CHAPTER 14

NEICO STATE LEASES ML-21568 AND ML-21569

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF APPENDICES

(All appendices are at the end of the chapter narrative)

14.0 NEICO STATE LEASES ML-21568 AND ML-21569

14.1 Introduction

This chapter contains information for an underground mining permit for state leases ML-21568 and ML-21569 located in T16S-R6E-Sec2 and T15S-R6E-Sec36 SLBM respectively, by Genwal Coal Company Inc. (Genwal), jointly owned by Nevada Electric Investment Company (NEICO) and Intermountain Power Agency (IPA) (Plate 2-1). A special use permit for a right-of-way (Chapter 13) to access these contiguous state coal leases, from federal coal leases UO-54762 and SL-062648 has been obtained from the Utah Division of Oil, Gas and Mining.

State leases ML-21568 and ML-21569 are 998 and 640 acres in size, respectively. In-place coal reserves total 18 million tons, of which 8 million tons will be recovered.

Mining of these two leases will not result in additional surface structures. All work performed will be done underground. Access will be solely via one set of presently existent portals in the Hiawatha coal seam located in lease SL-062648.

An underground mine design for these two state leases appears in Plates 3-3 and 3-3A. Detailed discussions of the underground mine design and mining plans are found in sections 14.6.1 and 14.3.2, respectively. Typical entry-ways are 20 feet wide. Lease ML-21568 contains 12 retreat panels, barrier pillars, a north-south main (1st South), and a bleeder (2nd South). Barrier protection, nine retreat panels, a main entry (Main North), as well as a north-south bleeder (1st Right) have been designed in Lease ML-21569.

Information concluded from present drill hole information excludes the possibility of multiple minable seams being present on either State Lease. However, Genwal Coal Company will drill up holes from the Hiawatha Seam in lease ML-21568 (Appendix 6-5). The up holes will be drilled up a maximum of 150' in an attempt to locate and evaluate the Blind Canyon and Bear seams to their potential to be feasibly mined. The up holes will be drilled on one-half mile spacing in

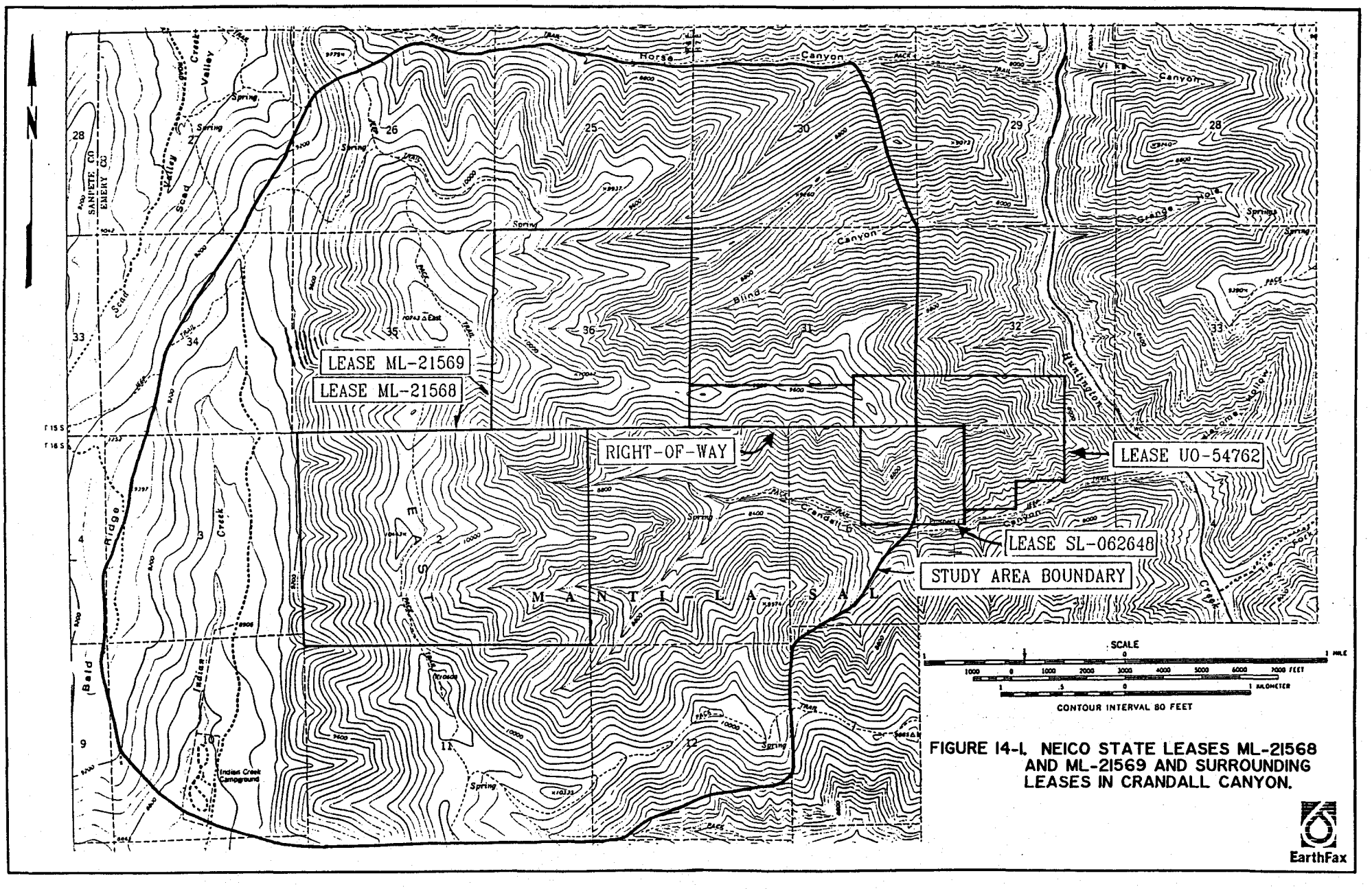


FIGURE 14-1. NEICO STATE LEASES ML-21568 AND ML-21569 AND SURROUNDING LEASES IN CRANDALL CANYON.

This document is organized similar to:

1) the Genwal Coal Company Mining and Reclamation Plan, Crandall Canyon Mine, which was organized as suggested by the revised guidelines issued November 3, 1980 by Byline C. Spencer of the Utah Division of Oil, Gas and Mining (UDOGM), and

2) as suggested by the Utah Coal Mining and Reclamation Regulatory Program's, Rules Pertaining to Underground Coal Mining Activities, revised guidelines issued May, 1987 by the Utah Division of Oil, Gas and Mining.

14.2 Legal, Financial, Compliance, and Related Information

Legal, financial, and compliance information contained in Sections 2.1 through 2.9 of the Crandall Canyon Mining and Reclamation Plan applies to state leases ML-21568 and ML-21569. Additional information relating specifically to the above mentioned leases is discussed in this chapter.

The proposed mining area lies in Utah State owned land. The legal owners of the surface rights are listed below.

United States Government
Administered by the United States
Department of Agriculture, Forest Service,
Intermountain Region
Manti-LaSal National Forest
599 West River Drive
Price, Utah 84501

Utah State Government
Administered by the State of Utah
Division of State Lands and Forestry
3 Triad Center, Suite 400
355 West North Temple
Salt Lake City, Utah 84180

14.3.1 Surface Facilities/Construction Plans. No additional portals, surface buildings, or surface structures will be built as a result of mining in state leases ML-21568 and ML-21569.

Coal handling, processing, preparation, and storage operations to be implemented are identical to those currently in operation and permitted (Section 3.2.4).

Power, water, and sewage systems to be used are those currently permitted and in-place (Sections 3.2.5, 3.2.6, and 3.2.7).

14.3.2 Operation Plan. Operation plans to be implemented are identical to those presently permitted/approved and in use (Section 3.3).

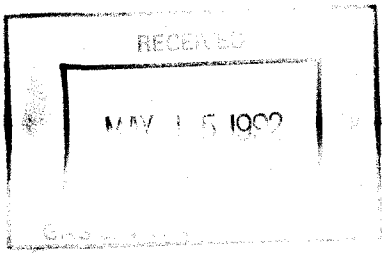
14.3.2.1 Mining Plans.

14.3.2.1.1 Projected Development of State Leases ML-21568 and ML-21569. An underground mine design has been developed and appears in Plate 3-3. Mined areas within both leases are bordered by 100 foot wide barrier pillars. Typical entry-ways are 20 feet wide. Typical pillars are 55 feet wide and 100 feet long, with 75 by 120 foot centers.

Mining will commence with lease ML-21569, and be followed by lease ML-21568. Five entries comprising "west mains" have been designed as a westward extension of the right-of-way into lease ML-21569. West mains extend to within 100 feet of the western edge of lease ML-21569. Four entries comprise both a north-south submain named Main North, and a bleeder called 1st Right. Nine retreat panels, and barrier protection are accessed via 1st Right and Main North. Pilar height (thickness of coal seam) ranges from about 5.5 to 10 feet.

Lease ML-21568 is to be accessed five entries which extend southward from West Mains along the eastern edge of the lease. Five entries, running east-west, extend to the western edge of lease ML-21568, and access 12 panels.

An incidental boundary change (ICB) of 50 acres is included in the North West corner of ML-21569. The ICB is for potential surface effects of mining only. No underground mining will take place within this ICB. A Forest Service Special use permit is in effect for this area.



A discussion of coal pillar and roof span design is found in Section 14.6.1.

14.3.2.1.2 **Retreat Mining.**

Retreat mining in lease ML-21569 will start with the first left panel, progress to the south terminating with the 9th left panel. The bleeder and main North will not be retreat mined. In lease ML-21568 retreat mining will commence with panels 1st right, progress to the North and end with the 12th right panel. The east-west submain will be retreat mined. The north-south submain bleeder will not be retreat mined.

Retreat mining will be limited to 50% extraction within a 20 degree angle-of-draw from the perennial stream channels until either the United States Forest Service grants permission to subside perennial streams, or until geotechnical data is provided by Genwal supporting use of a lesser angle-of-draw, and/or indicating that mine subsidence will have no surface effects. Total retreat mining will not occur beneath the stream channel buffer zones until Genwal has 1) delineated those portions of the stream reaches within the state leases which have perennial flow, (Table 14-4) and 2) shown that these reaches will not be adversely effected by mining activity (Plate 3-3). A 20 degree angle-of-draw was used to delineate the stream channel buffer zones.

Conclusion drawn by the BLM and from TerraTek Inc. support the 20 degree angle of draw and estimate the amount of maximum subsidence (Appendix 14-19).

14.3.2.2 **Waste Disposal Plans.** Waste disposal methods to be used are identical to those currently permitted/approved and in practice (Section 3.3.9).

The method of mining used at the Crandall Canyon Mine results in no development waste. Any rock waste resulting from unexpected roof falls and overcasts is not brought to the surface, but is disposed of along pillar lines or stored in areas that have not been retreat mined and that are not to be retreat mined. The material disposed of along the pillar lines is identical to

14.3.3 Environmental Protection.

14.3.3.1 Protection of Vegetative Resources.

14.3.3.1.1 Projected Impacts of Mining on Vegetative Resources. Since there are to be no new mine openings, surface structures, or subsidence (Section 14.6.2.1), no impact on vegetative resources is projected.

14.3.3.1.2 Monitoring Procedures. Mapping of the vegetation in T15S-R6E-Sec36 and T16S-R6E-Sec2, as well as in the immediate surrounding environs, was accomplished in detail. Color aerial photographs were taken and used in the field to ground check vegetation types, and as mapping guides in the lab. The area was mapped by walking a portion of the area while mapping the vegetation types directly on the aerial photographs. The aerial photographs were then used to interpolate vegetation communities in areas not negotiated by foot. Helicopter surveys were conducted to enhance mapping of the major vegetation patterns. Vegetation data was then transferred to topographic maps. Plates 14.2 and 14.3 are vegetation maps of T15S-R6E-Sec36 and T16S-R6E-Sec2, respectively. Plate 14.4 is a general vegetation map of the areas adjacent to these two sections.

14.3.3.2 Protection of Fish and Wildlife.

14.3.3.2.1 Projected Impacts of Mining on Fish and Wildlife. Since no surface disturbance is anticipated, no impact on fish and wildlife should occur. Larry Dalton, Division of Wildlife Resources, conducted an inventory of T16S-R6E-Sec2 and T15S-R6E-Sec36 on September 29, 1989 which revealed no raptor cliff nests. The area is of poor quality for cliff nesting raptors (Appendix 13-3).

14.3.3.2.2 Mitigating Measure to be Employed to Protect Fish and Wildlife. Genwal recognizes that the Division of Wildlife Resources and the Utah Division of Oil, Gas & Mining regard all seeps and springs to be important to wildlife. Should any seeps and springs become affected (flow decreased by 50% or more) by mining activity in state leases ML-21568 and ML-21569, Genwal will

notify the appropriate agencies and an acceptable mitigation plan will be developed as discussed in Section 3.4.6.2. Effluent limitations set forth in the NPDES Permit regulations (Appendix 3-8) will be complied with.

14.3.3.2.3 **Monitoring Procedures.** The applicant has committed to report to the regulatory authority the presence of any threatened or endangered species in the area. In the event any threatened or endangered species is observed to move into state lease ML-21568 or ML-21569, Genwal will notify the appropriate agencies and acceptable monitoring and mitigation plans will be developed. Genwal is committed to complying with all monitoring requirements established in the NPDES Permit (Appendix 3-8).

14.3.3.3 **Protection of Human Values.**

14.3.3.3.1 **Projected Impacts of Mining on Human Values, Historical and Cultural.** A letter dated November 27, 1989 from James Dykman, Division of State History states:

> "no prehistoric or historic sites have been recorded within the project area because no cultural resource surveys have been conducted. However, such sites may well exist in the project area." (Appendix 14-3).

A cultural resource survey was conducted in October 1988 by Les Wilke, Archeologist, Manti-LaSal National Forest (Appendix 5-6), in permit areas UO-54762 and a portion of SL-062648. Wilke found no cultural resources in the most-likely locations, and concluded that the remainder of the lease areas should have no cultural resources. Cultural resources present in the region generally lie near canyon bottoms adjacent to stream beds (Section 5). The majority of the area within leases ML-21568 and ML-21569 lie above stream beds. Therefore, Genwal determines there is at best only a low potential for historical resources existing in these two state leases.

As a result of: 1) the low potential for historical resources existing in leases ML-21568 and ML-21569, and 2) no anticipated surface disturbance, Genwal has determined that no impact on possible human value sites should occur. Consequently, there is insufficient evidence to warrant a field survey to

identify possible historic sites in these two leases.

14.3.4 Reclamation Plan.

14.3.4.1 Sealing of Mine Openings.

No new portals to the surface will result from mining of leases ML-21568 and ML-21569. Currently, only one exploration borehole, NVP-7 (4-DH7), intersects the proposed mined area (Figures 13-5 and 13-6). Well NVP-7 was abandoned in compliance with UMC regulations. Any future wells that intersect the proposed mined area will be abandoned in compliance with UMC 817.13, 817.14, and 817.50 regulations.

14.4 Geology

14.4.1 Regional Geology and Geology of Leases ML-21568 and ML-21569. A detailed discussion of the regional geologic framework, geology of these two state leases (stratigraphy and structure) appears in Chapter 6, and in the Seep and Spring Inventory of the Neico State Lands Coal Leases (ML-21568 and 21569) and Adjacent Areas, prepared by EarthFax Engineering, November 1989. A copy of the 1989 Seep and Spring Inventory has been forwarded to the Utah Division of Oil, Gas and Mining (UDOGM), and was enclosed in the 1990 first quarter report.

14.4.2 Rock Characteristics of Coal and Adjacent Units. Chemical analyses of the coal seam, and the strata immediately above and below in the areas that have been mined and that are currently being mined have been conducted (Sections 6.3, 6.4, 6.4.1, 6.4.2, 6.5.5.2, and Appendix 6-2).

Geochemical analyses of State Leases ML-21568 and ML-21569 will be conducted in compliance with the UDOGM's Guidelines For Underground and Surface Coal Mining, revised April, 1988. The following analyses of the Hiawatha coal seam and the immediate over- and underlying strata will be conducted: pH, electrical conductivity, particle size (texture), sodium absorption ratio, selenium, total N, boron, maximum acid and neutralization potentials, and organic

carbon (communication: March 1990, Henry Sauer, UDOGM). Specific sample analysis methods suggested in Table 6 of the above referenced UDOGM guideline will be utilized. Samples will be collected and analyses run at the time of commencement of mining operations, as lithologic/hydrologic conditions change during mining operations, and as directed by the UDOGM.

14.4.3 Geologic Effects On Mining. Discussions of mining hazards, surface hazards, and impacts of mining appear in Section 6.6.

14.5 Hydrology

14.5.1 Groundwater Hydrology.

14.5.1.1 Methodology and Regional Groundwater Hydrology. Seep and spring survey methodology, and the regional groundwater hydrology are outlined in Sections 7.1.1 and 7.1.2.1 respectively, and Section 2.0 of the November 1989 Seep and Spring Inventory.

14.5.1.2 State Leases ML-21568 and ML-21569 Plan Area Aquifers. Results of seep and spring surveys conducted in 1985, 1987, and 1989 (previously submitted to UDOGM) that encompass the above mentioned state leases appear in the November 1989 Seep and Spring Inventory. Hydrologic characteristics of the North Horn, Price River, Castlegate, and Blackhawk Formations are reviewed in Section 7.1.2.2, and in the 1989 Seep and Spring Inventory. Locations of the seeps and springs discovered during the inventories are shown in Figure 14-2.

The geologic conditions present at Trail Mountain, located approximately 10 miles south of Crandall Canyon, are very similar to those present at Genwal's Crandall Canyon Mine (Waddell et al., 1981). Due to the presence of similar geologic conditions, similar hydraulic conditions and results are expected at Genwal's mine.

The low flow rates from most of the seeps and springs emitting from the Blackhawk Formation result from the low hydraulic conductivity of the formation

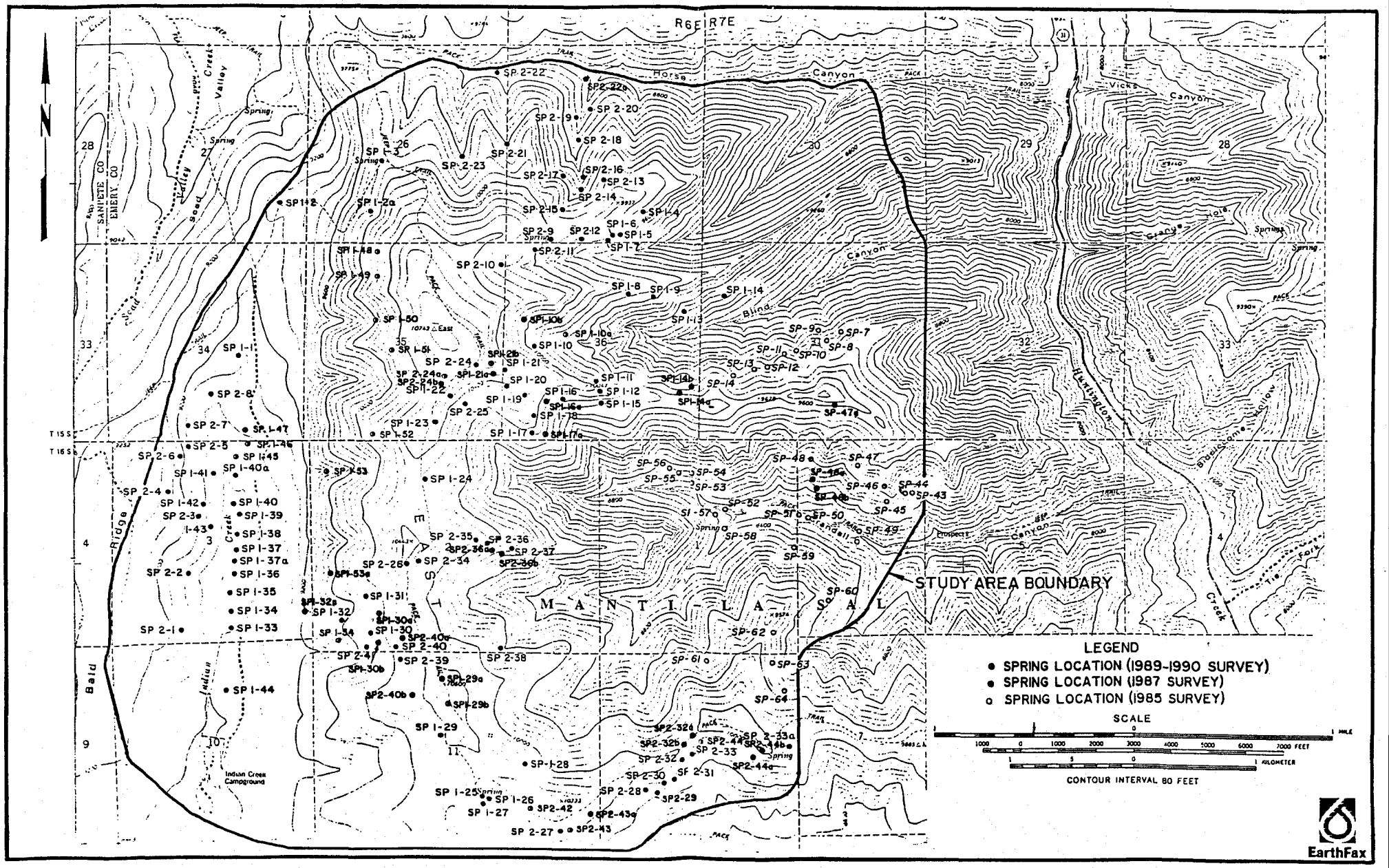


FIGURE 14-2. SEEP AND SPRING LOCATIONS IN NEICO STATE LEASES ML-21568 AND ML-21569 AND SURROUNDING AREAS.

where it remains unfractured. Laboratory permeability data from a core sample taken in T17S-R6E-Sec27 at Trail Mountain indicate an average horizontal hydraulic conductivity of $1.3x10^{-2}$ feet per day, and an average vertical hydraulic conductivity of $3.8x10^{-3}$ feet per day for sandstone units of the Blackhawk Formation (Lines, 1985). Shale and siltstone samples of the Blackhawk Formation have maximum horizontal and vertical hydraulic conductivities of only $1.0x10^{-7}$ and $1.2x10^{-6}$ feet per day, respectively (Lines, 1985). These low hydraulic conductivities of the shales and siltstones indicate that these finer-grained sediments within the Blackhawk serve as barriers to the downward migration of water. As a result, water recharge into the Blackhawk, either from adjacent formations, snow melt, or rainfall, is allowed to percolate vertically through sandstone beds until a siltstone/shale bed is encountered at which time the water is forced to travel laterally along the bedding plane to the surface. Similarly, the majority of the seeps and springs in the Castlegate, Star Point and North Horn Formations observed in the field surveys also issue from bedding planes. Due to the presence of these vertical permeability barriers, the aquifers in the North Horn, Price River, Castlegate, as well as in the upper portions of the Blackhawk Formations are perched, with no direct communication to the underlying regional Blackhawk-Star Point aquifer. Consequently, dewatering of the Blackhawk-Star Point aquifer resulting from mining the Hiawatha Coal of the Blackhawk Formation has little potential of affecting seeps and springs in the area (Lines, 1985).

All seeps and springs in T15S-R6E-Sec36 (Lease ML-21569), as well as those in surrounding sections, to the west in T15S-R6E-Sec35, east in T15S-R7E-Sec31, north in T15S-R6E-Sec25, and northwest in T15S-R6E-Sec26 (Figure 14-2), drain aquifers in the North Horn, Price River, and Castlegate Formations. These aquifers lie 470 to 2410 feet above the top of the Hiawatha Coal Seam, are found along bedding planes and appear perched with no direct hydraulic connection to the potential mine workings in the Hiawatha coal bed. As a result, mine dewatering is anticipated to have minimal, if any affects on these seeps and springs.

Similarly, seeps and springs in T16S-6E-Sec2 (Lease ML-21568), as well as those in surrounding sections, to the south in T16S-R6E-Sec11, and to the southeast in T16S-R6E-Sec12 (Figure 14-2), drain aquifers in the North Horn and

Price River Formations (Seep and Spring Inventory of the Neico State Lands Coal Leases and Adjacent Areas, Prepared by EarthFax Engineering, November 1989). These perched aquifers lie 1380 to 2150 feet above the top of the Hiawatha Coal Seam, and do not appear to be in hydraulic communication with the potential mine workings in the Hiawatha. Hence, there exists only a minimal likelihood that these seeps and springs would be affected by mine dewatering.

Seeps and springs east of lease ML-21568, in T16S-R6E-Sec1 (Figure 14-2), emit water from the Blackhawk Formation. The elevations of these seeps and springs lie 420 to 700 feet above the potentiometric surface of the regional Blackhawk-Star Point aquifer. These seeps and springs appear to also be discharging from perched aquifers. With no direct communication to the underlying regional aquifer these water sources should not be affected by mine dewatering.

Seeps and springs to the northwest of Lease ML-21568 in T15S-R6E-Sec34, to the west in T16S-R6E-Sec3, and to the southwest in T16S-R6E-Sec10 (Figure 14-2), discharge from the North Horn Formation, or alluvium covering the North Horn Formation in Little Joes Valley. In contrast to other seeps and springs in the study area, flows from these water sources increased substantially between the July and October 1987 surveys (November 1989 Seep and Spring Inventory of the Neico State Lands Coal Leases and Adjacent Areas, prepared by EarthFax Engineering Inc). This anomalous water flow trend is attributed to three factors. First, recharge from the Joes Valley Fault Zone. These water sources lie in a linear trend parallel to the fault zone, directly along or to the west of Indian Creek which also follows the trace of the fault zone. Secondly, recharge from water in the colluvium and alluvium on the west-facing slope of East Mountain flows downhill toward Little Joes Valley and discharges into the valley alluvium. The relatively late arrival of this water is due to the lag time as this snowmelt-derived water travels through the soil to the valley floor. Thirdly, these seeps and springs in Little Joes Valley lie in a different drainage basin than those in the rest of the study area, a drainage basin which is displaying a contrasting flow pattern to that present in the Huntington Creek tributaries on the east-facing slopes of East Mountain.

14.5.1.3 Groundwater Development and Mine Dewatering.

14.5.1.3.1 Water Supply. Table 14-2 contains a listing of groundwater rights (and their associated seeps and springs) in and adjacent to State Leases ML-21568 and ML-21569. This data was obtained from the files of the Utah Division of Water Rights in June 1990. More in-depth information concerning these rights is contained in Appendix 14.4. Locations of these water rights are denoted in Figure 14-3. Table 14-2 also shows what groundwater right corresponds to the seeps and springs observed in the field inventories.

No sign of current use by stock animals has been observed during the seep and spring inventories. Apparently, the use of these water rights has been curtailed.

14.5.1.3.2 Mine Dewatering. Present inflow into the underground mine workings total no more than 100 gallons per minute. Inflow water is used in underground mining operations.

14.5.1.4 Effects of Mining Operation on Groundwater.

Mine dewatering (resulting in removal of water from the aquifers) is the primary mechanism by which the groundwater system may be impacted. As previously stated, it is believed that the water emitting from seeps and springs in State Leases ML-21568 and ML-21569, as well as in the surrounding areas, originate from perched aquifers with no direct communication with the regional Blackhawk-Star Point aquifer. Thus, dewatering resulting from mining the Hiawatha Coal of the Blackhawk Formation has little potential for impact. This observation is in agreement with conditions present at Trail Mountain as reported by Lines (1985).

As previously stated, average horizontal and vertical hydraulic conductivities of 1.3×10^{-2} and 3.8×10^{-3} feet per day, respectively, are present in sandstones of the Blackhawk Formation (Lines, 1985). Blackhawk shales and siltstones have maximum horizontal and vertical hydraulic conductivities of 1.0×10^{-7} and 1.2×10^{-6} feet per day, respectively (Lines, 1985). Lines (1985) also reports maximum horizontal and vertical hydraulic conductivities for the Stat Point Sandstone of 3.1×10^{-2} and 1.1×10^{-2} feet per day, respectively.

TABLE 14-2. Groundwater rights in Neico State Leases ML-21568 and ML-21569 Plan, and Adjacent Areas

W.U. Claim No.	Owner	Flow [cfs] Claim/ Allotment	Use	Period of Use	Source	Seep/ Spring No.
93-624	U.S. Forest Serv.	.011(a)	Stockwater	July 6 to Sept 25	Spring	NF
93-1176	U.S. Forest Serv.	.015(a)	Stockwater	July 6 to Sept 25	Spring	SP 1-3
93-1403	U.S. Forest Serv.	.011(a)	Stockwater	July 6 to Sept 25	Spring	SP 2-14
93-1404	U.S. Forest Serv.	.011(a)	Stockwater	July 6 to Sept 25	Spring	SP 2-9
93-1406	U.S. Forest Serv.	.011(a)	Stockwater	July 6 to Sept 25	Spring	SP 2-24
93-1407	U.S. Forest Serv.	.011(a)	Stockwater	July 6 to Sept 25	Spring	SP-47a
93-1408	U.S. Forest Serv.	.011(a)	Stockwater	July 6 to Sept 25	Spring	SP-47
93-1409	U.S. Forest Serv.	.011(a)	Stockwater	July 6 to Sept 25	Spring	SP-58
93-1410	U.S. Forest Serv.	.011(b)	Stockwater	July 1 to Sept 30	Spring	SP 1-29
93-1572	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	NF
93-1573	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-44
93-1574	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	NF
93-1575	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-33

Table 14-2 (cont.). Groundwater rights in Neico State Leases ML-21568 and ML-21569 Plan, and Adjacent Areas

W.U. Claim No.	Owner	Flow [cfs] Claim/ Allotment	Use	Period of Use	Source	Seep/ Spring No.
93-1576	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 2-2
93-1577	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-34
93-1578	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-35
93-1579	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-36
93-1580	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-37a
93-1581	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-37
93-1582	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-38
93-1583	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-43
93-1584	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-39
93-1585	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-40
93-1586	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-40a
93-1587	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-45
93-1588	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-47
93-1589	U.S. Forest Serv.	.011(c)	Stockwater	June 21 to Sept 20	Spring	SP 1-46

Table 14-2 (cont.). Groundwater rights in Neico State Leases ML-21568 and ML-21569 Plan, and Adjacent Areas

W.U. Claim No.	Owner	Flow [cfs] Claim/ Allotment	Use	Period of Use	Source	Seep/ Spring No.
93-1639	U.S. Forest Serv.	.011(d)	Stockwater	June 6 to Sept 30	Spring	NF
93-1640	U.S. Forest Serv.	.011(d)	Stockwater	June 6 to Sept 30	Spring	NF
93-1641	U.S. Forest Serv.	.011(d)	Stockwater	June 6 to Sept 30	Spring	NF
93-1642	U.S. Forest Serv.	.011(d)	Stockwater	June 6 to Sept 30	Spring	SP 2-3
93-1643	U.S. Forest Serv.	.011(d)	Stockwater	June 6 to Sept 30	Spring	SP 2-6
93-1644	U.S. Forest Serv.	.011(d)	Stockwater	June 6 to Sept 30	Spring	SP 2-7

(a) Part of water rights WUC 93-175, -183, -191, -336, -378, -483, -606, -623, -1176, -1403, -1404, -1406, -1407, 1408, and -1409 on Crandall Canyon Allotment
(b) Part of water right WUC 93-198 on Crandall Ridge Allotment
(c) Part of water right WUC 93-1588 on Trail Mountain Allotment
(d) Part of water right WUC 93-1673 on Joes Valley Allotment
NF Not found

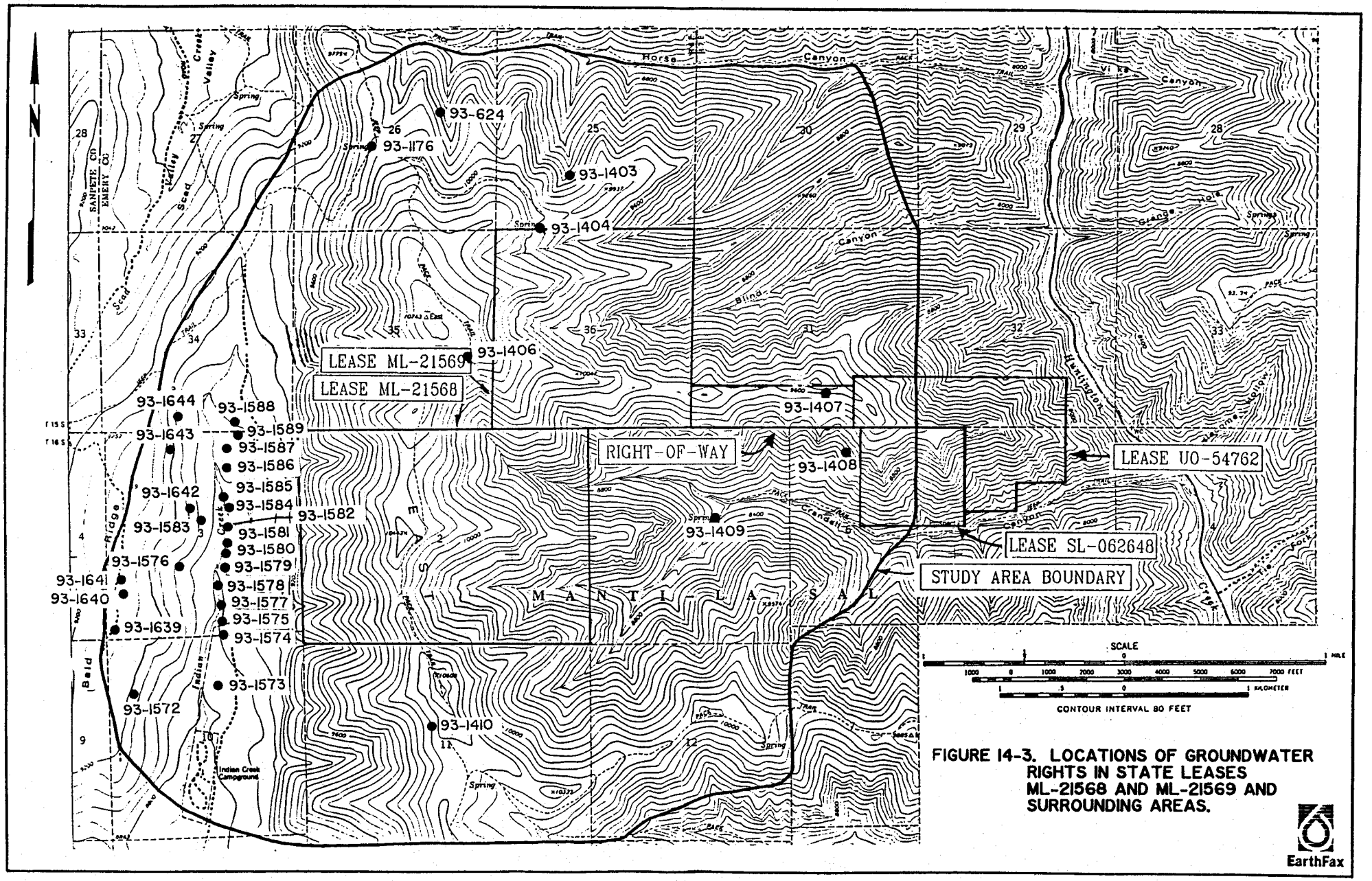


FIGURE 14-3. LOCATIONS OF GROUNDWATER RIGHTS IN STATE LEASES ML-21568 AND ML-21569 AND SURROUNDING AREAS.

EarthFax

A slug test performed in MW-1 in Crandall Canyon (Figure 7-4) revealed a hydraulic conductivity of 0.1 foot per day for the Star Point Sandstone (section 7.1.2.2). This value translates to a transmissivity of 4.5 square feet per day, similar to those reported by Lines (1985) at Trail Mountain.

A map of the potentiometric surface of the Blackhawk-Star Point aquifer in Crandall Canyon appears in Figure 14-4. The horizontal hydraulic gradient is 0.12 foot per foot. This mapped area of the potentiometric surface underlies the steep south-facing slope of Crandall Canyon (compare with Figure 14-3). Hence, this horizontal hydraulic gradient can be regarded as high for the Crandall Canyon area as a whole.

Due to the topographic elevation of the Hiawatha Coal Seam in Leases ML-21568 and ML-21569 the mine workings will be in the saturated portion of the Blackhawk-Star Point aquifer (compare Figures 14-4 and 14-5). As a result, groundwater inflow at the Crandall Canyon Mine is expected.

Estimates of groundwater inflow into the Crandall Canyon mine are based on modeling results of Lines (1985) obtained from study of the identical regional Blackhawk-Star Point aquifer system at Trail Mountain. Lines used a finite-dimensional computer model developed by McDonald and Harbaugh (1984) to obtain order-of-magnitude estimates of potential mine inflow resulting from mine dewatering.

Mine inflow rates in leases ML-21568 and ML-21569 are estimated using Figure 14-6. The graph appearing in Figure 14-6 uses hydraulic conductivities of 0.01 and 0.02 foot per day for the Blackhawk and Star Point Formations, respectively. To evaluate the accuracy of these curves in predicting inflow into the above mentioned leases, the amount of water currently entering the present mine workings in areas below the potentiometric surface of the regional Blackhawk-Star Point aquifer were compared to that predicted in Figure 14-6. The area presently beneath the potentiometric surface is about 3000 feet in length and 1500 feet in width (compare Figures 14-4 and 14-5). The family of curves (Figure 14-6) with a horizontal hydraulic gradient (I) of 0.098 were used, since this hydraulic gradient value agrees closely with that measured at Crandall Canyon (I = 0.12). The predicted inflow of 0.33 cfs (148 gpm) is above the

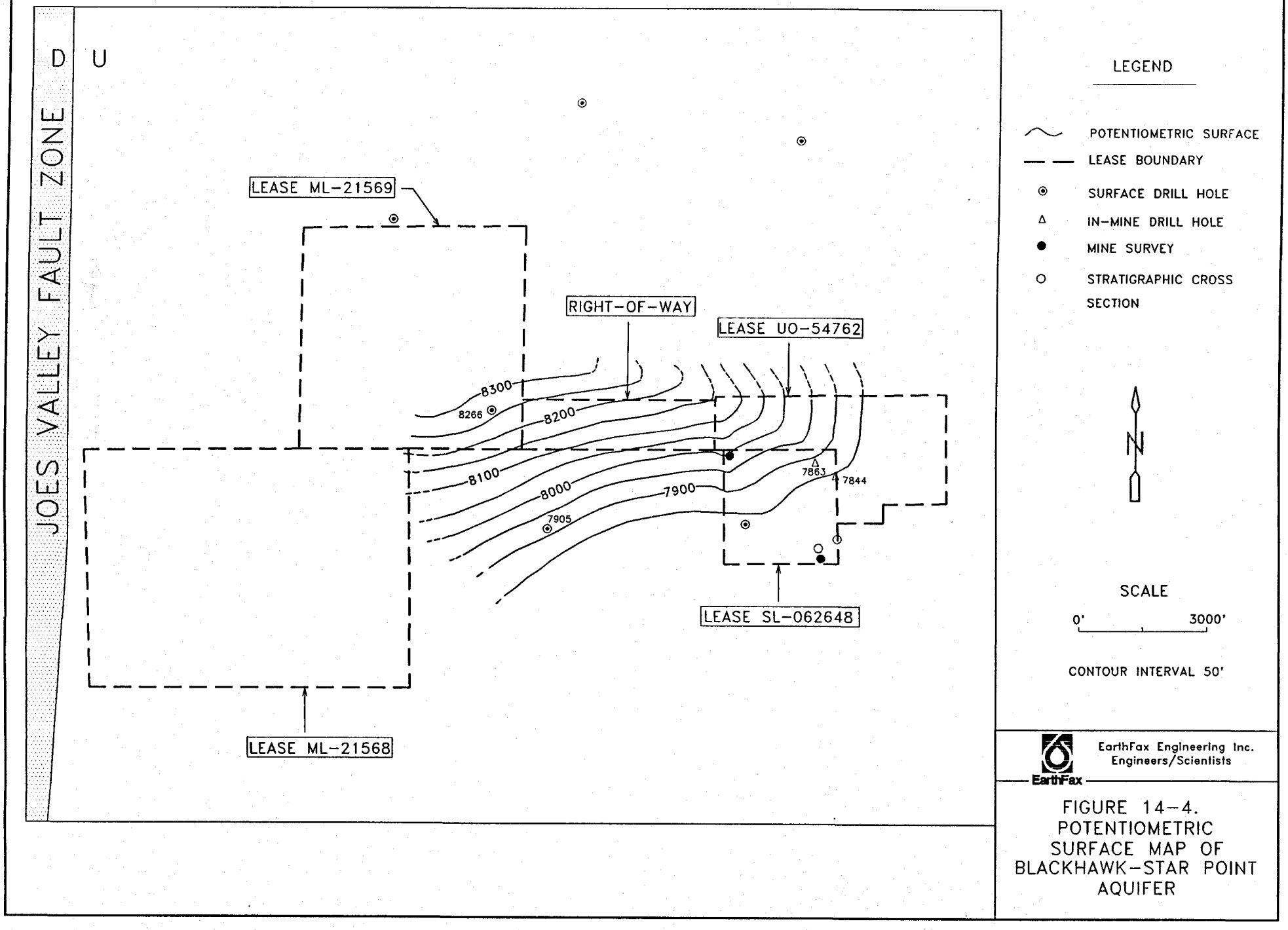


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FIGURE 14-4.
POTENTIOMETRIC SURFACE MAP OF BLACKHAWK-STAR POINT AQUIFER

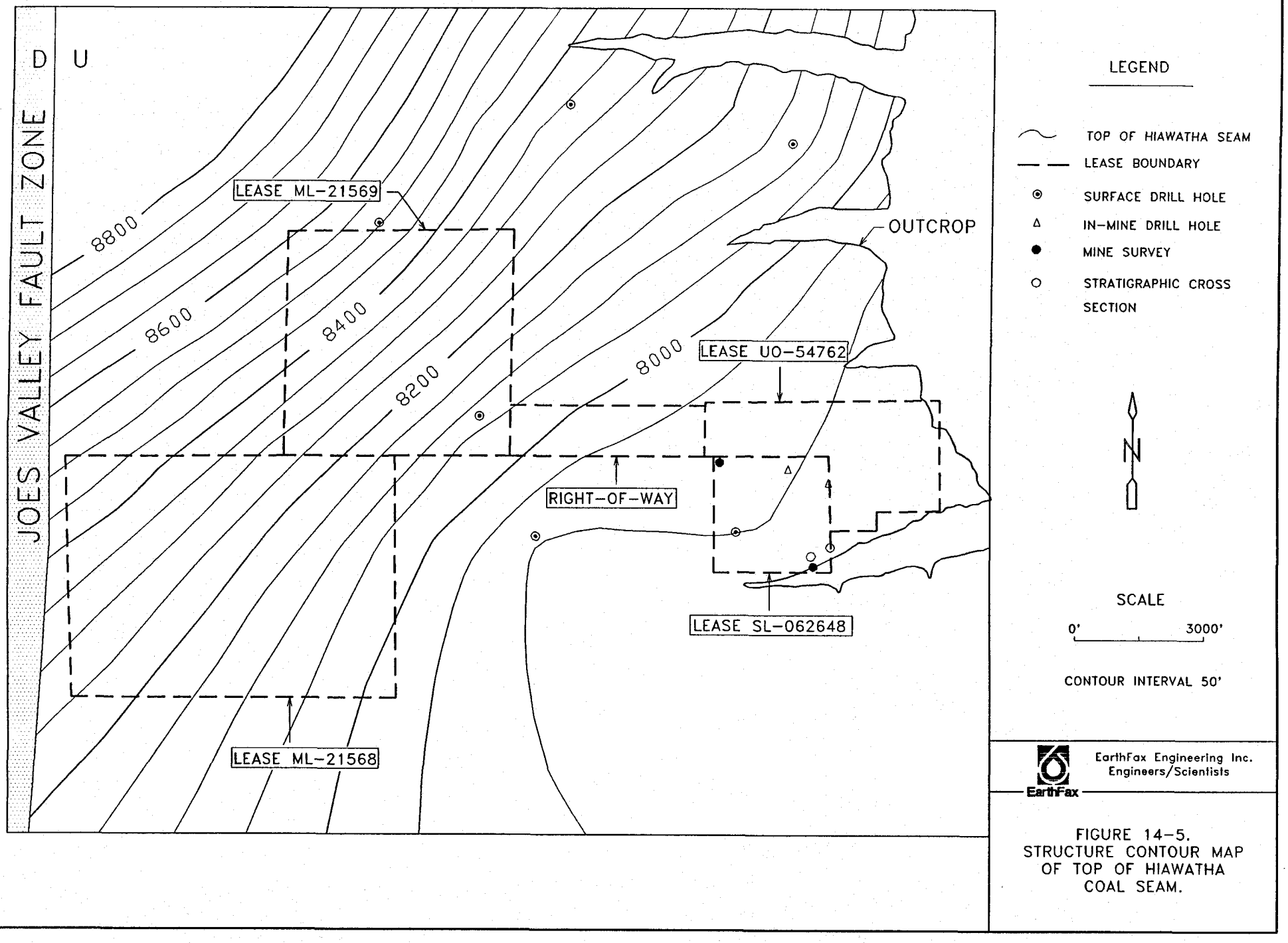

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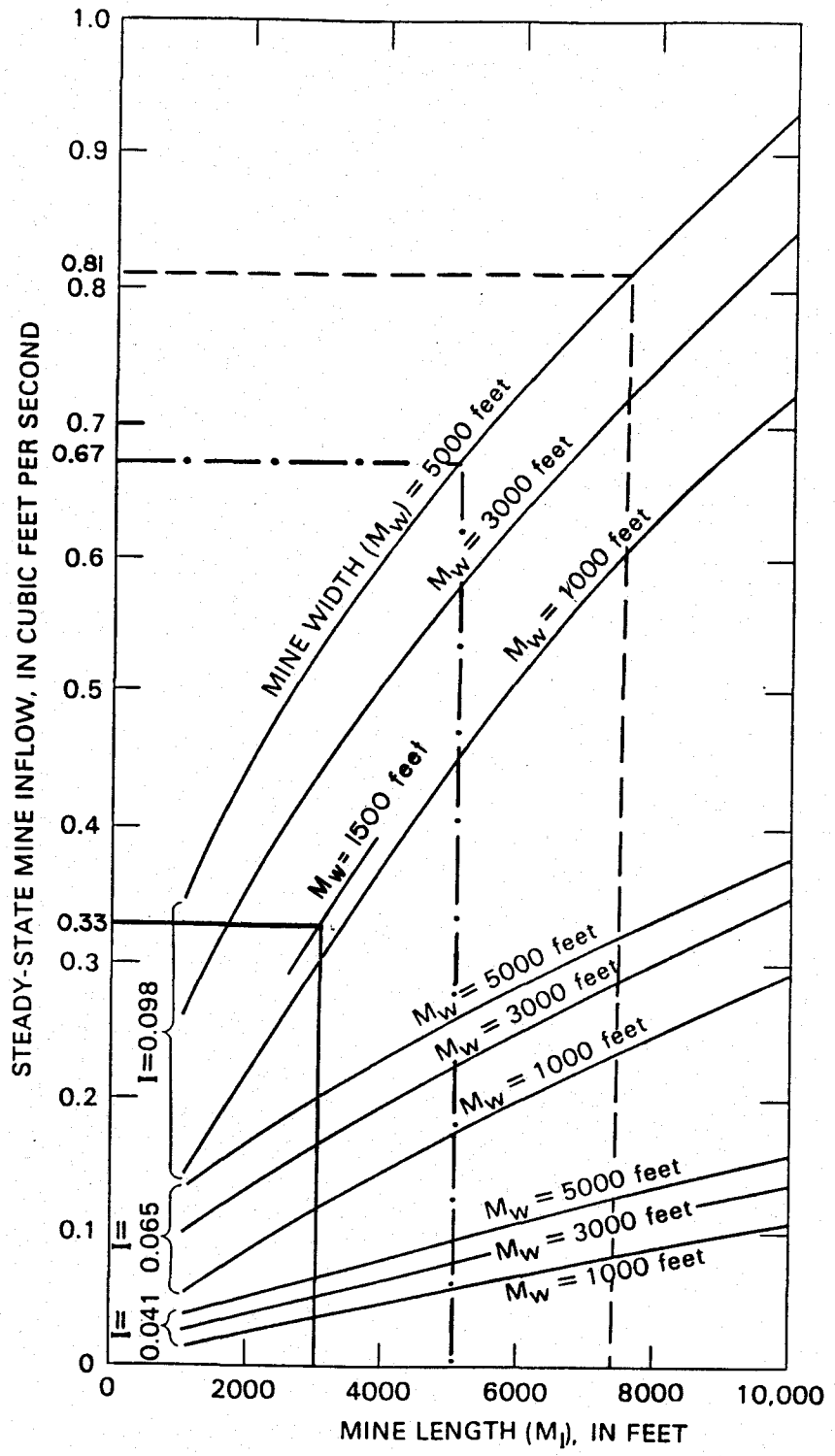
FIGURE 14-5.
STRUCTURE CONTOUR MAP
OF TOP OF HIAWATHA
COAL SEAM.



SOURCE: LINES (1985)

——— PRESENT MINE AREA

— — LEASE ML-21568

—·— LEASE ML-21569

FIGURE 14-6. PROJECTED GROUNDWATER INFLOW INTO THE NEICO STATE LEASES ML-21568 AND ML-21569 PROPOSED MINE WORKINGS.

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present-day observed inflow of 100 gpm. As a result, predictions of mine inflow rates to be experienced in Leases ML-21568 and ML-21569 obtained from Figure 14-6 can be regarded as high limits.

Lease ML-21568 has a total mine width and length of 5400 and 7400 feet, respectively (Plate 14-1). The proposed mine area within lease ML-21569 has a total width of 4880 feet and length of 5160 feet (Plate 14-1). The curve corresponding to a mine width of 5000 feet in Figure 14-6 is used in estimating inflow for both leases. Estimated inflow into Lease ML-21568 is 0.81 cfs (364 gpm); inflow into Lease ML-21569 is estimated to be 0.67 cfs (300 gpm)(Figure 14-6). Since these estimates are for fully-developed mine areas, inflows to be experienced during mining operations are expected to be lower, and progressively increase during development of the mine workings. The emplacement of the majority of the mine inflows are anticipated to be encountered in gob sections near the working face of the mine.

14.5.1.5 Mitigation and Control Plan. Based on information presented in the preceding section, only minimal impacts on groundwater resources in the vicinity of Leases ML-21568 and ML-21569 may result.

Should it be necessary to develop alternate water supplies due to unexpected diminution or interruption of flows as a direct result of mining activities, the applicant will contact the Utah Division of Wildlife Resources and develop plans to install a guzzler on a case-by-case basis.

14.5.1.6 Groundwater Monitoring Plan. Groundwater monitoring for Leases ML-21568 and ML-21569 and the surrounding area will include collection of water quality and quantity data from spring SP 2-24 (water right 93-1406) and SP 2-9 (water right 93-1404)(Figure 14-3). These water sources were chosen since water rights have been filed for these springs with the U.S. Forest Service (Table 14-2), and they fall within the maximum limit of possible subsidence (Section 14.6.2.1). Samples will be preserved and analyzed according to procedures outlined in Section 7.1.6. Appendix 13-6 contains an example of the water sampling field report forms to be used.

Quarterly inventories identifying the location and geologic occurrence of mine inflows that exceed three gallons per minute will be conducted. Specific inflows will be selected for continued monitoring in consultation with the UDOGM. Inflow samples will be collected quarterly (normally in January, April, July, and October) and analyzed according to table 7-4. Samples collected every fifth year during the low-flow period (normally October) will be analyzed according to Table 7-5.

14.5.2 Surface water Hydrology.

14.5.2.1 Methodology and Existing Surface Water Resources.

Detailed discussions of the methodology of investigation, and existing surface water resources are found in Sections 7.2.1 and 7.2.2 respectively.

14.5.2.2 Surface Water Development and Control.

14.5.2.2.1 Water Supply. Table 14-3 contains a listing of surface water rights in the plan area as well as areas adjacent to Leases ML-21568 and ML-21569. This data was obtained from the files of the Utah Division of Water Rights in June 1990. More in-depth data pertaining to these water rights is found in Appendix 14-4. Locations of these surface water rights are denoted in Figure 14-7.

All surface rights are held by the U.S. Forest Service or the State of Utah Division of State Lands and Forestry for stockwatering purposes. However, during the seep and spring surveys (June 1985, October 1985, July 1987, October 1987, October 1989, June 1990) no signs of stock usage of these surface water rights were observed. Although the rights exist, usage is apparently curtailed.

14.5.2.2.2 Runoff- and Sediment-Control Facilities. A detailed discussion of runoff- and sediment-control facilities consisting of: sedimentation pond and dam, primary and emergency spillways (riprap, bed material, and filter blanket), and boulder-covered slope is found in Section 7.2.3.2 (see also Appendices 7-4, 7-5, 7-6, and 7-7).

Table 14-3. Surface water rights in Neico State Leases ML-21568 and ML-21569 plan, and adjacent areas.

W.U. Claim No.	Owner	Claim/ Allotment	Use	Period of Use	Source
93-175	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-181	U.S. Forest Service	(b)	Stockwater	July 1 to Aug 30	Stream
93-183	U.S. Forest Service	(a)	Stockwater	July 6 to Aug 25	Stream
93-184	UT State Lands & Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-190	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream
93-191	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-198	U.S. Forest Service	(e)	Stockwater	July 1 to Sept 30	Stream
93-258	UT State Lands & Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-336	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-377	U.S. Forest Service	(f)	Stockwater	June 1 to Sept 30	Stream
93-383	UT State Lands & Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-483	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream

Table 14-3 (cont.). Surface water rights in Neico State Leases ML-21568 and ML-21569 plan, and adjacent areas.

W.U. Claim No.	Owner	Claim/ Allotment	Use	Period of Use	Source
93-606	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-1180	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream
93-1590	U.S. Forest Service	(g)	Stockwater	June 21 to Sept 20	Stream
93-1673	U.S. Forest Service	(h)	Stockwater	June 6 to Sept 30	Stream

(a) Part of water right WUC 93-1403 on Crandall Canyon Allotment
(b) Part of water right WUC 93-507 on Horse Creek Allotment
(c) Part of water right WUC 93-500
(d) Part of water right WUC 93-116 on Gentry Mountain Allotment
(e) Part of water rights WUC 93-193, -198, -201, -1410, -1411, -1412, -1413, and -1414 on Crandall Canyon Allotment
(f) Part of water right WUC 93-377 on Little Joes Valley Allotment
(g) Part of water right WUC 93-1588 on Trail Mountain Allotment
(h) Part of water rights WUC 93-985, -1632, and -1677 on Joes Valley Allotment

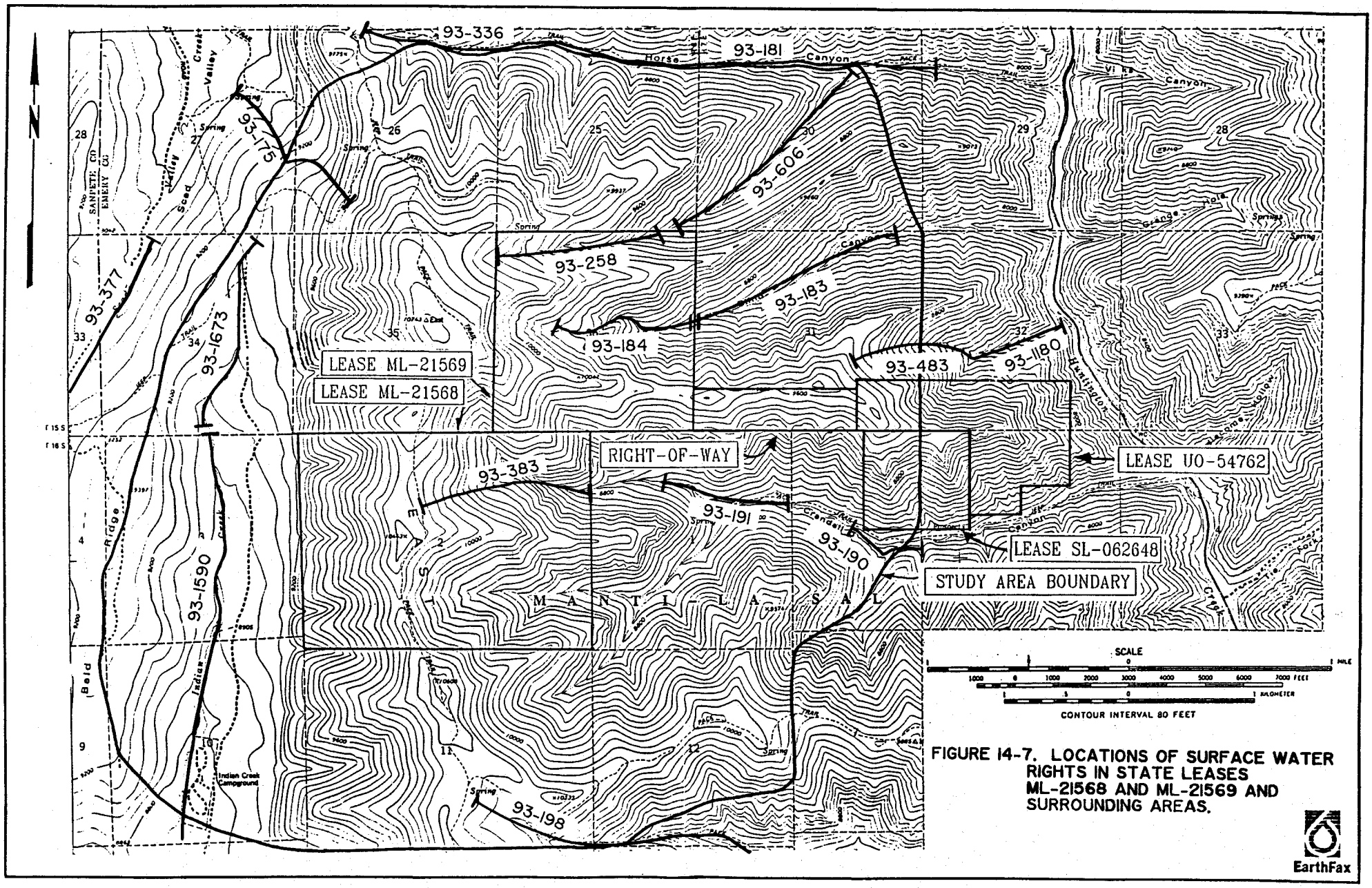

FIGURE 14-7. LOCATIONS OF SURFACE WATER RIGHTS IN STATE LEASES ML-21568 AND ML-21569 AND SURROUNDING AREAS.

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14.5.2.3 **Effects of Mining on Surface Water.** Runoff- and sediment-control facilities discussed in Section 7.2.3.2 were designed to safely and effectively convey and control runoff from the specified storm events. As a result, sediment yields in the permit area will be minimized.

14.5.2.4 **Mitigation and Control Plans.** The forenamed runoff- and sediment control facilities, designed to protect and mitigate potential impacts to the surface hydrologic balance of the area, will be subject to quarterly inspections to ensure continual effective operation. Necessary repairs will be conducted immediately. An example of a typical inspection form to be used is found in Appendix 13-6.

14.5.2.5 **Surface Water Monitoring Plan.** A 12-inch parshall flume has been installed at the mouth of Blind Creek (Appendix 14-5, Figure 14-13) to monitor water-levels. This flume is equipped with a Stevens Type-F water-level recorder to allow collection of continuous stream discharge data. Charts will be changed and the flume inspected monthly. Calculations of return-period/peak-flow estimates appear in Appendix 14-5.

Samples to be analyzed for water quality will be collected quarterly (usually in January, April, July, and October) from the flume site. Samples will be analyzed according to the list contained in Table 7-8. Every fifth year (1990, 1995, etc.) samples will be collected during the low-flow period (usually October) and analyzed according to Table 7-9. Samples will be analyzed for total and dissolved constituents according to the above referenced lists.

Further details of the surface water monitoring plan are discussed in Section 7.2.6.

14.6 Geotechnical

14.6.1 **Underground Mine Design.** An underground mine design has been developed and appears in Plate 14-1. Mined areas within both leases are bordered by 100 foot wide barrier pillars. All entry-ways are 20 feet wide. Pillars are

60 feet wide and 140 feet long, with 80 by 160 foot centers.

Six entries comprising "west mains" have been designed as a westward extension of the right-of-way into lease ML-21569. West mains extend to within 100 feet of the western edge of lease ML-21569. Five entries comprise both a north-south submain named 7th North, and an east-west submain called 5th West. Eight panels, retreat rooms, and barrier protection are accessed via 5th West and 7th North. Pillars within the barrier protection area have 120 by 60 foot centers. Pilar height (thickness of coal seam) ranges from about 5.5 to 10 feet.

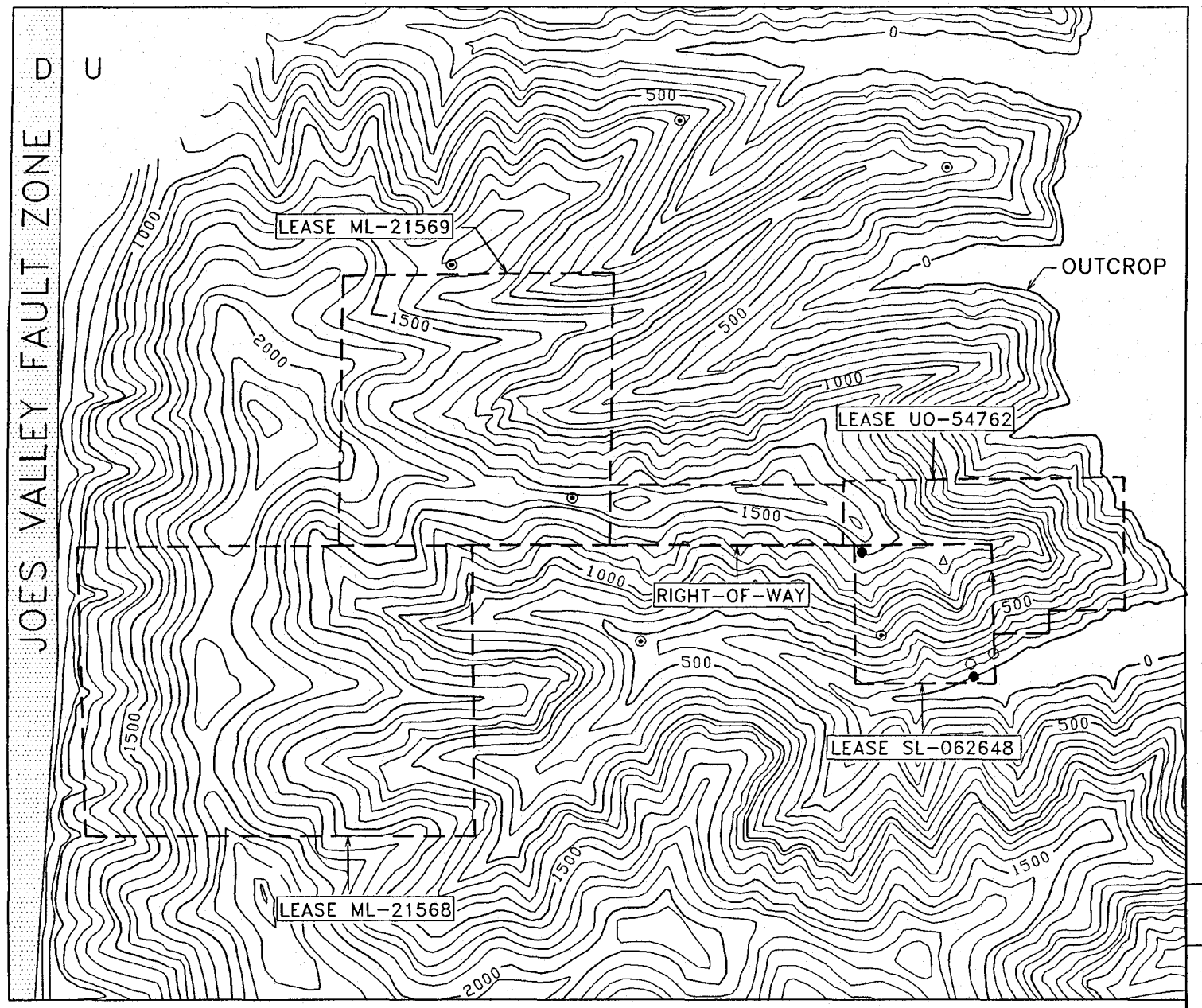
Lease ML-21568 is to be accessed via six entries which extend southward from West Mains along the eastern edge of the lease. Five entries, running east-west, extend to the western edge of lease ML-21568, and access 12 panels.

14.6.1.1 Coal Pillar Design.

An isopach map of the Hiawatha Coal Seam overburden appears in Figure 14-8. Overburden thickness above the area to be mined in Lease ML-21568 range from 750 to 2200 feet. The area to be mined in Lease ML-21569 has overburden thicknesses of 600 to 2100 feet. Hiawatha coal seam thickness (height of coal pillars) appears in Plate 14-1. Due to the paucity of drill hole data, a coal thickness of 10 feet is assumed to be present in Lease ML-21568.

Methods used to evaluate safety factors of the pillar design are discussed in Sections 12.3.1 and 12.3.2, as well as in Appendix 12-1. A minimum acceptable safety factor for main entries and rooms are 1.5 and 1.3, respectively (Appendix 12-1). Calculations of pillar safety factors are found in Appendix 14-6. Pillar safety factors range from 0.92 to 1.77. As the ratio of pillar length to height approaches 12, pillars are regarded as being able to bear any load (Section 12.3.2). The pillar length to height ratio in Lease ML-21568 is 14, and in Lease ML-21569 ranges from 14 to 20, all well above the value of 12; thus the pillars should be able to bear any load.

14.6.1.2 Roof Span Design. Accepted practice in the Wasatch Plateau is to use 20-foot entry and crosscut widths. Previous experience in the Crandall



LEGEND

- OVERBURDEN ISOPACH
- LEASE BOUNDARY
- SURFACE DRILL HOLE
- IN-MINE DRILL HOLE
- MINE SURVEY
- STRATIGRAPHIC CROSS SECTION

SCALE

0' 3000'

CONTOUR INTERVAL 100'

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FIGURE 14-8.
ISOPACH MAP OF
HIAWATHA COAL SEAM
OVERBURDEN.

Canyon and nearby mines have supported this roof span width. Roof span in Leases ML-21568 and ML-21569 is 20 feet in entries and crosscuts. Roof support bolting will consist of 4 foot resin pins with 4 foot centers.

14.6.2 Subsidence Effects of Mining.

14.6.2.1 Projected Subsidence Effects.

In order to delineate the maximum limit of possible subsidence in the vicinity of Leases ML-21568 and ML-21569, a positive limit (draw) angle of 30° from vertical (60° from horizontal) from the lease boundaries was used. A correction for topographic variability was made in order to accurately determine the maximum surface limit of subsidence. The maximum surface limit of possible subsidence is shown in Figure 14-9. A discussion of the methodology used in determining the maximum limit of subsidence is given in Appendix 14-7. Draw angles of 15° or less have been observed in moderately strong overburdens in the Book Cliffs and Summerset mining areas of Utah and Colorado, respectively (section 7.1.4). Because a draw angle of 30° is used, and draw angles are projected from lease boundaries (rather than the mined edge of barrier pillars) the resultant maximum limit of subsidence is a worst-case estimate.

Maximum subsidence magnitudes that may occur appear in Figure 14-9. The method used in calculating subsidence magnitude is discussed in sections 12.4.1 and 12.4.2, pertinent graphs appear in Appendices 12-3 and 12-4. The maximum amount of possible subsidence is only 3.5 feet, and occurs in the central portions of Lease ML-21568. Subsidence values were calculated by reducing coal thicknesses shown in Plate 14-1 by 50% which represents the unrecoverable coal in the pillared areas. These values were multiplied by 70% to obtain the maximum amount, i.e. worse-case scenario, of subsidence possible (Appendix 12-3). The subsidence values were further reduced in areas bordering the barrier pillar along the perimeter of the leases according to Appendix 12-4. A one foot contour interval was used to map the majority of this subsidence data. A 3.5 foot contour was added to delineate that area where the maximum possible amount of subsidence may occur.

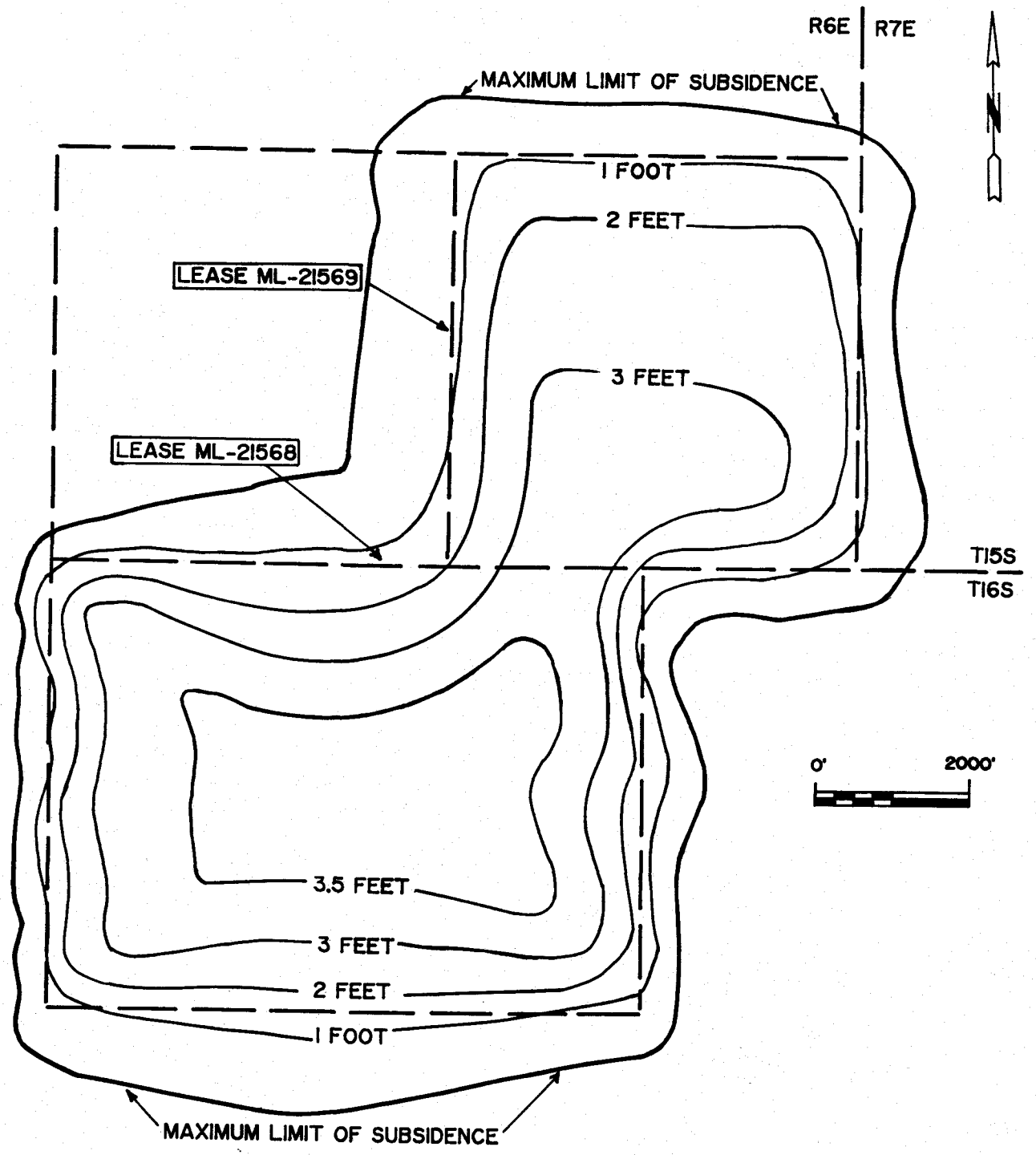

FIGURE 14-9. MAXIMUM SURFACE LIMIT AND MAGNITUDE OF POSSIBLE SUBSIDENCE IN STATE LEASES ML-21568 AND ML-21569 AND SURROUNDING AREA.

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Those seeps and springs that lie within the maximum limit of surface subsidence are delineated on Figure 14-10. Seeps and springs within the subsidence limit emit water from the North Horn and Price River Formations 1000 to 2100 feet (100 to 210 times the coal bed thickness) above the interval to be mined. If repeated subsidence via roof failure occurs, elastic deflation is believed to occur at a distance of nine coal seam thicknesses (90 feet) above the coal (see Section 12.4.2). If any tension cracks do develop, they should be sealed by clay migration occurring during elastic deformation. As a result, these seeps and springs should not be affected by subsidence, however monitoring will be conducted as described in section 14.5.1.6.

14.6.2.2 Subsidence Control and Mitigation Methods.

Examinations of federal, state, and county records, as well as the surface revealed there are no man-made structures, utilities right-of-ways, or public or private resources necessitating protection from subsidence. Material damage or diminution of value or foreseeable use of lands should not occur.

Genwal recognizes that the Division of Wildlife Resources and the Division of Oil, Gas and Mining consider all seeps and springs to be important to wildlife. Should any seeps and springs within the limit of potential subsidence become adversely affected, flow decrease by 50% or more due to mining, Genwal will notify the appropriate agencies and begin developing an acceptable mitigation plan.

In the event subsidence negatively impacts grazing, the operator will compensate the owner or appropriate party by paying the fair market value for the loss experienced. Compensation will be made after the grazing loss is proven to have resulted from surface subsidence.

14.6.2.3 Subsidence Monitoring Plan. An aerial (photogrammetric) subsidence monitoring plan has been designed, and is currently being conducted. This method of monitoring subsidence has been implemented in neighboring mines, and meets UDOGM approval. Baseline flight lines were flown over Sections 31 and 32 of T15S-R7E, Sections 5 and 6 of T16S-R7E, Sections 1 and 2 of T16S-R6E, and

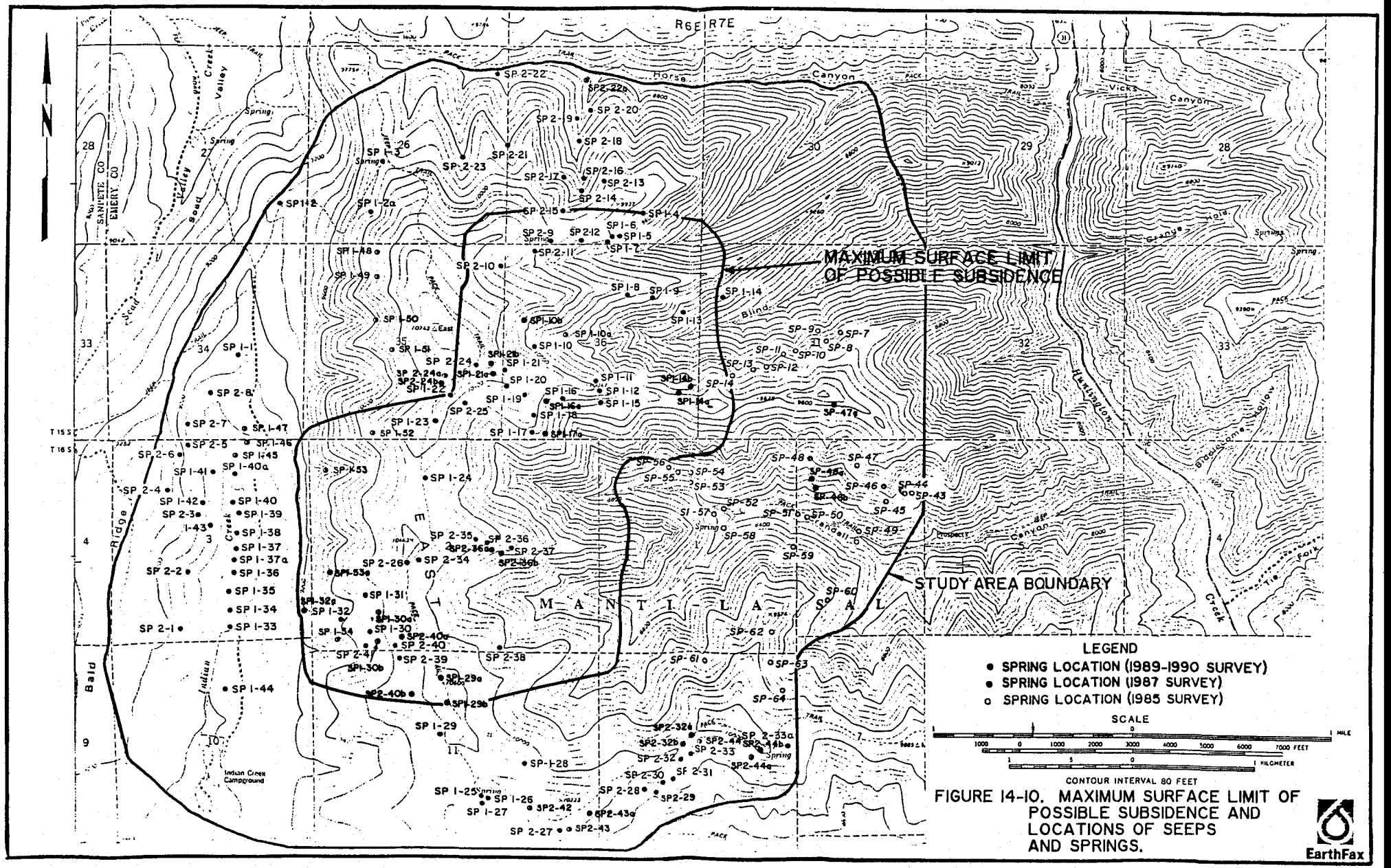

FIGURE 14-10. MAXIMUM SURFACE LIMIT OF POSSIBLE SUBSIDENCE AND LOCATIONS OF SEEPS AND SPRINGS.

Sections 35 and 36 of T15S-R6E in October 1989. Pin locations have been surveyed and a pin map generated. Aerial surveys will be conducted each year Leases ML-21568 and ML-21569 are in operation.

14.7 REFERENCES

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