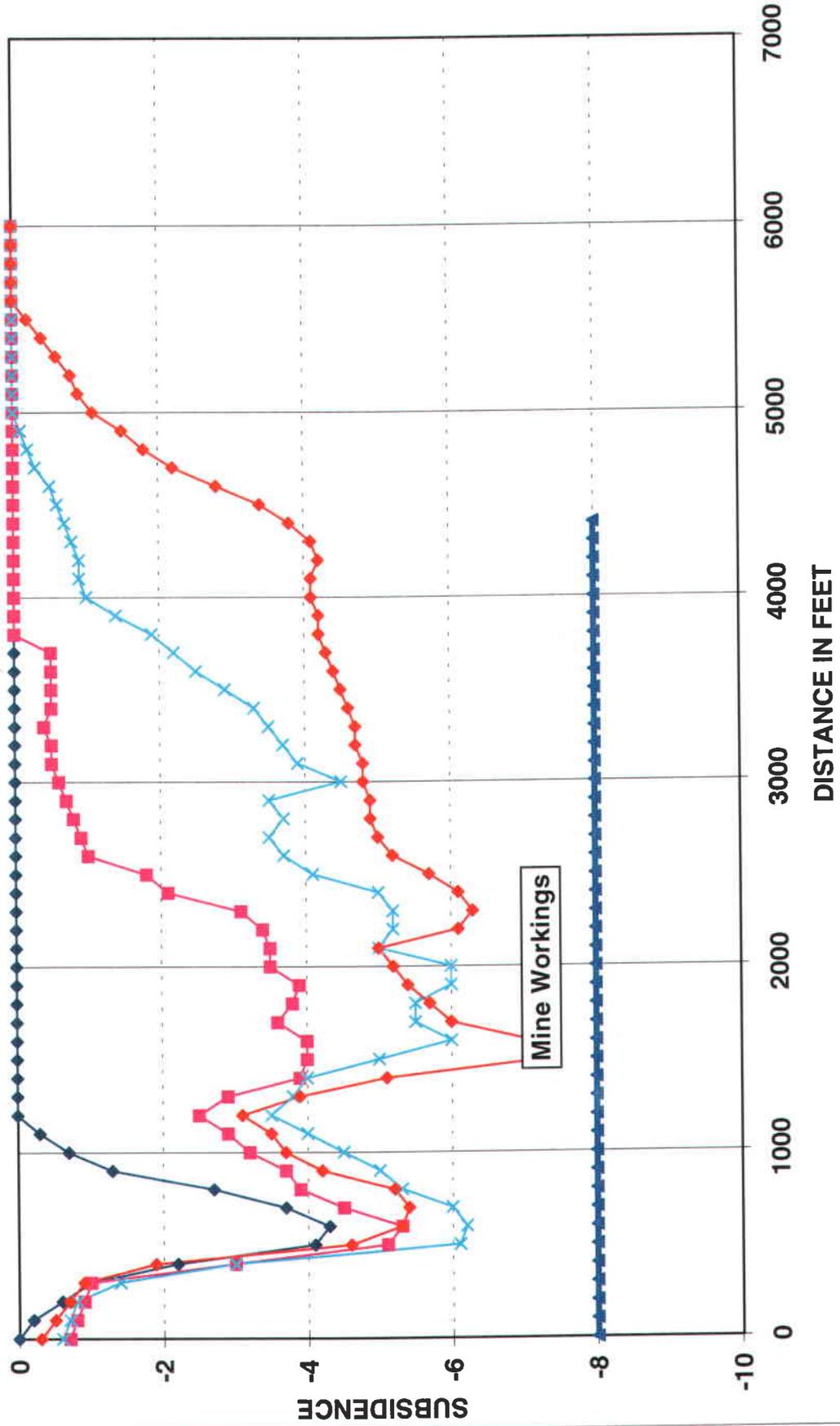
AREA 22  
 MINING\RODGER\SUBSIDE\AREAMAPS\AREA22B.DWG

ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140	
MINE MAP DEER CREEK MINE 2ND W - 8TH W LONGWALL PANELS OFF 3RD NORTH	
DRAWN BY: RODGER C. FRY	FIGURE 74
SCALE: 1" = 600'	DRAWING #
DATE: March 22, 2000	SHEET 1 OF 1
REV:	



# Area 22 Subsidence Profile

North - South



◆ 1996    ■ 1997    × 1998    ◆ 1999

Figure 76

# Area 22 Subsidence Profile West - East

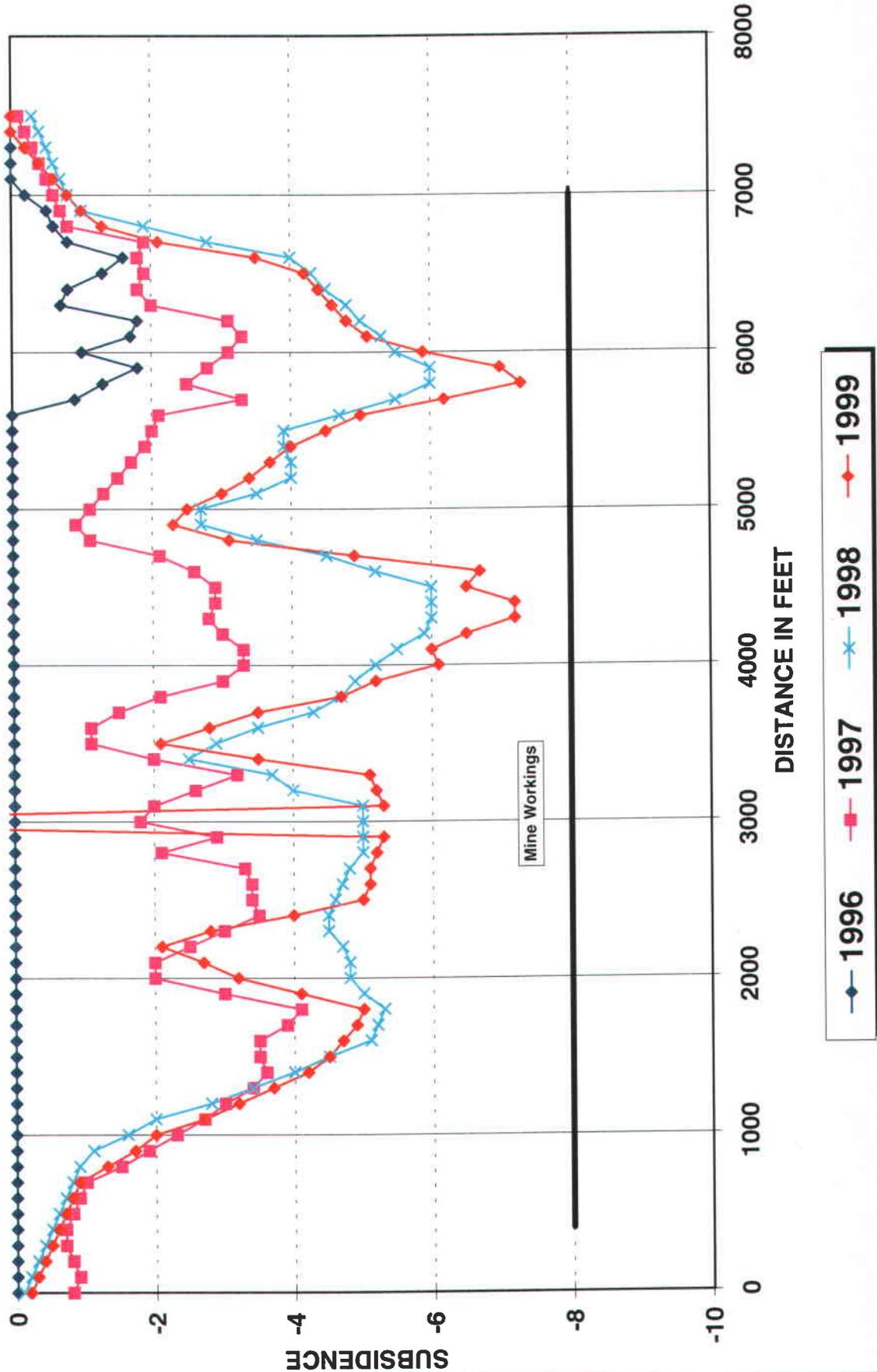


Figure 77

Area 23

Trail Mountain Mine 2nd through 5th East Longwall Panels off 5th Left

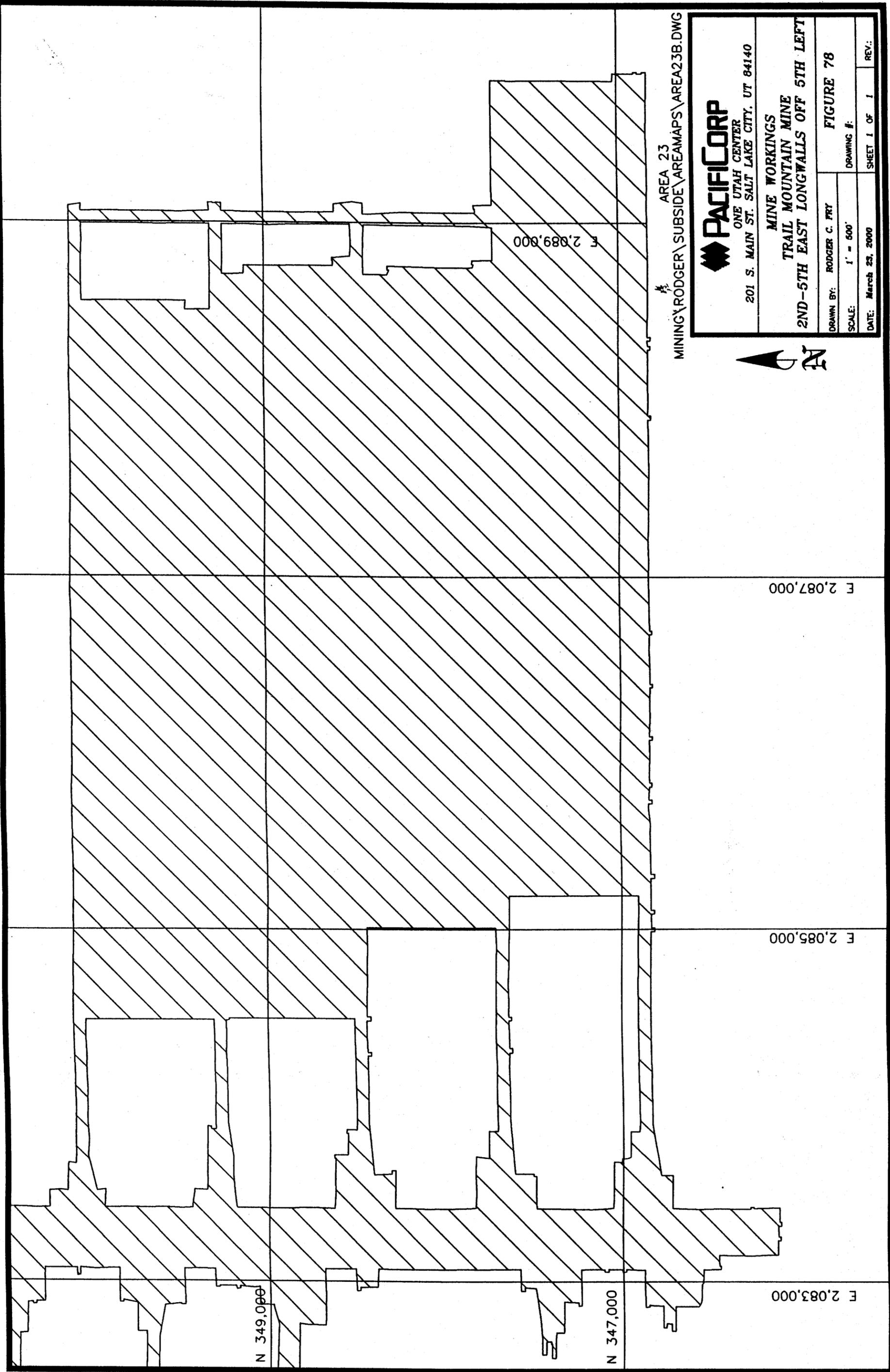
Mining in the 2nd East Longwall Panel began in October 1995 and mining continued until February 1996. In this panel only the eastern 2,600 feet was mined because the western 2,000 feet was not minable due to high ash content in the coal. Mining Began in the 3rd East Panel in February and was completed in June 1996. Mining began in the 4th East panel starting in June 1996 and was completed in October 1996. Mining then began in the 5<sup>th</sup> East panel which was completed in March 1997 (see figure 78). All of the longwall mining conducted to date has extracted an average thickness of 8 feet of coal. Mining in this area is now complete.

This area generally contains gentle south-facing slopes that project down to a steep escarpment along the south and east end of the area. Elevations in the area range from 8,750 feet to less than 6,700 feet along the coal outcrop in Straight Canyon. The land is sparsely vegetated with grasses and brush with some dense patches of ponderosa pine at the higher elevations and pinion-juniper trees in the steeper slopes above and below the escarpment.

The subsidence monitoring has detected up to eight (8) feet of subsidence that has occurred. This maximum subsidence is located over the east end of the 4th East longwall panels (see figures 79, 80 & 81). Most of the undermined area has subsided between five (5) and seven (7) feet. One point at the extreme east side of the 5<sup>th</sup> East panel shows

subsidence up to over 22 feet. This is in an area of steep terrain and may be reading inaccuracies or a large boulder may have moved causing the change in readings between 1996 and 1997 but no additional change was noted in the past two years. The subsidence area is entirely contained within the undermined area, therefore; the angle of draw is steeper than 10 degrees from the verticle. As the subsidence trough further matures over the next year, a more precise measurement of the angle of draw can be made.

No surface fractures or visual evidence of subsidence has been observed. One spring is located in the area but as of yet has not been subsided. No change in spring discharge has been identified due to the mining activities (see 1999 Annual Hydrologic Monitoring Report).



MINING\RODGER\SUBSIDE\AREAMAPS\AREA23B.DWG  
 AREA 23



ONE UTAH CENTER  
 201 S. MAIN ST. SALT LAKE CITY, UT 84140

MINE WORKINGS  
 TRAIL MOUNTAIN MINE  
 2ND-5TH EAST LONGWALLS OFF 5TH LEFT

DRAWN BY: RODGER C. FRY	FIGURE 78
SCALE: 1" = 500'	DRAWING #:
DATE: March 23, 2000	SHEET 1 OF 1
	REV.:



# Area 23 Subsidence Profile North - South

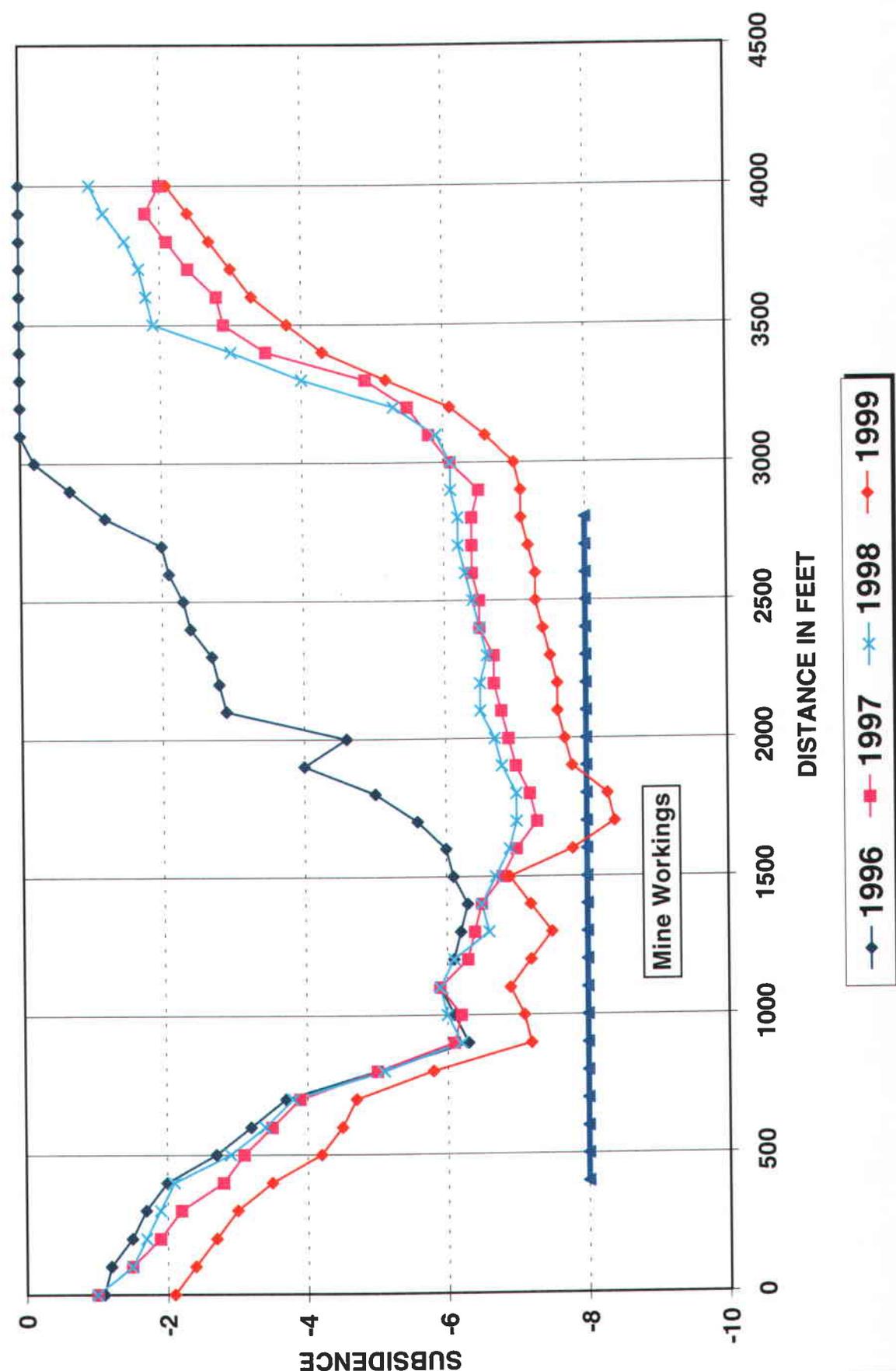
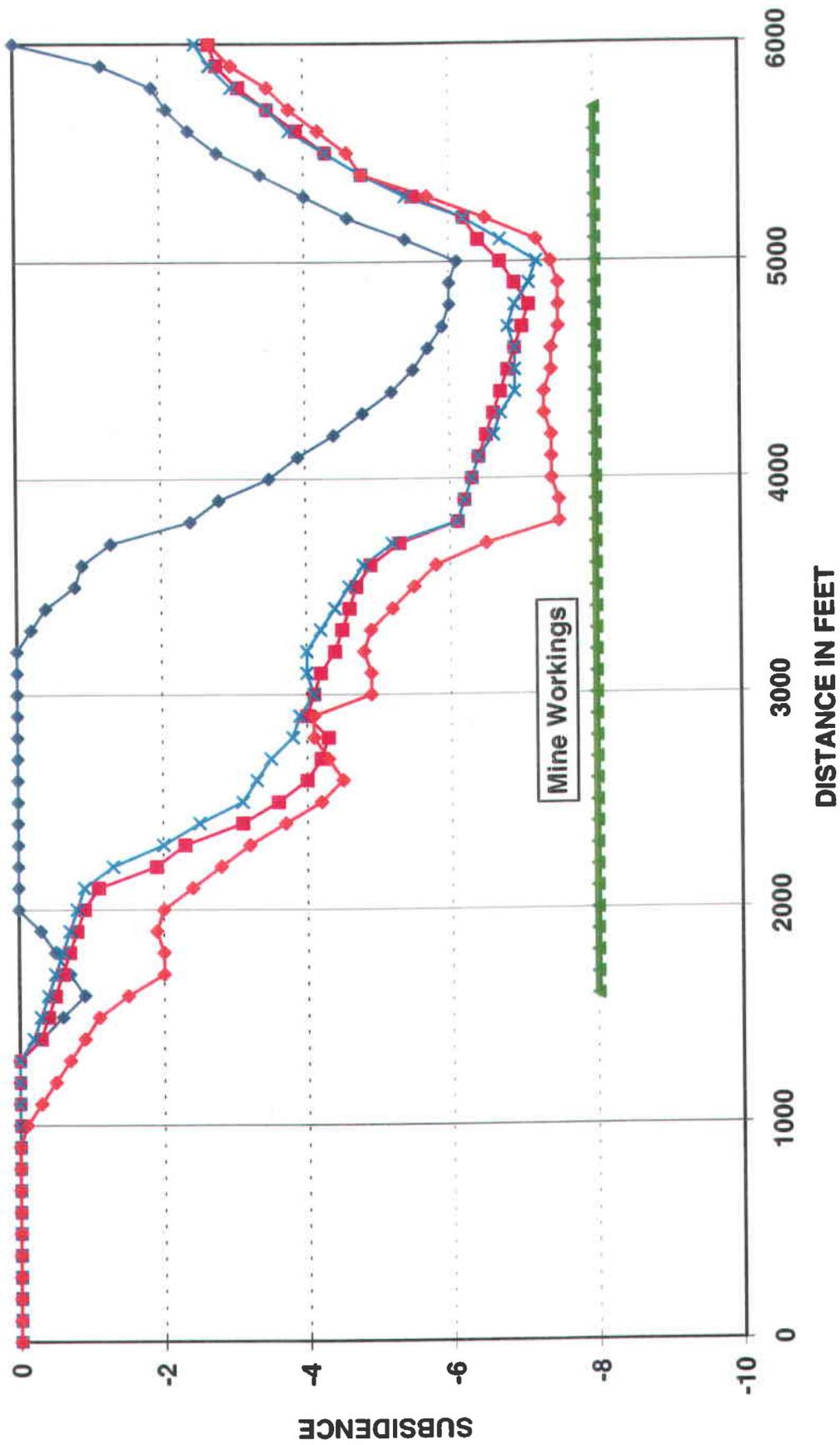


Figure 80

# Area 23 Subsidence Profile

West - East



Legend:  
1996 (Blue diamonds)  
1997 (Red squares)  
1998 (Blue crosses)  
1999 (Red diamonds)

Figure 81

## AREA 24

### TRAIL MOUNTAIN MINE 1<sup>ST</sup>-10<sup>TH</sup> RIGHT OFF 5<sup>TH</sup> LEFT

Mining in the 9<sup>th</sup> Right panel began in March 1997 and was completed at the end of August 1997. In 1998, the western 4,800 feet of the 8<sup>th</sup> Right panel had been extracted leaving the remaining 1,600 feet unmined due to inferior coal quality. Mining then moved into the 7<sup>th</sup> Right panel and by the end of August, 1998, all of this panel had been extracted. By August 31, 1999, the entire 6<sup>th</sup> right panel had been extracted and all but the eastern 750 feet of the 5<sup>th</sup> right panel had been mined. The mining was completed to an average mining height of nine (9) feet.

The topography within this mining area is quite variable. Elevations range from less than 7,000 feet in Straight Canyon on the southwest side of the area, where the topography is very rugged, to over 8,800 feet in the northeast portion of the area where the land is gently sloping to the south. The lower elevation areas are heavily vegetated with pinion and juniper trees interspersed with grasses. The higher elevations have stands of spruce and aspen trees separated by areas of sage brush and grasses.

The overburden above the coal seam in this area ranges from less than 1,400 feet in the southwest corner of the area to over 2,200 feet in the northeast corner of the area.

The subsidence monitoring showed an increase in subsidence in 1999 from that measured the previous years. The maximum subsidence over the 9<sup>th</sup> Right panel was slightly over 2 feet in 1997 but was measured at over 5 feet in 1999. The extent of subsidence as great as 5 feet increased from that in 1998 as would be expected. It is

expected that the subsidence will continue to increase slightly and progress to the north as mining advances in that direction (see figures 83, 84 and 85). Because subsidence in this area is not mature, no angle of draw has been calculated. The subsidence that has occurred has not had any effect on the current land use or on the hydrology of the area (see 1999 Annual Hydrologic Monitoring Report).

AREA 24  
MINING\RODGER\SUBSIDE\AREAMAPS\AREA24BM.DWG



ONE UTAH CENTER  
201 S. MAIN ST. SALT LAKE CITY, UT 84140

MINE WORKINGS  
TRAIL MOUNTAIN MINE  
1ST RIGHT-10TH RIGHT  
OFF 5TH LEFT

DRAWN BY: RODGER C. FRY

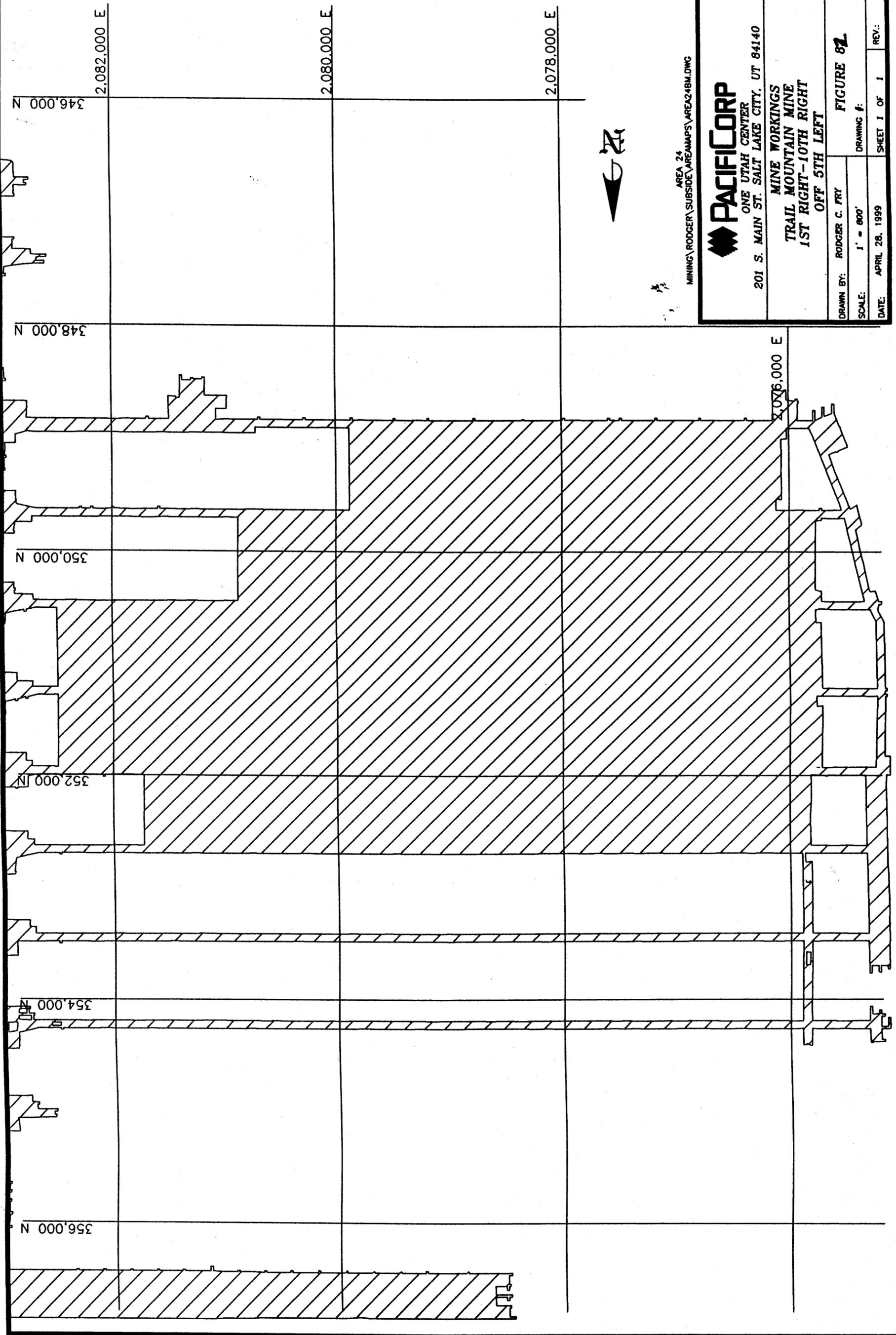
SCALE: 1" = 800'

DATE: APRIL 28, 1999

FIGURE 82

DRAWING #:

REV.: SHEET 1 OF 1



# Area 24 Subsidence Profile

North - South

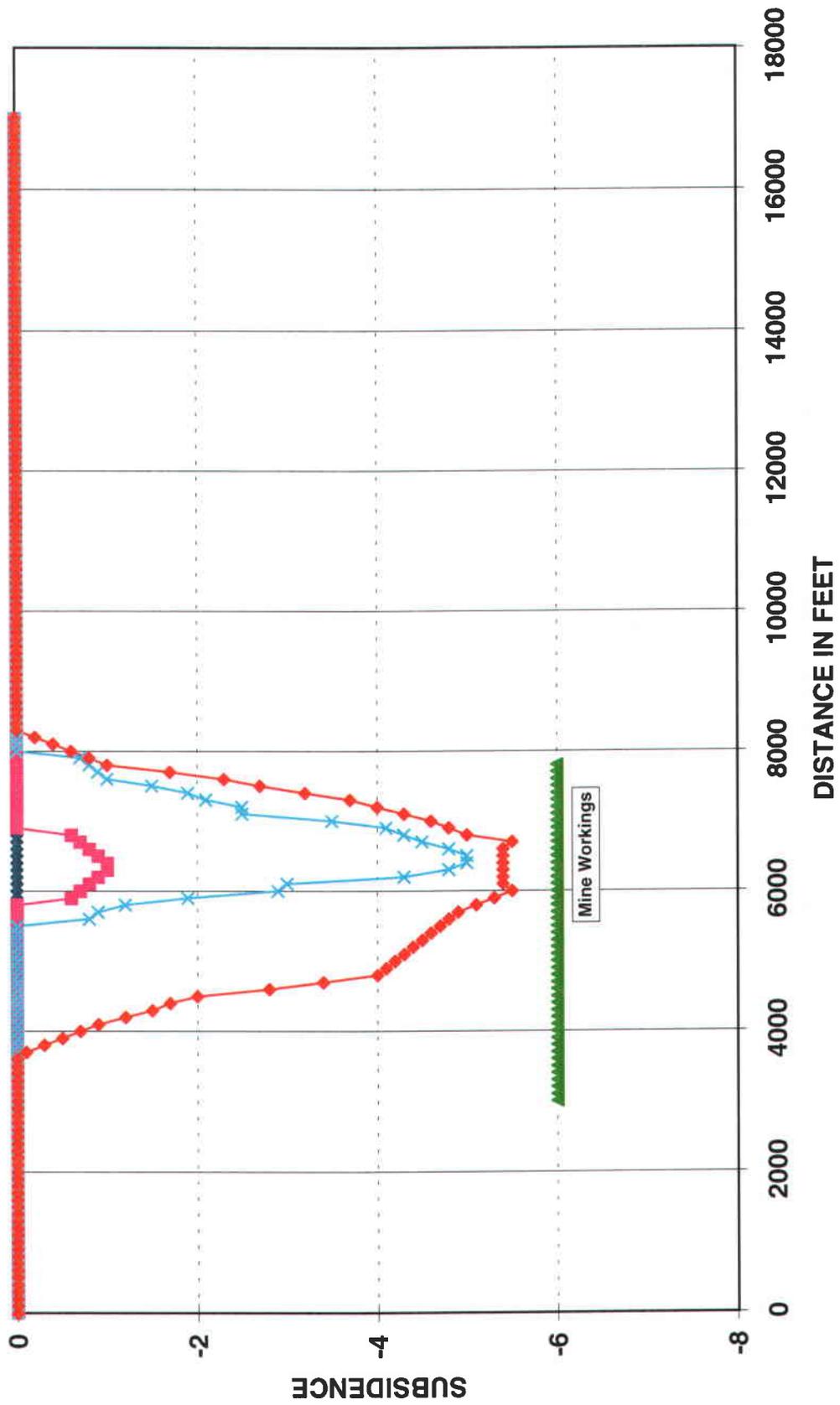


Figure 84

# Area 24 Subsidence Profile West - East

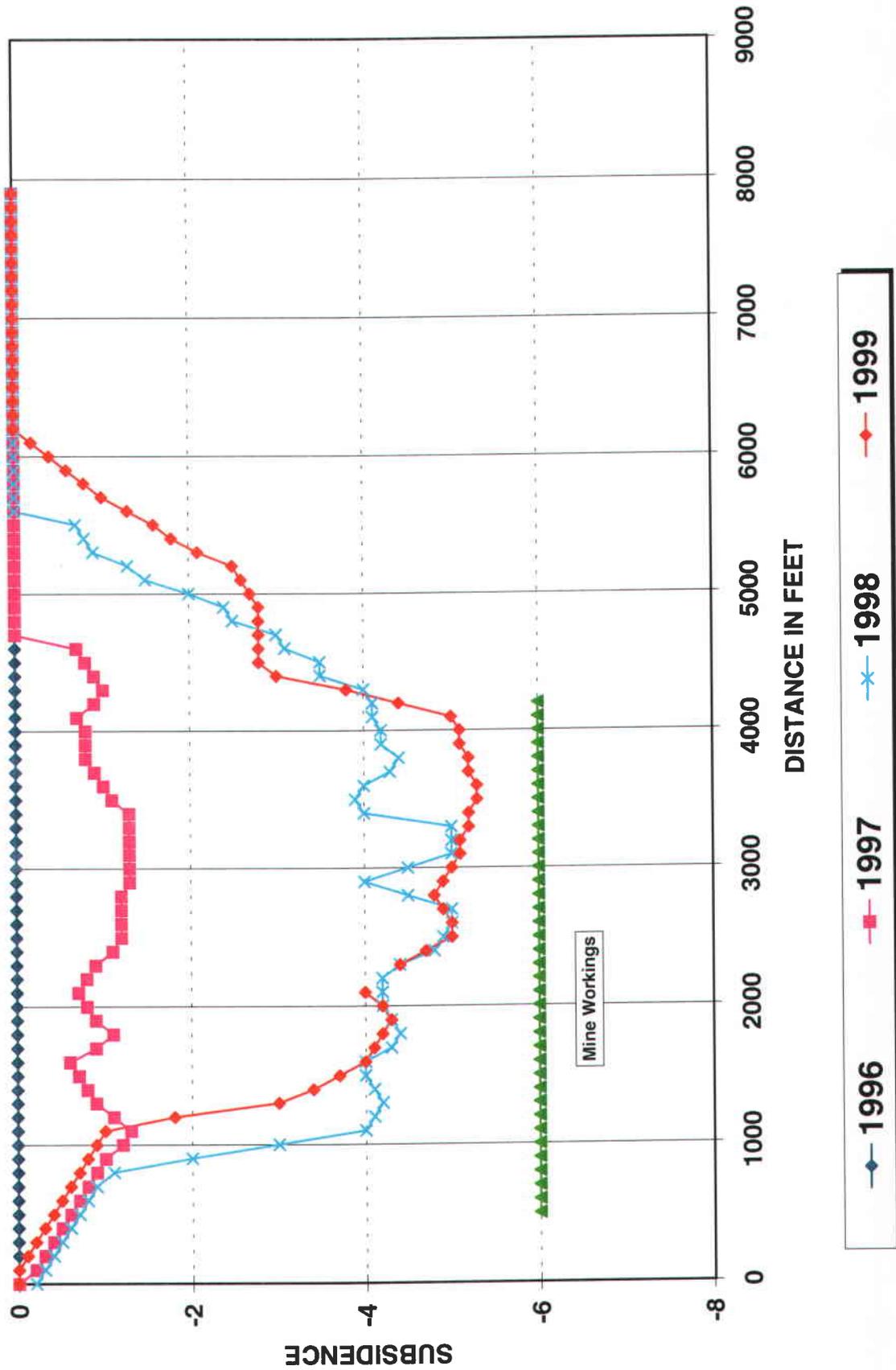


Figure 85

## AREA 25

### Deer Creek Mine 5<sup>th</sup> Through 14<sup>th</sup> West off 5<sup>th</sup> North Longwall Panels

Mining in this area will eventually be completed in both the Blind Canyon and Hiawatha seams where as present mining has only been completed in the Blind Canyon Seam. Longwall Mining began in this area in the eleventh west panel in April of 1999. By August 31, 1999, the eastern 4,400 feet of this panel had been mined. Future mining in this area will remove the remaining 3,600 feet of the eleventh west panel and then will mine the panels to the north and to the south before progressing into the Hiawatha seam below. Overburden in this area ranges from less than 400 in both the north and south of the area to over 1,700 feet beneath North Rilda Ridge.

The topography in this region is very rugged. North Rilda Ridge is situated in an east-west trend in the center of the area and the topography drops off steeply to the north into Mill Fork and the South into Rilda Canyon. The Castlegate Sandstone forms an escarpment which is present near the top and encircles North Rilda Ridge on the North, East and South. The south facing slopes below the cliff are covered with grass brush and juniper trees while the north facing slopes in Mill Canyon are densely covered with conifers.

The subsidence monitoring in this area shows that subsidence has begun to occur in the eastern portion of the longwall panel. A maximum of 3 feet of subsidence has been observed in a small area. Because only the first longwall panel has been mined at this time, critical width of mined-out area has not been achieved and as a result the strata above the

coal is able to bridge over and limit the amount of subsidence that has occurred. In the coming years, as mining progresses the subsidence trough will widen and will and will become more pronounced. It should be expected that maximum subsidence with one seam mined will be between 5 and 7 feet and after mining of the second seam it should reach 12 ro 13 feet.

In June of 1999 several prisms were placed on the top of the Castlegate sandstone cliff to enable the monitoring of the cliff stability as they are undermined. Some of the prisms have been undermined but no major movement has been detected to date. The prism data can be found in the appendix.

A few minor springs are located on top of North Rilda Ridge. Monitoring has shown mining to have no effects on the hydrology of the area (see Hydrologic Monitoring Report for 1999).

MINING\ROGGER\SUBSIDE\AREAMAPS\AREA25BASE.DWG



AREA 25  
ONE UTAH CENTER  
201 S. MAIN ST. SALT LAKE CITY, UT 84140

SUBSIDENCE  
DEER CREEK MINE  
10TH THROUGH 14TH WEST OFF 5TH NORTH

DRAWN BY: RODGER C. FRY

FIGURE 86

SCALE: 1" = 600'

DRAWING #:

DATE: FEB. 09. 2000

SHEET 1 OF 1

REV.:



390,000 N

2,105,000 E

396,000 N

2,103,000 E

394,000 N

2,101,000 E

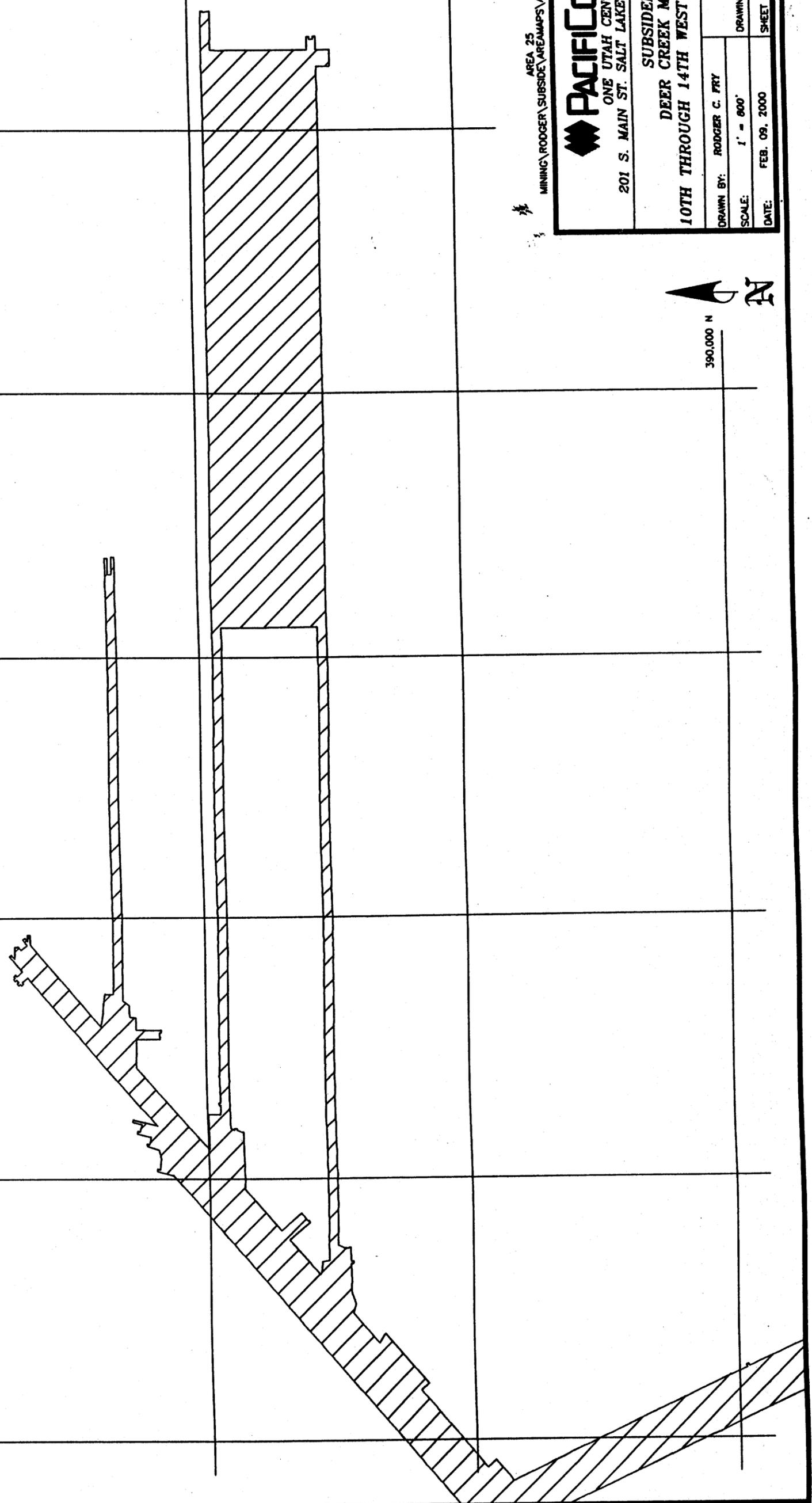
392,000 N

2,099,000 E

2,097,000 E

2,095,000 E

2,093,000 E



**AREA 25  
NORTH-SOUTH PROFILE**

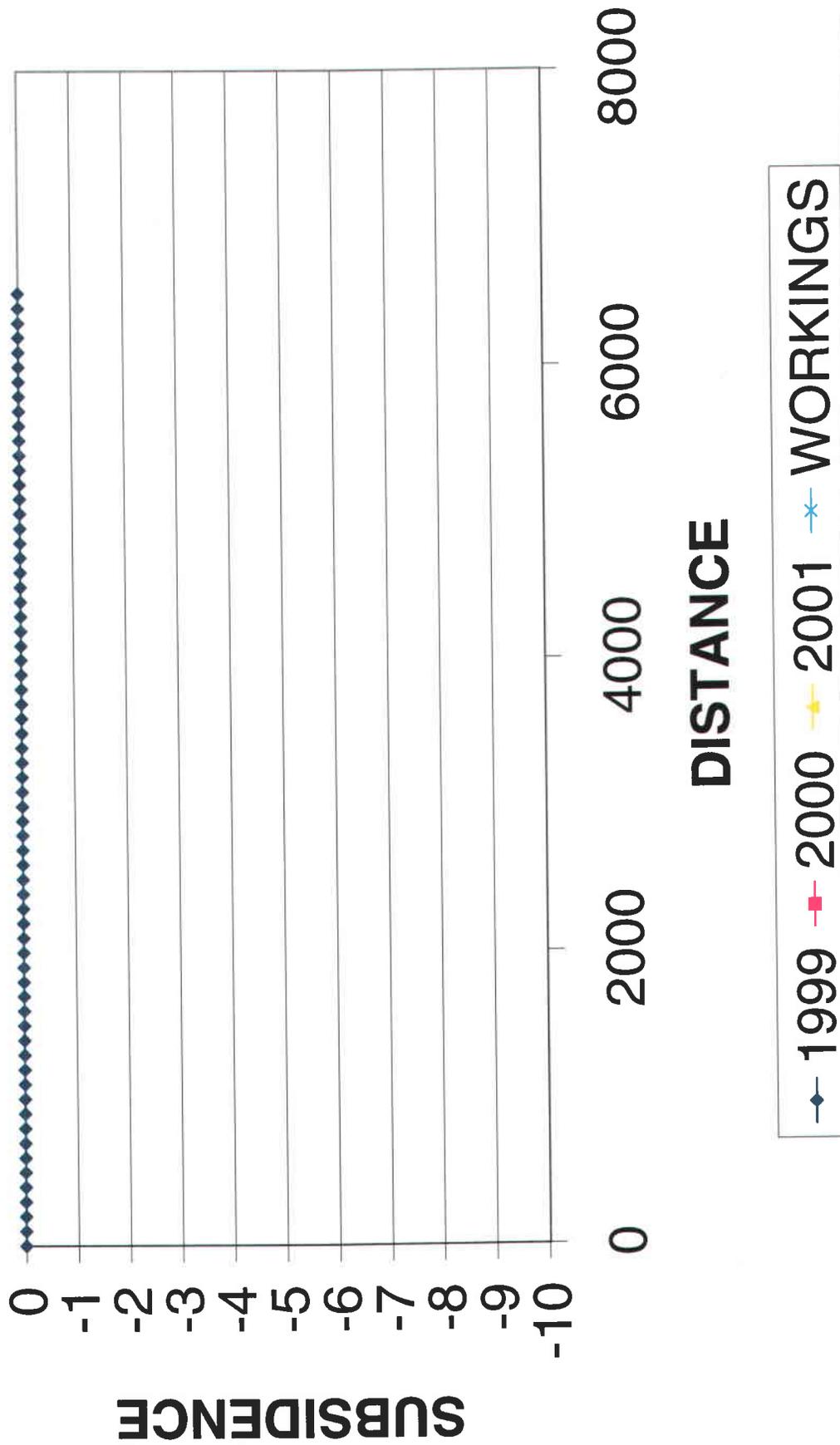
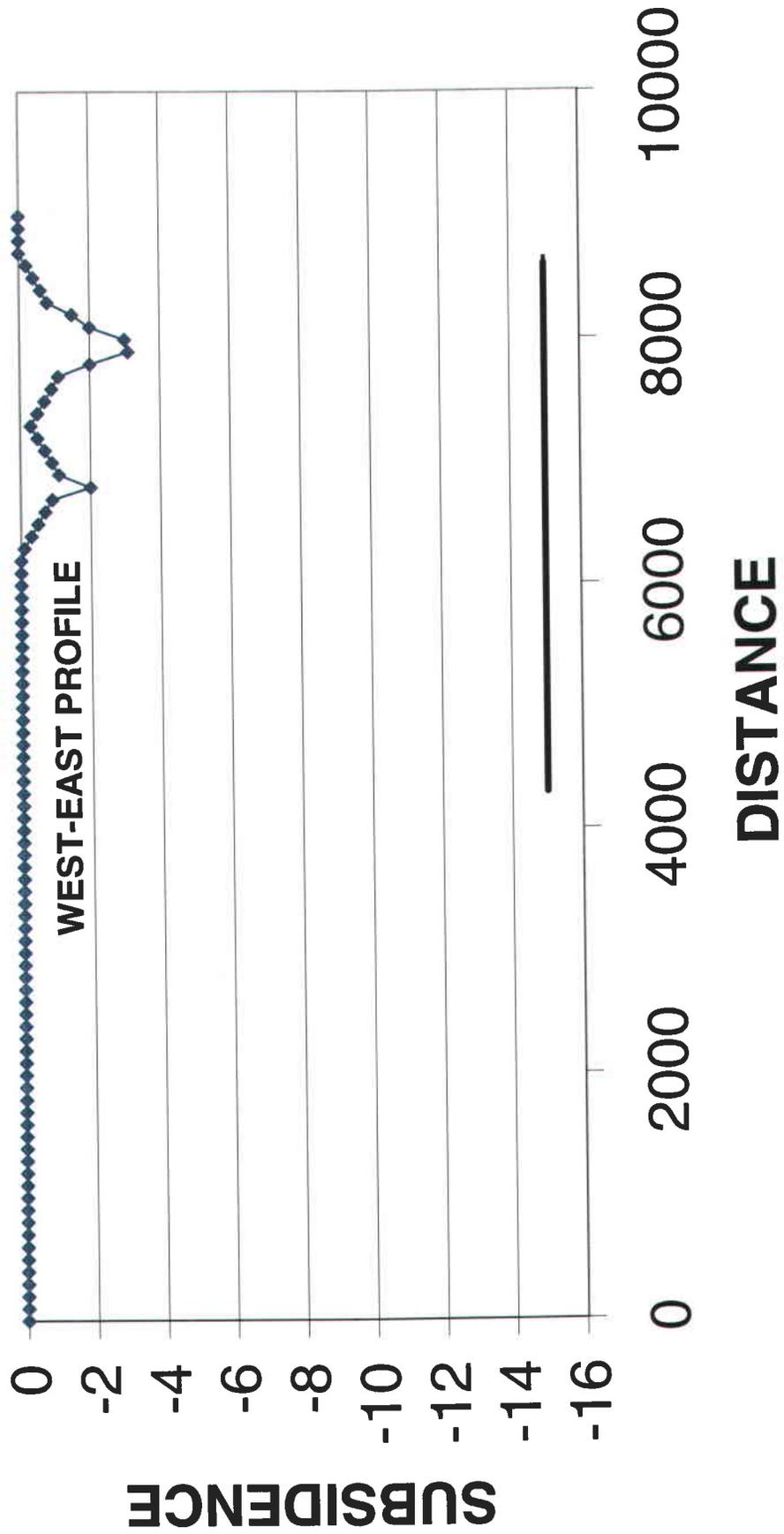


FIGURE 88

# AREA 25



—◆— 1999 —■— 2000 —▲— 2001 BC WORKINGS

FIGURE 89

### Predicted Maximum Subsidence

A comparison between observed and predicted maximum subsidence for the various areas on PacifiCorp's property has been made using a method developed by the British National Coal Board (NCB). The NCB method utilizes graphs compiled from numerous field observations and takes into consideration the length and width of the mined-out area, thickness of coal extracted, and depth of cover. The method is claimed to be correct to  $\pm 10\%$  in the majority of cases, assuming certain limiting conditions are met. The table below compares predicted maximum subsidence with observed subsidence for areas on East Mountain.

Area	Subsidence (feet)		
	Predicted Maximum	Observed	% of Predicted
1* DC 9E/W 1R	15.2	28.0	184
2 DC 5-8E/W, 3-13R	13.8	13.1	95
3 DC 1N Area 7.7	7.7	5.5	71
4 DC 2-17R	13.6	13.5	99
5 DC 2-5L	13.5	15.5	114
6 W 1-2W	5.0	4.5	90
7 Bee 2N off 8W	6.6	7.4	112
8 Bee/Des E&W Sections	6.8	4.8	104

Area	Subsidence (feet)		
	Predicted Maximum	Observed	% of Predicted
9 Little Dove 1N	4.3	3.5	81
10 Old American Fuel Mine	7.0	6.1	87
11 DC C&D N	13.7	13.2	96
12 W 2L	1.5	0.0	0
13 Des-Bee-Dove Southern Areas	2.0	1.8	90
14 Cottonwood 6-7E	7.6	4.7	62
15 Cottonwood 9-12W	7.2	5.0	69
16 Cottonwood 8-11E	7.4	4.5	61
17 Cottonwood 16-15 W	8.1	7.2	89
18 Deer Creek 2nd-7th R	7.7	7.2	94
19 Deer Creek 7th & 8th E	7.9	4.5	57
20 Deer Creek 1st & 2nd L	7.8	6.1	79
21 Deer Creek 2nd- 7th E	7.5	7.5	100
22 Deer Creek 2nd-8th W	7.5	8.1	108
23 Trail Mountain 2 <sup>nd</sup> -5 <sup>th</sup> E	1.8	8.1	104
24 Trail Mountain 1 <sup>st</sup> - 10 <sup>th</sup> Right	7.5	5.4	72
25 Deer Creek 10-14 <sup>th</sup> West	3	6	50

\* This area does not fit the NCB prediction model.

In most areas subsidence is less than the maximum predicted by the NCB model. The

observed subsidence shown here represents the actual maximum subsidence for the particular geologic conditions -- probably the case in some areas since subsidence appears to have ceased in several areas where the NCB predicted maxima were not reached. In areas showing greater than expected subsidence, chain pillars or barriers between sections are probably crushing so that strata above the working caves as it would if a wider zone had been mined.

### Mitigation of Surface Effects

Prior to mining in an area, we notify the land owner that mining will be in progress beneath his property. The land owners within our permit boundary are as follows:

Karl A. Seely, Inc.

LDS Church

US Forest Service

US Bureau of Land Management

Elk Springs Property Users Assn.

Kent Barton

We will continue to notify those owners prior to undermining their properties.

Over most areas where subsidence has been observed on East Mountain, present land use has not been affected in any way. Areas 2, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 20, 23, 24 and 25 are good examples of subsidence without visible surface disturbance or adverse hydrologic effects. In such areas no mitigation is necessary.

In a few areas, such as Areas 1, 3, 4, 7, 10, 11, 14, 21 and 22, surface fractures have been detected. In order to protect livestock PacifiCorp has erected a fence around Area 1 where fractures are of sufficient magnitude to pose a threat to wandering cattle. In the regions where the fractures could be reclaimed they have been filled in with heavy equipment and the escarpments have been evenly contoured and reseeded. In Area 4, the small tension

fractures that formed were reclaimed by filling in the fractures using a motor-grader and reseeding the area. In Area 14, where cracks have also been observed, these were filled in by hand in 1998 and reseeded. The U.S. Forest Service accepted this mitigation as being sufficient and complete.

In Areas 3, 7, 10, 11, 21 and 22 where only minor fracturing has occurred on remote ridges and/or where land use has not been affected, more damage would be done by gaining access to and repairing or fencing fractures than can be justified; therefore, mitigation is counterproductive in those areas and is not planned.

## Summary

As of August 1999 PacifiCorp has identified twenty-five (25) areas of mining-induced subsidence on the East Mountain/Trail Mountain property. Terrain in the subsidence areas ranges from relatively flat mountain tops with thick overburden of up to 2,200 feet to steep slopes and cliffs with overburden of less than 200 feet. The most noticeable subsidence effects occur in the steep cliff areas and where mining next to burned coal appears to have caused crushing of the clinker beds. Most of the fractures observed over mined areas have occurred under these conditions, especially where the Castlegate Sandstone (or similar lithologic unit) crops out or is near the surface. The sandstones yield to stress by brittle deformation (fracturing).

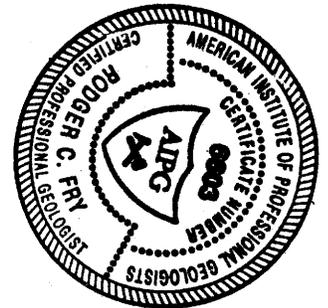
In areas where overburden is thicker and other, more clay-rich formations crop out, longwall and room-and-pillar mining methods have allowed the multiple seam mining of large quantities of coal without apparent impact on the environment because the overburden yields through plastic deformation. Areas such as the Beehive-Deseret east and west room-and-pillar sections (Areas 8 and 13) and the Deer Creek 4th through 8th East-Wilberg 3rd through 13th Right longwall panels (Area 2) have demonstrated that subsidence can occur over a broad area with no visible or hydrologic effects. In excess of eighty percent (80%) of the East Mountain property has conditions similar to those areas; therefore, the mining methods being utilized are well suited to the geologic conditions, allowing subsidence to occur without impacting the hydrology or present land use of the area.

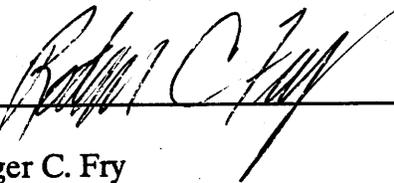
An effort was made again this year to predict maximum possible subsidence for the various areas where subsidence has been detected. The prediction was then compared with observed subsidence for each area. It appears that the actual subsidence occurring on East Mountain/Trail mountain is slightly less than that predicted by the NCB model.

## Professional Certification of Subsidence Data

I, Rodger C. Fry being a Certified Professional Geologist, with significant experience in subsidence monitoring, certify that the subsidence data contained in this document was collected under my direction, and the attached subsidence materials were prepared by me using industry-accepted methods. I further certify that the interpretations contained herein are an accurate representation of the subsidence that has occurred.

Dated this 30<sup>th</sup> day of March, 2000.



  
\_\_\_\_\_

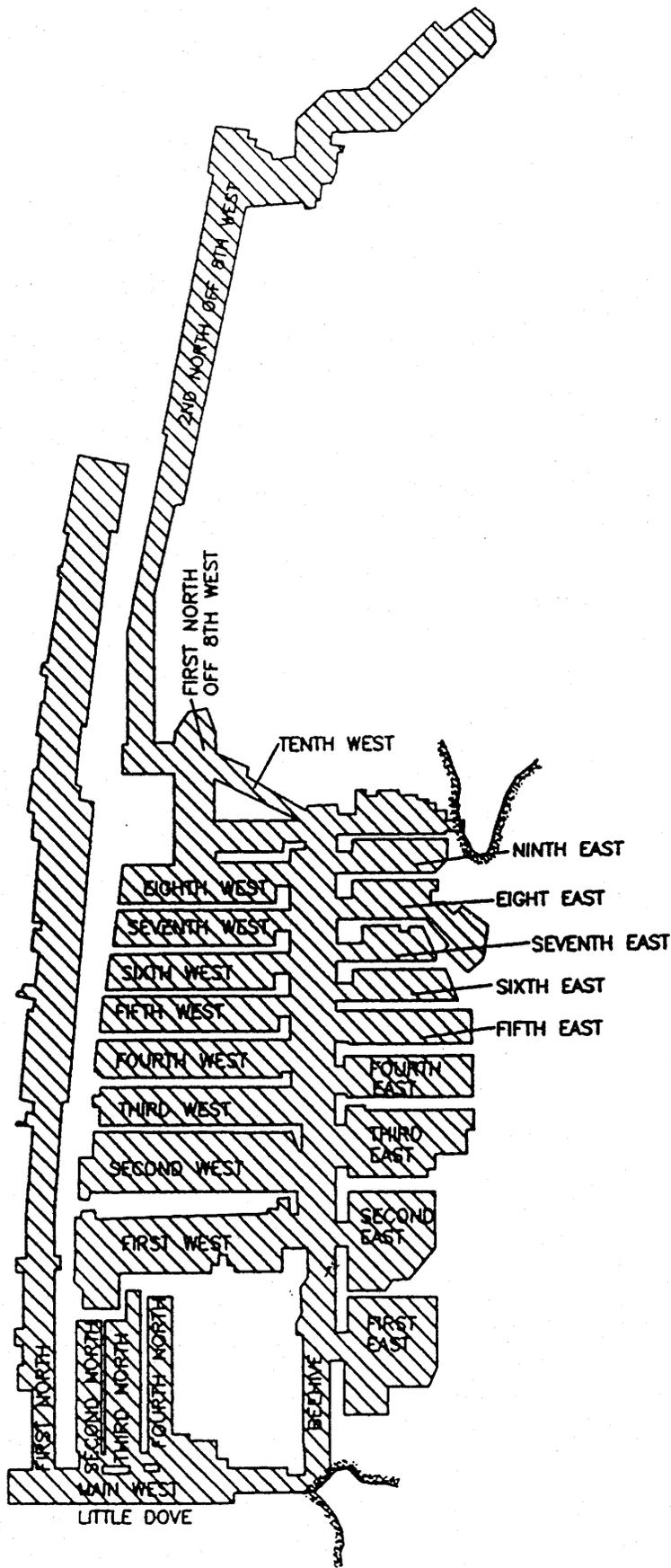
Rodger C. Fry

No. 6603

## **APPENDICES**

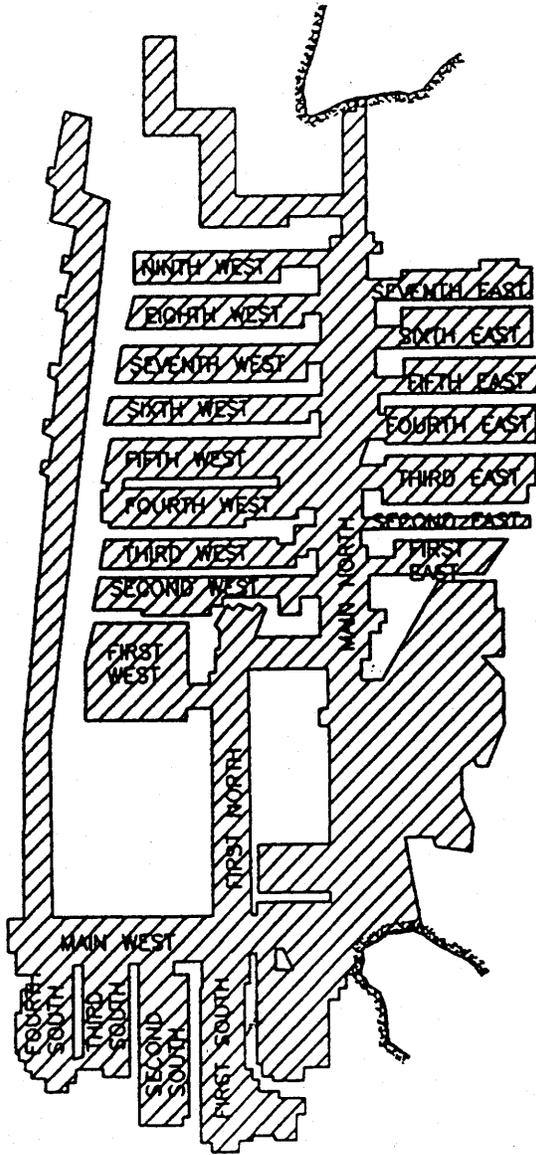
**RAW DATA**

**Des-Bee-Dove Mines**



**BEEHIVE & LITTLE DOVE COAL MINES**

SCALE: 1" = 2,000'

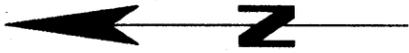


**DESERET COAL MINE**

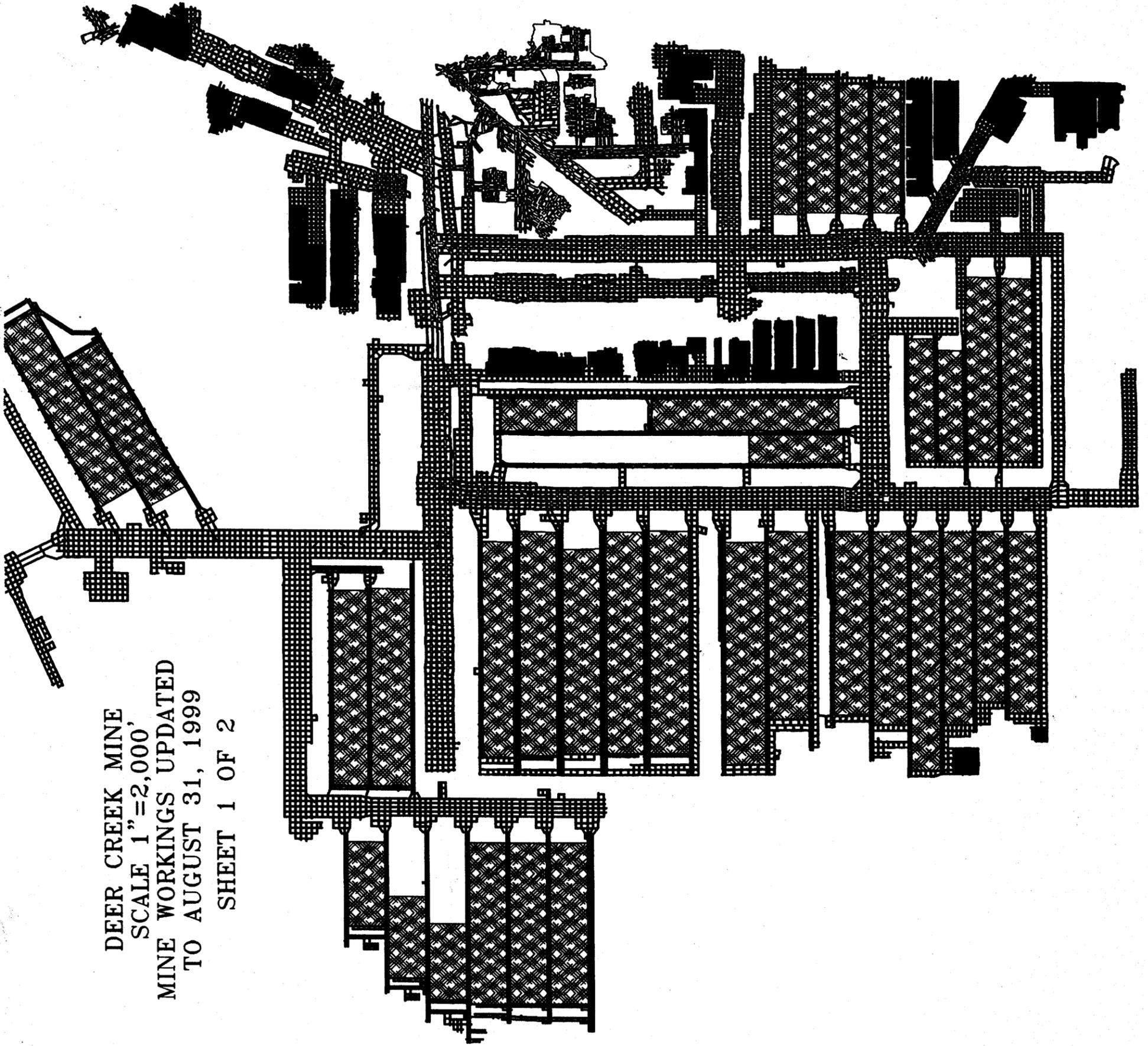
SCALE: 1" = 2,000'

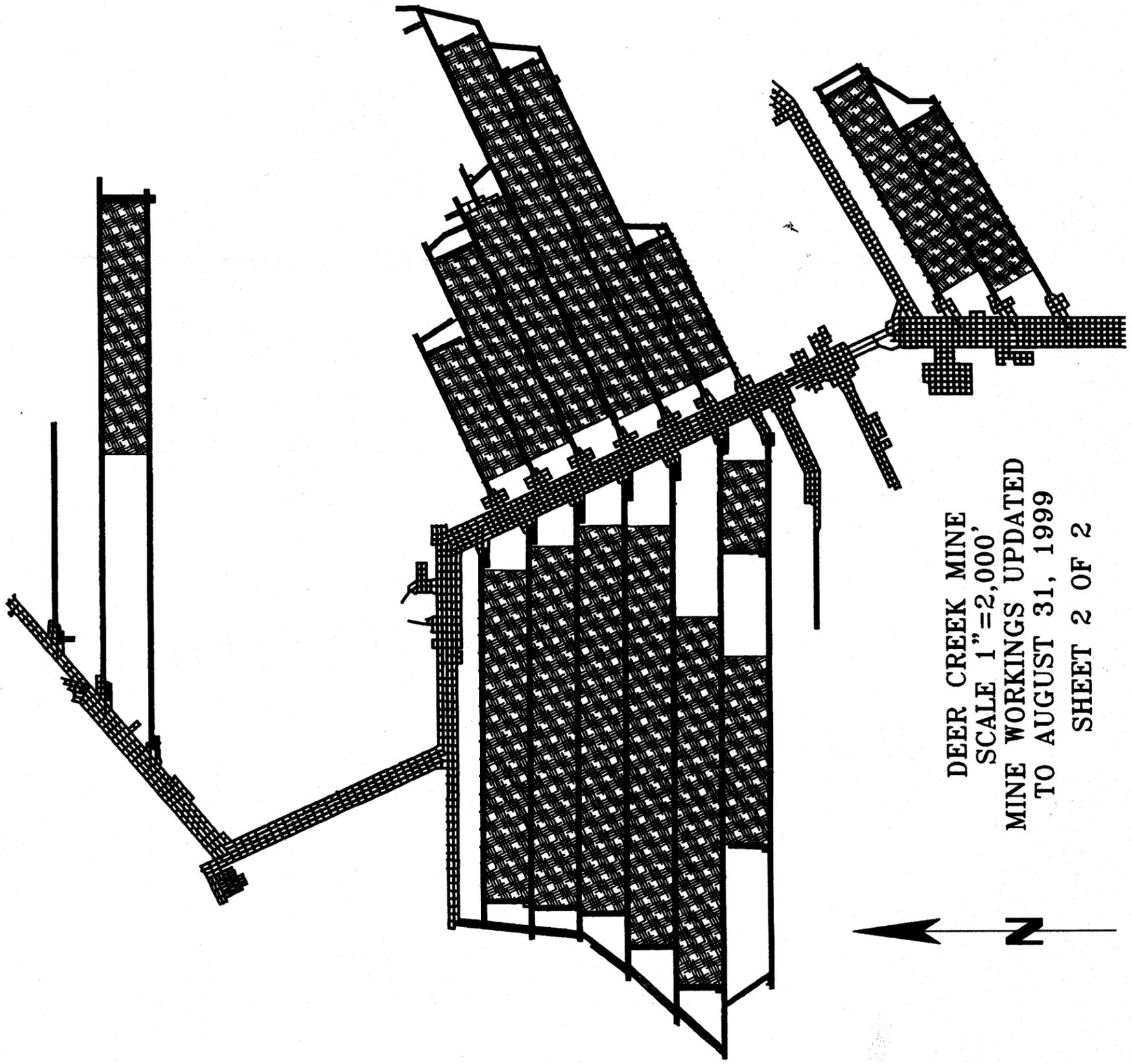


**Deer Creek Mine**



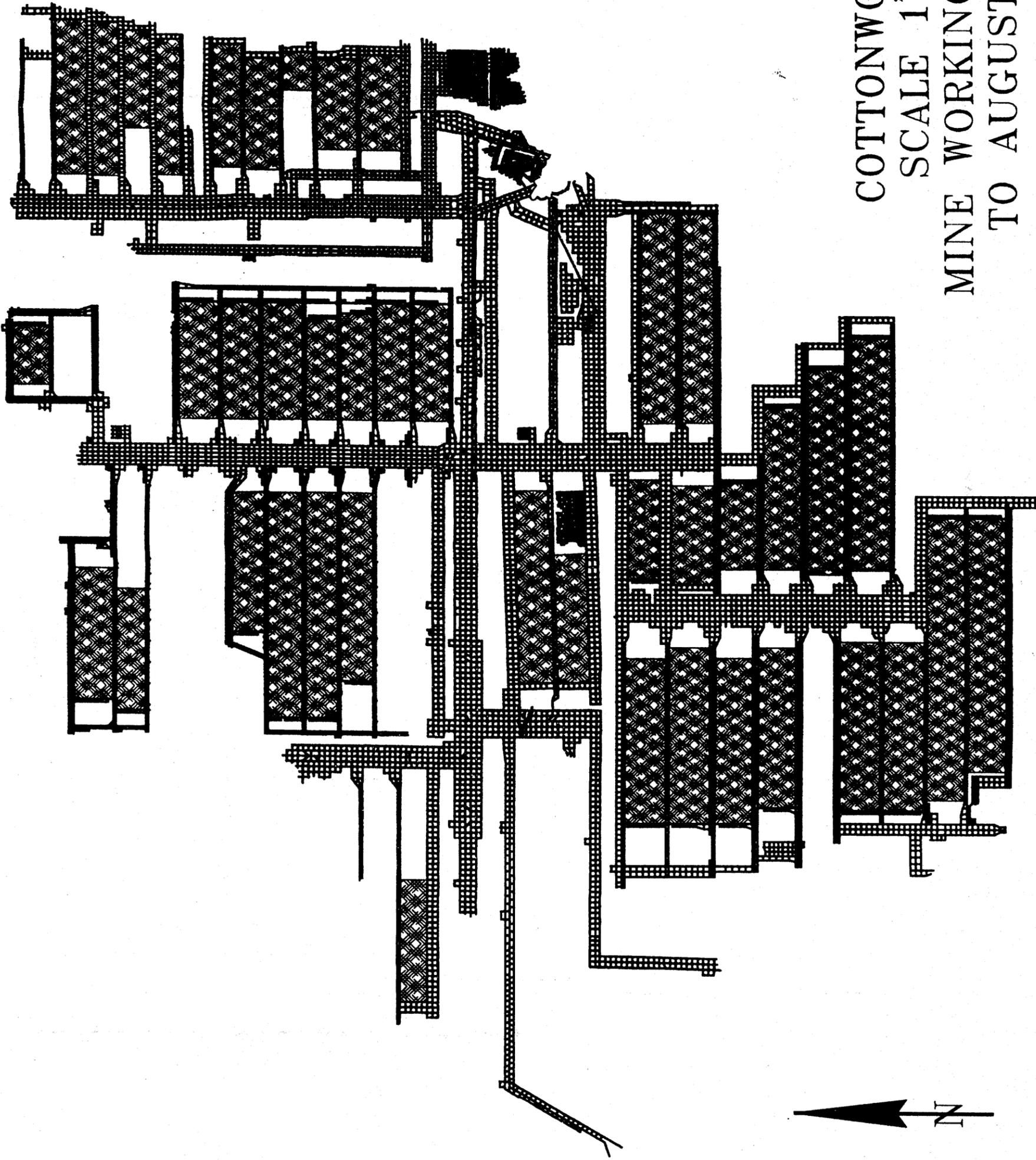
DEER CREEK MINE  
SCALE 1"=2,000'  
MINE WORKINGS UPDATED  
TO AUGUST 31, 1999  
SHEET 1 OF 2





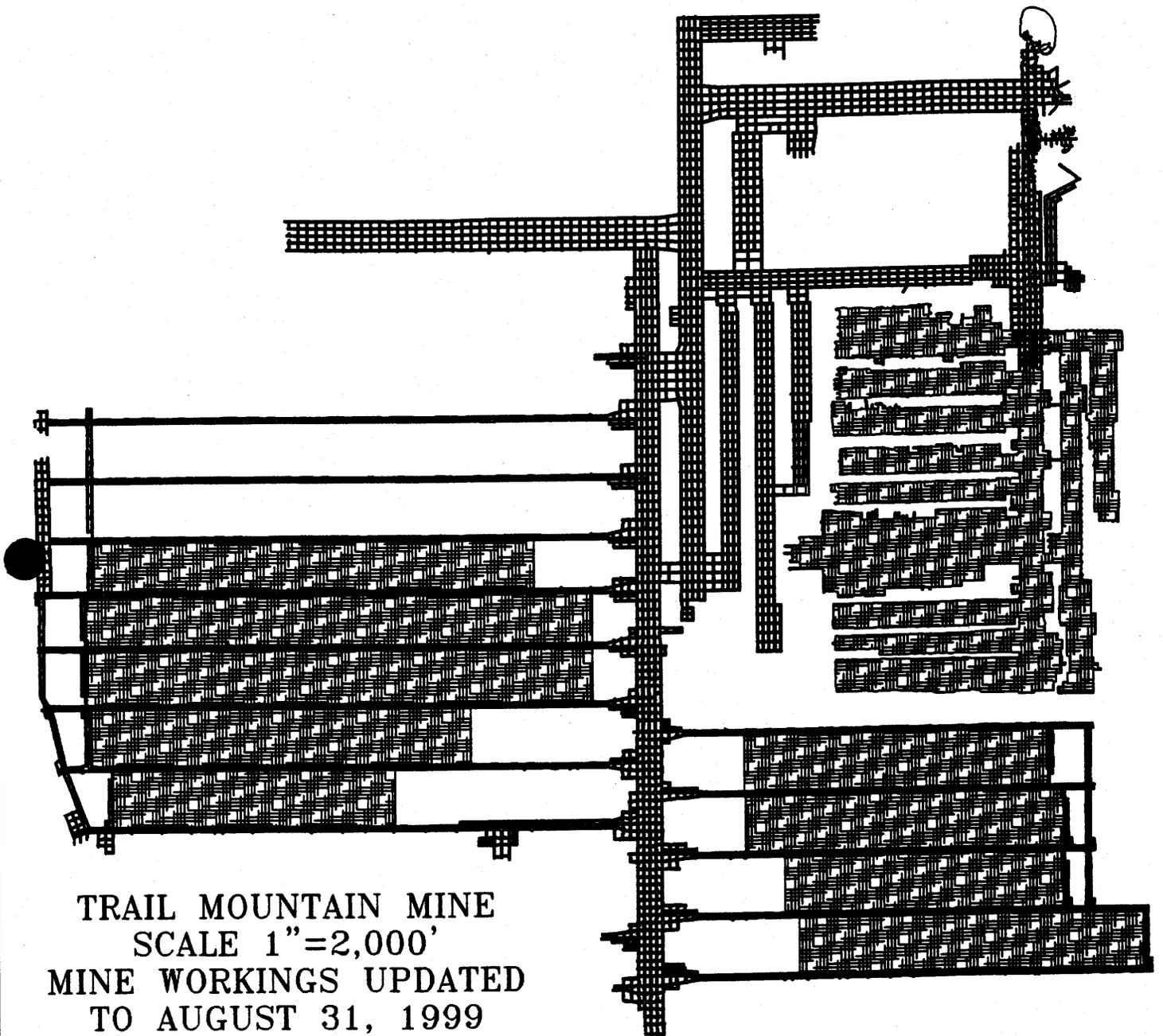
DEER CREEK MINE  
SCALE 1"=2,000'  
MINE WORKINGS UPDATED  
TO AUGUST 31, 1999  
SHEET 2 OF 2

**Wilberg/Cottonwood Mine**



COTTONWOOD MINE  
SCALE 1" = 2,000'  
MINE WORKINGS UPDATED  
TO AUGUST 31, 1996

**Trail Mountain Mine**



TRAIL MOUNTAIN MINE  
SCALE 1"=2,000'  
MINE WORKINGS UPDATED  
TO AUGUST 31, 1999



**Spring Map with 5-Year Mine Plan**

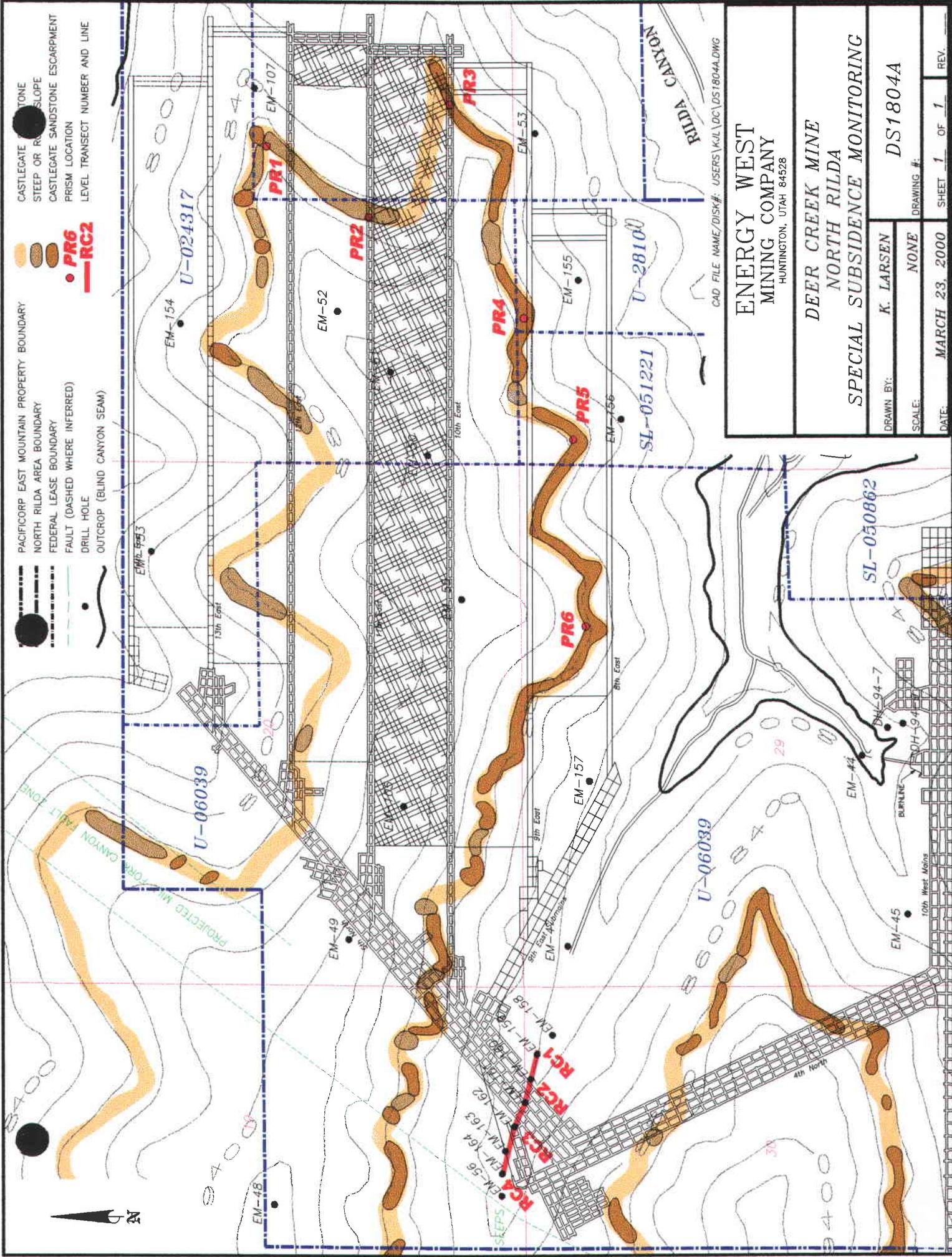
**Showing Subsidence**

## **Cliff Stability Survey Targets**

- PACIFICORP EAST MOUNTAIN PROPERTY BOUNDARY
- NORTH RILDA AREA BOUNDARY
- FEDERAL LEASE BOUNDARY
- FAULT (DASHED WHERE INFERRED)
- DRILL HOLE
- OUTCROP (BLIND CANYON SEAM)

- CASTLEGATE SANDSTONE
- STEEP OR ROCK SLOPE
- CASTLEGATE SANDSTONE ESCARPMENT
- PRISM LOCATION
- LEVEL TRANSECT NUMBER AND LINE

- PR6
- RC2



CAD FILE NAME/DISK#: USERS\K\L\DC\DS18044.DWG

**ENERGY WEST  
MINING COMPANY**  
HUNTINGTON, UTAH 84528

**DEER CREEK MINE  
NORTH RILDA  
SPECIAL SUBSIDENCE MONITORING**

DRAWN BY:	K. LARSEN	DRAWING #:	DS18044
SCALE:	NONE	SHEET	1 OF 1
DATE:	MARCH 23, 2000	REV.	

# RILDA CANYON PRISMS

Prisms 1-3 Installed on February 24, 1999

## Baseline Data PRISM 1

Date	Northing		Easting		Elevation	
	Reading	Variance	Reading	Variance	Reading	Variance
03/02/1999	394,906.00		2,102,579.31		8758.21	
03/04/1999	394,905.99		2,102,579.32		8758.21	
03/08/1999	394,905.84		2,102,579.33		8758.19	
03/11/1999	394,906.00		2,102,579.25		8758.13	
03/18/1999	394,906.01		2,102,579.37		8758.13	
03/23/1999	394,906.01		2,102,579.35		8758.13	
03/26/1999	394,906.00		2,102,579.33		8758.16	
03/29/1999	394,905.83		2,102,579.28		8758.08	
03/31/1999	394,905.99		2,102,579.23		8757.94	
04/08/1999	394,905.97		2,102,579.11		8757.97	
04/12/1999	394,906.04		2,102,579.26		8758.1	
04/21/1999	394,905.99		2,102,579.23		8757.98	
04/26/1999	394,906.01		2,102,579.25		8758.05	
05/03/1999	394,905.95		2,102,579.28		8757.99	
05/10/1999	394,905.87		2,102,579.39		8757.93	
05/17/1999	394,905.94		2,102,579.25		8757.93	
05/24/1999	394,905.89		2,102,579.23		8757.95	
06/07/1999	394,905.99		2,102,579.25		8757.91	
06/14/1999	394,905.87		2,102,579.40		8758.26	
08/03/1999	394,906.09	0.13	2,102,579.67	0.38	8758.85	0.78
09/15/1999	394,905.77	-0.19	2,102,579.99	0.70	8758.83	0.76
10/08/1999	394,905.85	-0.11	2,102,579.92	0.63	8758.74	0.67
11/05/1999	394,905.84	-0.12	2,102,580.00	0.72	8758.89	0.82
11/29/1999	394,905.80	-0.16	2,102,580.03	0.74	8759.05	0.98
02/02/2000	394,905.88	-0.07	2,102,580.15	0.86	8759.07	1.00
02/04/2000	394,905.82	-0.14	2,102,580.02	0.73	8759.00	0.93
02/07/2000	394,906.11	0.15	2,102,579.92	0.63	8758.81	0.74
02/08/2000	394,905.50	-0.45	2,102,580.09	0.80	8758.96	0.89
02/16/2000	394,906.13	0.17	2,102,579.91	0.63	8758.85	0.78
02/21/2000	394,905.41	-0.55	2,102,580.23	0.95	8759.47	1.40

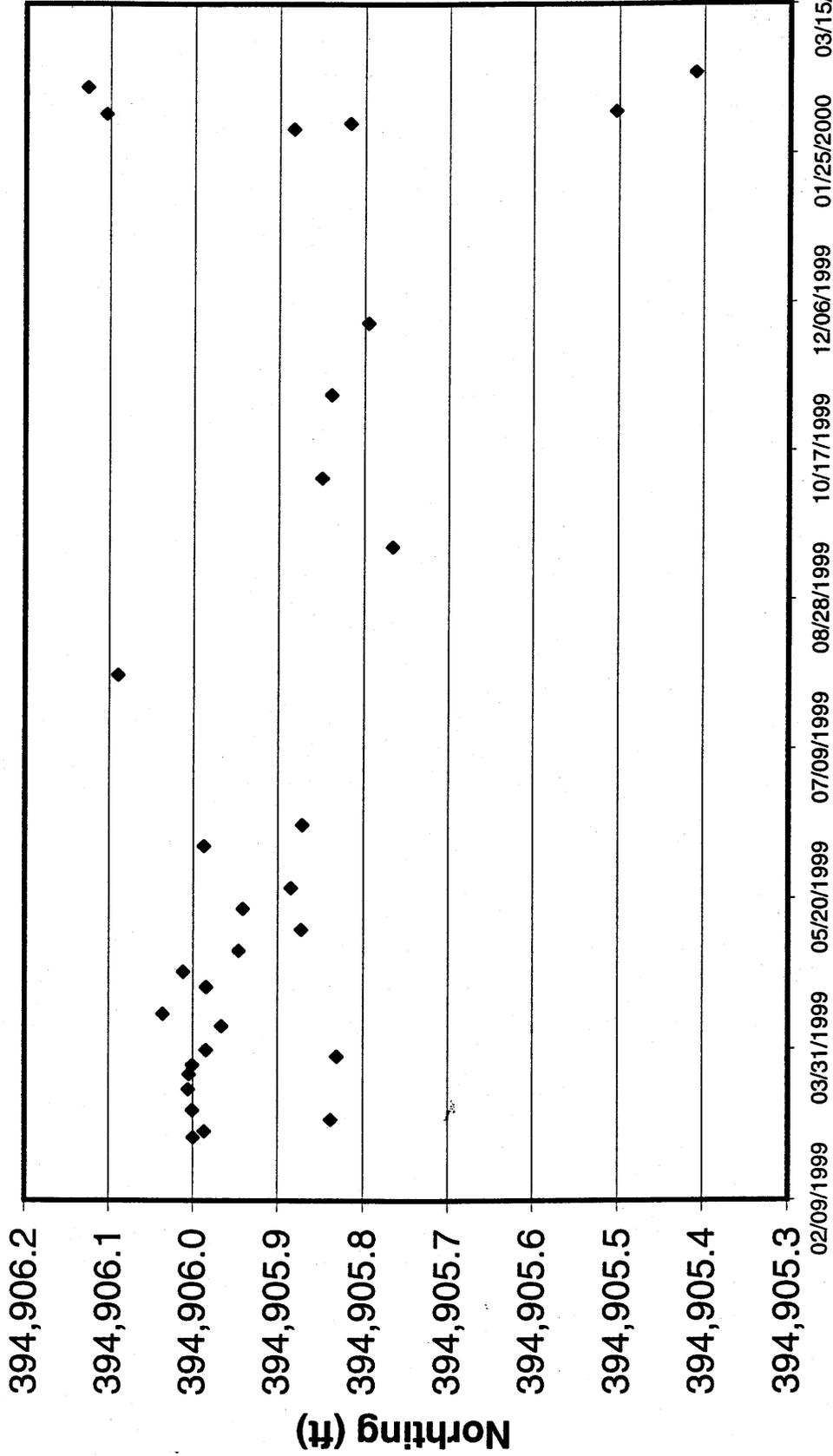
Average Survey Prior  
To Undermining  
Cut off Date 14-Jun-99  
Northing 394,905.96  
Easting 2,102,579.29  
Elevation 8,758.07

Average Cutoff

GOING UNDER #2 PRISM - Blind Canyon Seam



# Rilda Canyon Prism #1



◆ Northing



# RILDA CANYON PRISMS

Prisms 1-3 Installed on February 24, 1999

## Baseline Data

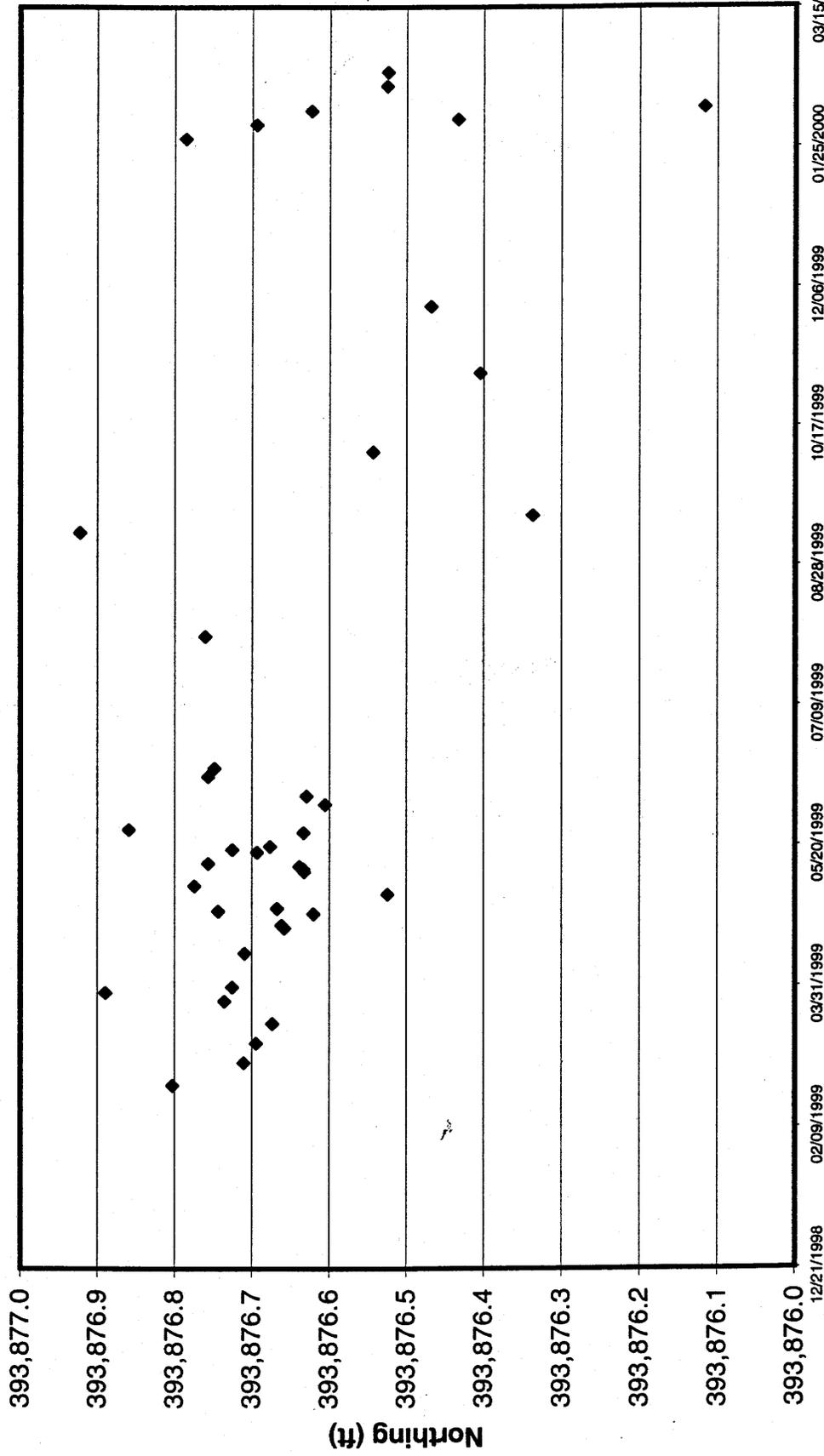
### PRISM 2

Date	Northing		Easting		Elevation	
	Reading	Variance	Reading	Variance	Reading	Variance
03/04/1999	393,876.71		2,101,870.34		8733.05	
03/11/1999	393,876.70		2,101,870.29		8733.05	
03/18/1999	393,876.67		2,101,870.32		8733.04	
03/26/1999	393,876.74		2,101,870.29		8732.89	
03/29/1999	393,876.89		2,101,870.37		8733.00	
03/31/1999	393,876.73		2,101,870.39		8732.95	
04/12/1999	393,876.71		2,101,870.30		8732.98	
04/21/1999	393,876.66		2,101,870.32		8732.92	
04/22/1999	393,876.66		2,101,870.24		8732.92	
04/26/1999	393,876.62		2,101,870.29		8732.82	
04/27/1999	393,876.74		2,101,870.31		8732.94	
04/28/1999	393,876.67		2,101,870.35		8,732.93	
05/03/1999	393,876.53		2,101,870.35		8732.83	
05/06/1999	393,876.78		2,101,870.23		8732.90	
05/11/1999	393,876.63		2,101,870.33		8732.99	
05/12/1999	393,876.63		2,101,870.40		8733.00	
05/13/1999	393,876.64		2,101,870.35		8732.96	
05/14/1999	393,876.76		2,101,870.22		8732.87	
05/18/1999	393,876.69		2,101,870.34		8732.86	
05/19/1999	393,876.73		2,101,870.41		8732.92	
05/20/1999	393,876.68		2,101,870.37		8733.00	
02/24/1999	393,876.80		2,101,870.32		8732.92	
05/25/1999	393,876.63		2,101,870.28		8732.88	
05/26/1999	393,876.86		2,101,870.32		8732.92	
06/04/1999	393,876.61		2,101,870.33		8732.63	
06/07/1999	393,876.63		2,101,870.32		8732.65	
06/14/1999	393,876.76		2,101,870.45		8732.70	
06/17/1999	393,876.75		2,101,870.26		8732.66	
08/03/1999	393,876.76		2,101,870.84		8733.67	
09/09/1999	393,876.92		2,101,870.63		8733.42	
09/15/1999	393,876.34		2,101,871.04		8733.32	
<b>Average Cutoff</b>						
10/08/1999	393,876.54	-0.15	2,101,871.06	0.69	8733.55	0.60
11/05/1999	393,876.41	-0.29	2,101,871.08	0.70	8733.54	0.59
11/29/1999	393,876.47	-0.23	2,101,871.01	0.63	8733.52	0.57
01/28/2000	393,876.79	0.09	2,101,871.10	0.73	8733.57	0.62
02/02/2000	393,876.70	0.00	2,101,871.26	0.89	8733.69	0.74
02/04/2000	393,876.43	-0.26	2,101,871.53	1.16	8733.31	0.36
<b>GOING UNDER #2 PRISM - 1</b>						
02/07/2000	393,876.62	-0.07	2,101,871.22	0.85	8733.02	0.07
02/08/2000	393,876.12	-0.58	2,101,871.98	1.60	8732.73	-0.22
02/16/2000	393,876.53	-0.17	2,101,872.54	2.16	8730.06	-2.89
02/21/2000	393,876.53	-0.17	2,101,872.35	1.98	8729.87	-3.08

Average Su  
To Unde  
Cut off Date  
Northing  
Easting  
Elevation

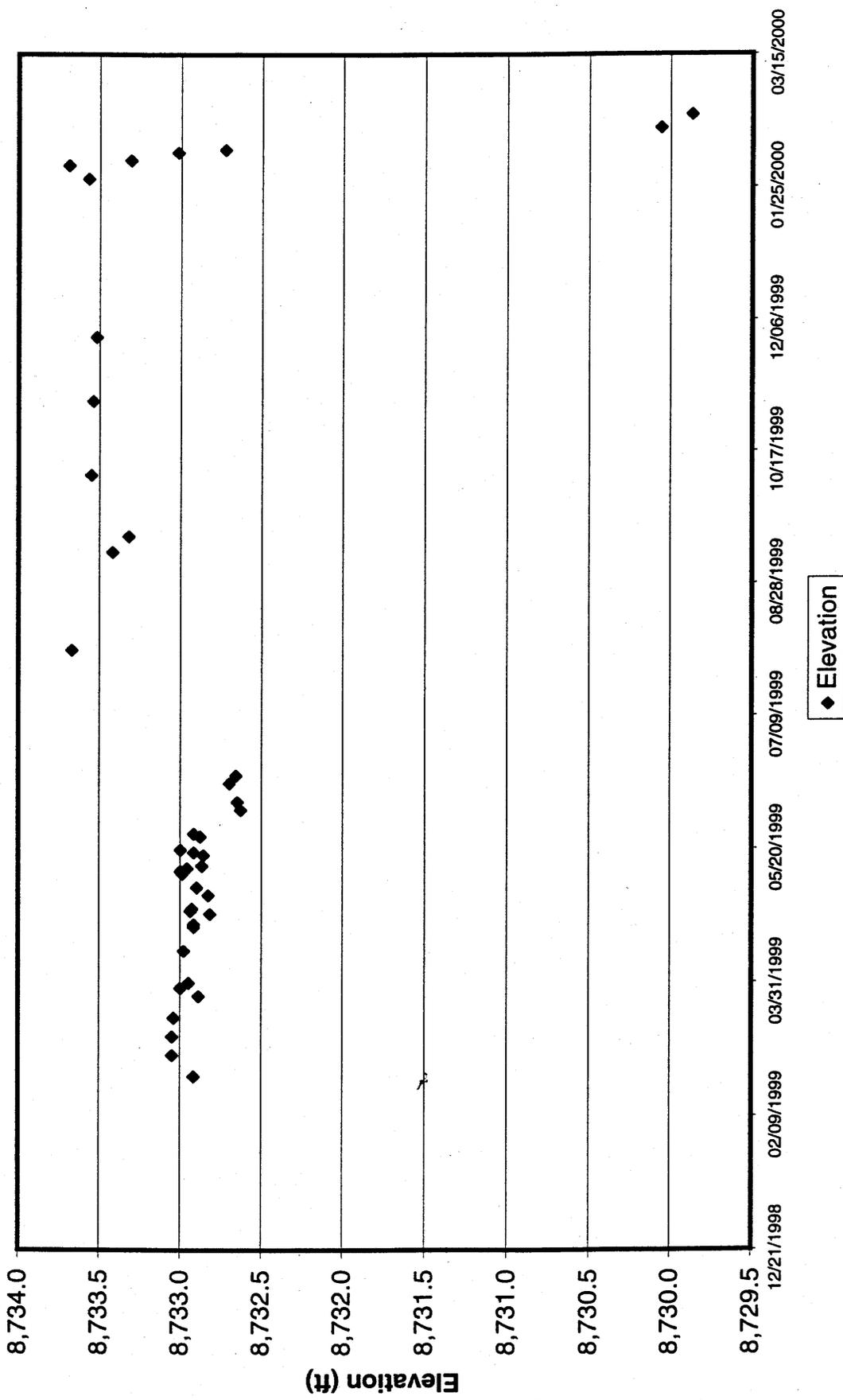


# Rilda Canyon Prism #2



◆ Northing

# Rilda Canyon Prism #2

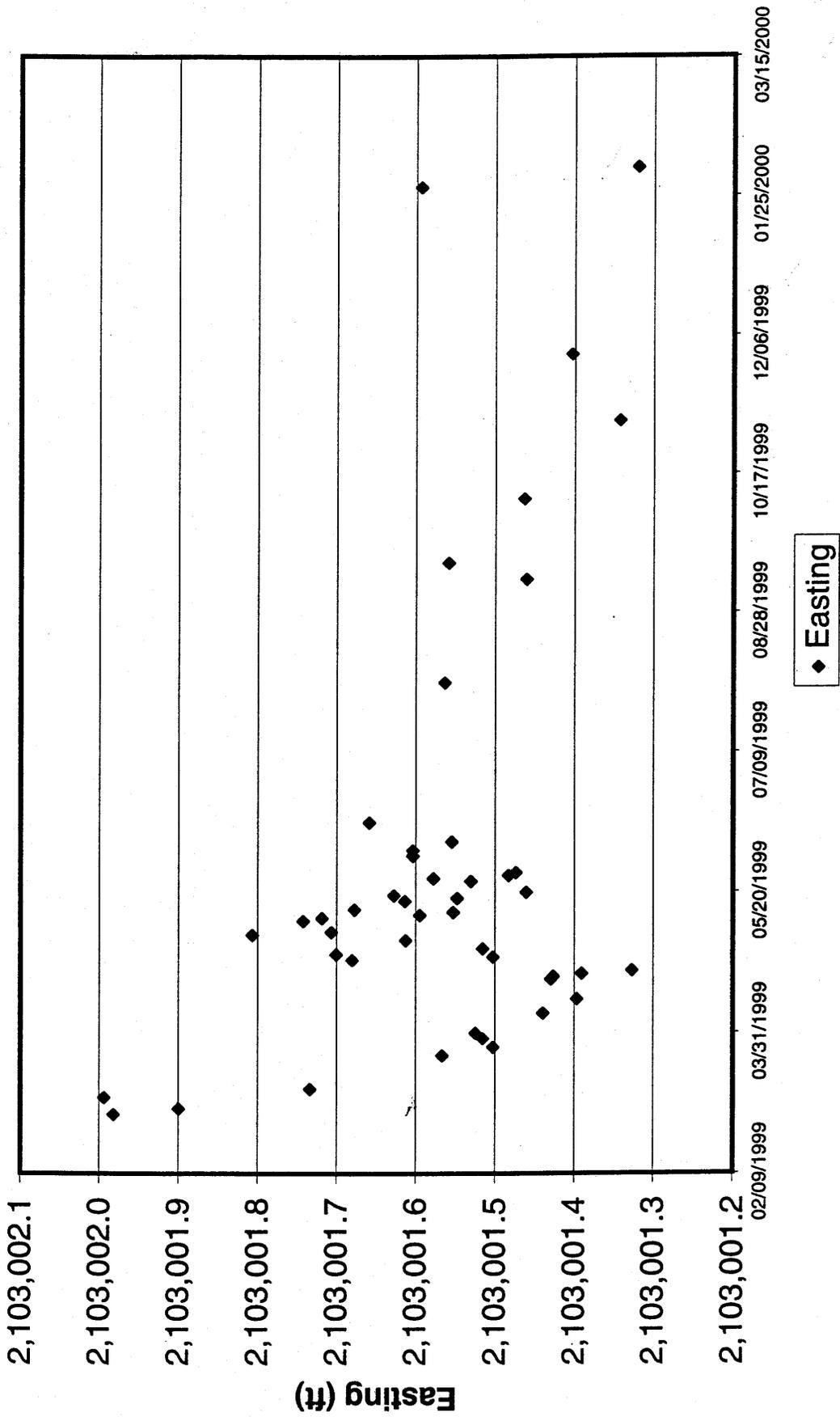


**RILDA CANYON PRISMS**  
Prisms 1-3 Installed on February 24, 1999

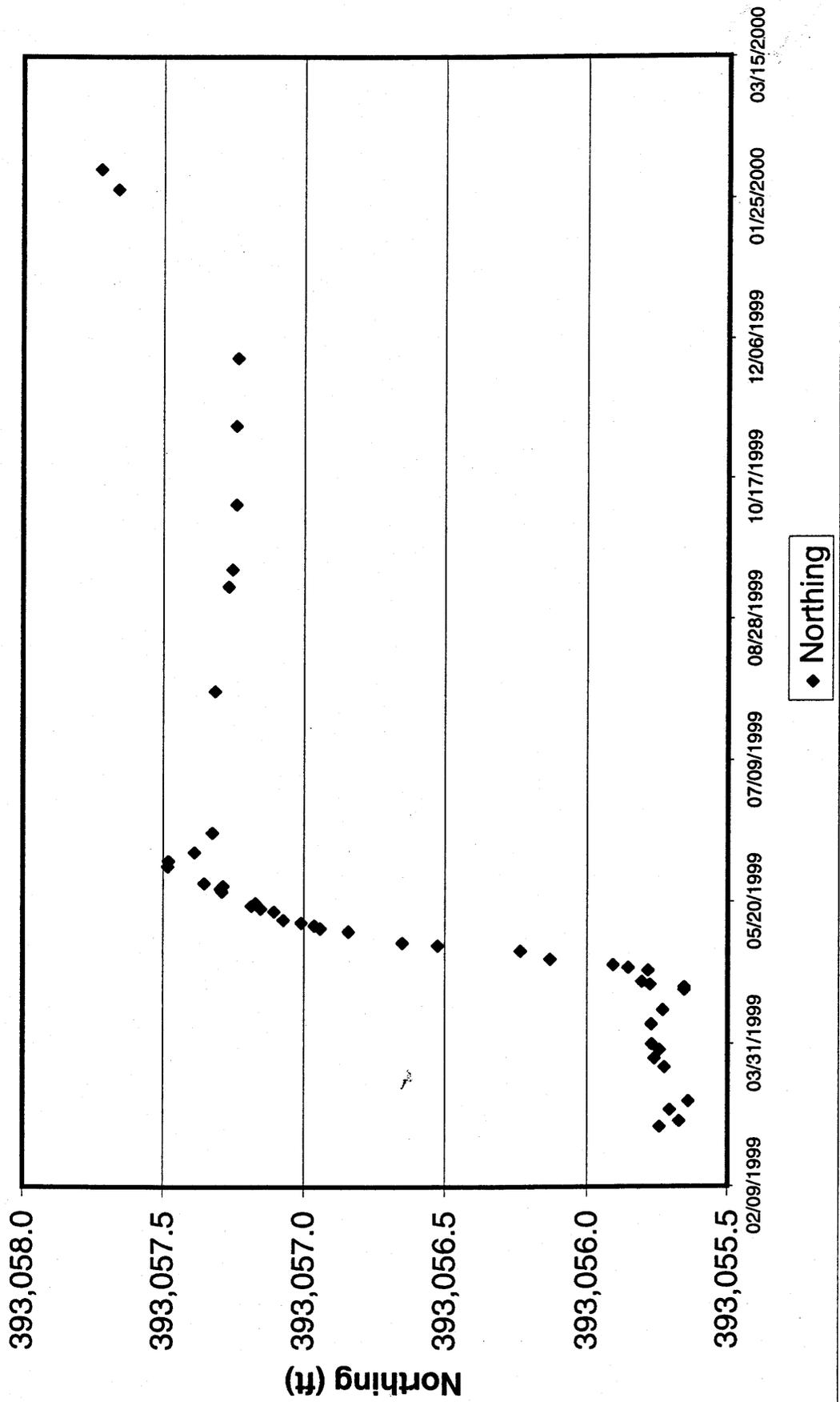
**Baseline Data**  
**PRISM 3**

Date	Northing		Easting		Elevation		
	Reading	Variance	Reading	Variance	Reading	Variance	
03/02/1999	393,055.74		2,103,001.98		8706.11		
03/04/1999	393,055.67		2,103,001.90		8706.17		
03/08/1999	393,055.71		2,103,001.99		8706.06		
03/11/1999	393,055.64		2,103,001.73		8705.98		
03/23/1999	393,055.73		2,103,001.57		8705.92		
03/26/1999	393,055.76		2,103,001.50		8705.95		
03/29/1999	393,055.74		2,103,001.52		8705.97		
03/31/1999	393,055.77		2,103,001.53		8705.89		<b>Average Cutoff</b>
04/07/1999	393,055.77	0.05	2,103,001.44	-0.28	8705.89	-0.12	
04/12/1999	393,055.73	0.01	2,103,001.40	-0.32	8705.94	-0.07	
04/19/1999	393,055.65	-0.07	2,103,001.43	-0.29	8706.08	0.07	
04/20/1999	393,055.65	-0.07	2,103,001.43	-0.29	8706.03	0.02	
04/21/1999	393,055.78	0.06	2,103,001.39	-0.32	8705.89	-0.12	
04/22/1999	393,055.80	0.08	2,103,001.33	-0.39	8705.89	-0.12	
04/26/1999	393,055.78	0.06	2,103,001.68	-0.03	8705.96	-0.05	<b>GOING UNDER</b>
04/27/1999	393,055.85	0.13	2,103,001.50	-0.21	8705.90	-0.11	
04/28/1999	393,055.91	0.19	2,103,001.70	-0.01	8705.86	-0.15	<b>Average t</b>
04/30/1999	393,056.13	0.41	2,103,001.52	-0.20	8705.91	-0.10	<b>To Uni</b>
05/03/1999	393,056.24	0.52	2,103,001.61	-0.10	8705.87	-0.14	<b>Cut off Date</b>
05/05/1999	393,056.53	0.81	2,103,001.81	0.09	8705.78	-0.23	<b>Northing</b>
05/06/1999	393,056.65	0.93	2,103,001.71	-0.01	8705.73	-0.28	<b>Easting</b>
05/10/1999	393,056.84	1.12	2,103,001.74	0.03	8705.76	-0.25	<b>Elevation</b>
05/11/1999	393,056.94	1.22	2,103,001.72	0.00	8705.67	-0.34	
05/12/1999	393,056.96	1.24	2,103,001.60	-0.12	8705.68	-0.33	
05/13/1999	393,057.01	1.29	2,103,001.55	-0.16	8705.69	-0.32	
05/14/1999	393,057.08	1.36	2,103,001.68	-0.04	8705.68	-0.33	
05/17/1999	393,057.11	1.39	2,103,001.61	-0.10	8705.76	-0.25	
05/18/1999	393,057.16	1.44	2,103,001.55	-0.17	8705.72	-0.29	
05/19/1999	393,057.19	1.47	2,103,001.63	-0.09	8705.67	-0.34	
05/20/1999	393,057.17	1.45	2,103,001.46	-0.25	8705.76	-0.25	
05/24/1999	393,057.29	1.57	2,103,001.53	-0.18	8705.70	-0.31	
05/25/1999	393,057.30	1.58	2,103,001.58	-0.14	8705.74	-0.27	
05/26/1999	393,057.29	1.57	2,103,001.48	-0.23	8705.73	-0.28	
05/27/1999	393,057.36	1.64	2,103,001.47	-0.24	8705.63	-0.38	
06/02/1999	393,057.49	1.77	2,103,001.60	-0.11	8705.61	-0.40	
06/04/1999	393,057.48	1.76	2,103,001.60	-0.11	8705.55	-0.46	
06/07/1999	393,057.39	1.67	2,103,001.56	-0.16	8705.71	-0.30	
06/14/1999	393,057.33	1.61	2,103,001.66	-0.06	8705.67	-0.34	
08/03/1999	393,057.32	1.60	2,103,001.56	-0.15	8705.93	-0.08	
09/09/1999	393,057.27	1.55	2,103,001.46	-0.25	8706.02	0.01	
09/15/1999	393,057.26	1.54	2,103,001.56	-0.16	8705.90	-0.11	
10/08/1999	393,057.24	1.52	2,103,001.46	-0.25	8705.92	-0.09	
11/05/1999	393,057.24	1.52	2,103,001.34	-0.37	8705.93	-0.08	
11/29/1999	393,057.24	1.52	2,103,001.40	-0.31	8705.99	-0.02	
01/28/2000	393,057.66	1.94	2,103,001.59	-0.12	8705.89	-0.12	
02/04/2000	393,057.73	2.01	2,103,001.32	-0.40	8705.83	-0.18	

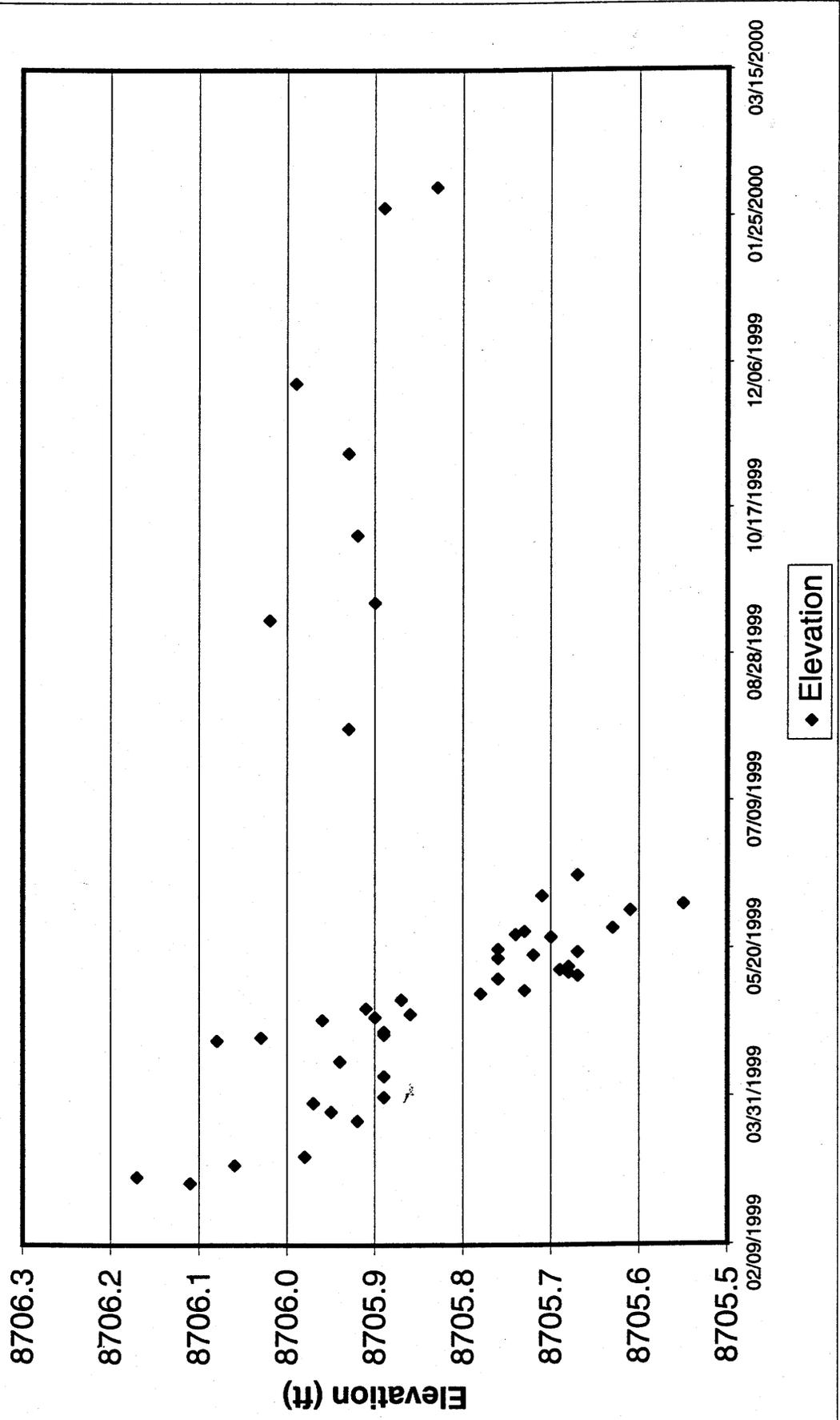
# Rilda Canyon Prism #3



# Rilda Canyon Prism #3



# Rilda Canyon Prism #3



# ***RILDA CANYON PRISMS***

**Prisms 4-6 Installed on JUNE 21, 1999**

## **Baseline Data**

### **PRISM 4**

<b>Date</b>	<b>Northing</b>		<b>Easting</b>		<b>Elevation</b>	
	<b>Reading</b>	<b>Variance</b>	<b>Reading</b>	<b>Variance</b>	<b>Reading</b>	<b>Variance</b>
06/29/1999	392,315.99		2,100,862.09		8794.10	
08/03/1999	392,316.03		2,100,862.00		8794.14	
09/15/1999	392,316.01		2,100,861.69		8794.12	
10/08/1999	392,315.84		2,100,861.96		8794.24	
11/05/1999	392,315.89		2,100,861.99		8794.14	
11/29/1999	392,315.94		2,100,861.81		8794.20	

# ***RILDA CANYON PRISMS***

**Prisms 4-6 Installed on JUNE 21, 1999**

## **Baseline Data PRISM 5**

<b>Date</b>	<b>Northing</b>		<b>Easting</b>		<b>Elevation</b>	
	<b>Reading</b>	<b>Variance</b>	<b>Reading</b>	<b>Variance</b>	<b>Reading</b>	<b>Variance</b>
06/29/1999	391,820.30		2,099,639.96		8814.77	
08/03/1999	391,820.29		2,099,639.88		8814.82	
09/15/1999	391,820.20		2,099,639.59		8814.79	
10/08/1999	391,820.18		2,099,639.89		8814.82	
11/05/1999	391,820.24		2,099,639.83		8814.77	
11/29/1999	391,820.20		2,099,639.65		8814.83	

# **RILDA CANYON PRISMS**

**Prisms 4-6 Installed on JUNE 21, 1999**

## **Baseline Data**

### **PRISM 6**

<b>Date</b>	<b>Northing</b>		<b>Easting</b>		<b>Elevation</b>	
	<b>Reading</b>	<b>Variance</b>	<b>Reading</b>	<b>Variance</b>	<b>Reading</b>	<b>Variance</b>
06/29/1999	391,695.08		2,097,768.41		8862.11	
08/03/1999	391,695.11		2,097,768.49		8862.19	
09/15/1999	391,694.89		2,097,768.38		8862.15	
10/08/1999	391,695.05		2,097,768.60		8862.23	
11/05/1999	391,695.03		2,097,768.53		8862.26	
11/29/1999	391,694.93		2,097,768.37		8862.32	

