MINING THE HOLY MOSES VEIN

Selective Cultural Resource Inventory of the Principal Historic Mine Sites on the Holy Moses Vein

Creede Mining District

Mineral County, Colorado

Volume I

Prepared Under Contract Between

Willow Creek Reclamation Committee

and

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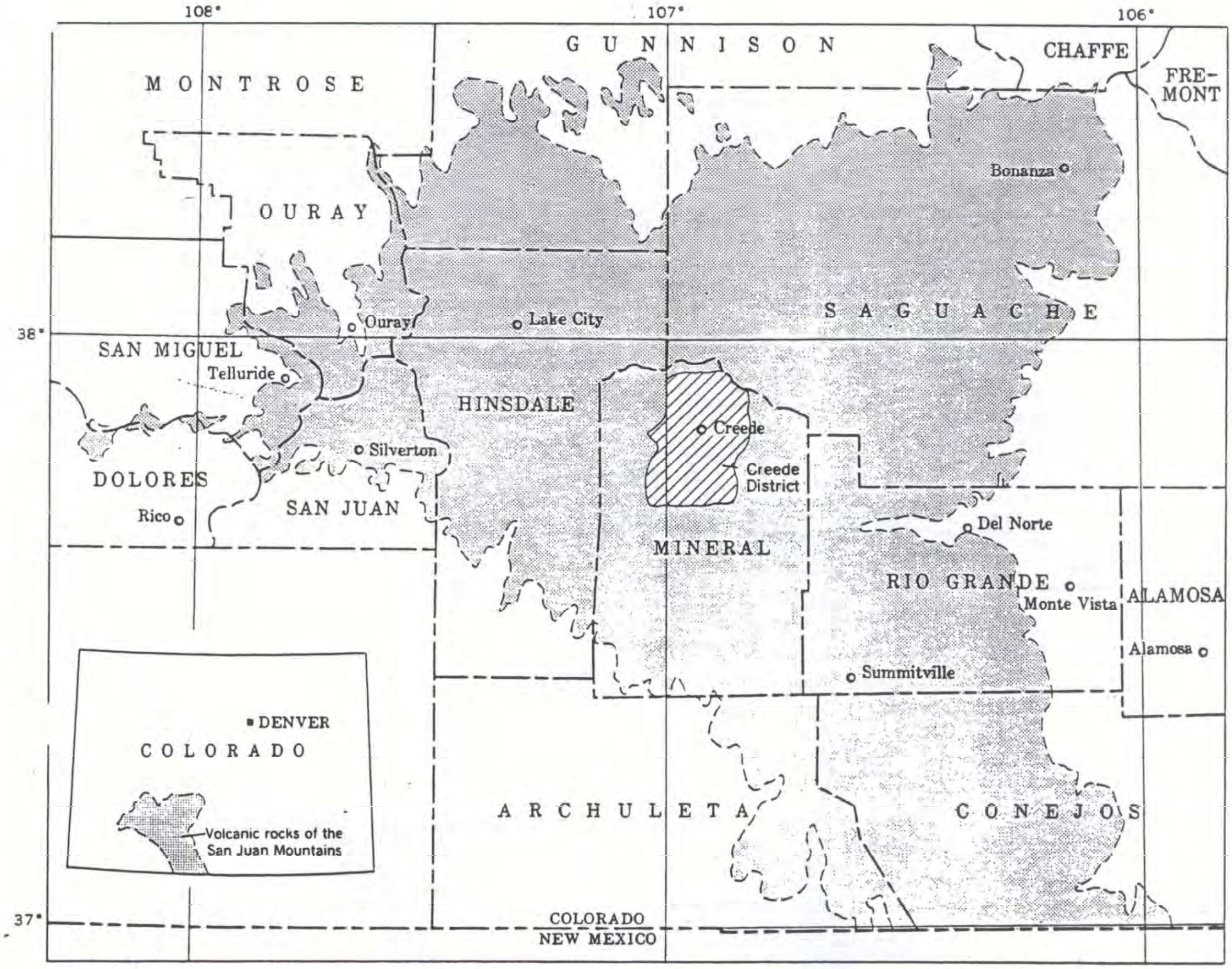
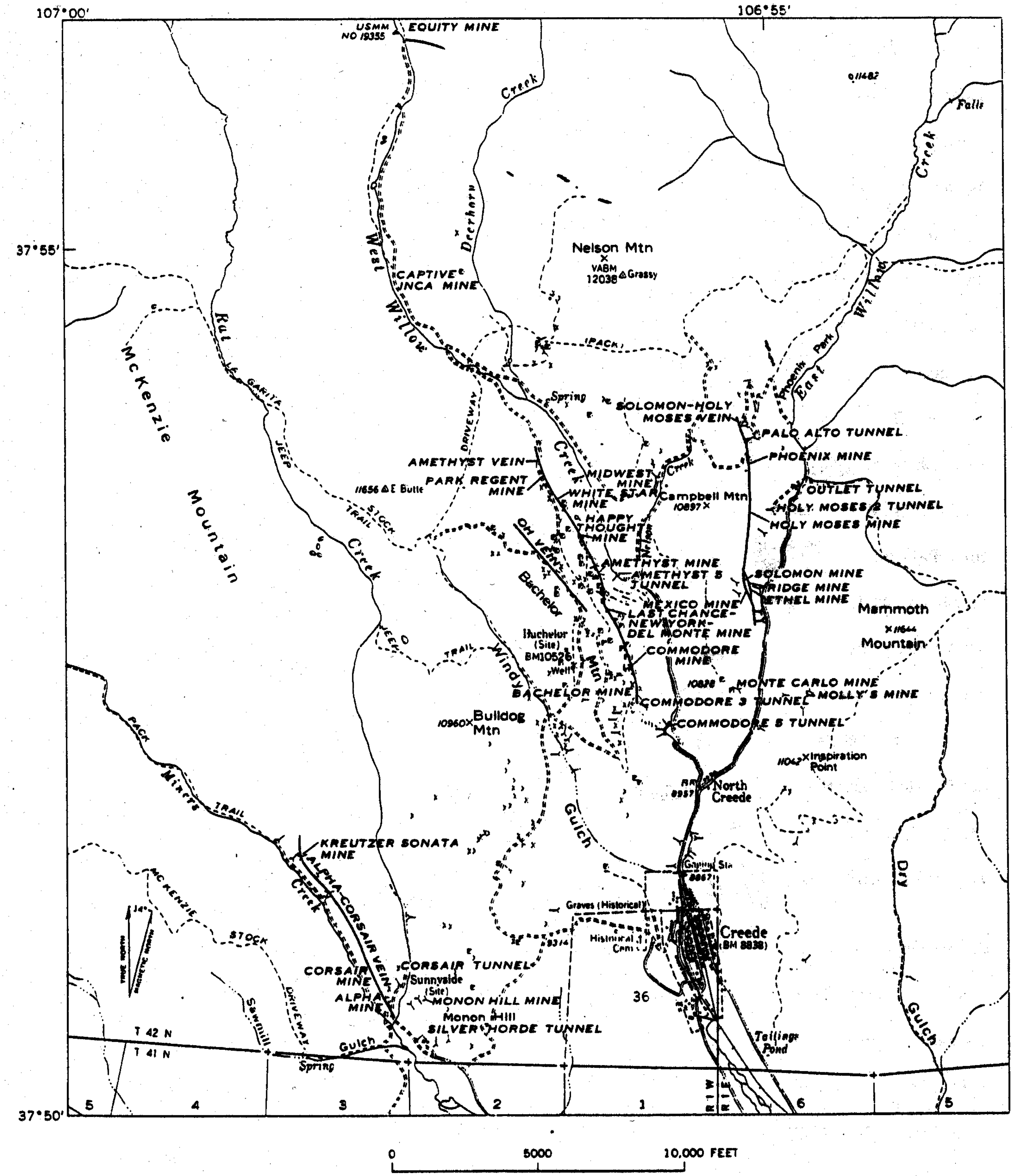


Map of the principal ore veins, mines, and prospects in the Creede Mining District, Mineral County, Colorado. Steven & Ratte, 1965.



Master Legend for Site Plan Views

Plan View Symbols

= Scree

= Timber

= Bedrock

= Drainage

= Fill Bank

= Cut Bank

= Hewn Log

= Log Post

= Timber Post

= Brick Debris

= Mine Rail Line

= Timbers/Boards

= Rock Foundation

= Brick Foundation

= Concrete Foundation

= Shaft Compartment

= Boiler Clinker Dump

= Direction Downslope

= Waste Rock Dump Slope

Architectural Symbols

= Door

= Doorway

= Window

= Timber

ABSTRACT

During the summer of 2000, Mountain States Historical inventoried the principal historic mine sites and select prospect sites on the Holy Moses Vein in the Creede Mining District, Mineral County, Colorado. A total of 4 mine complexes, 3 prospect complexes, and 2 powerhouse sites were recorded in a manner surpassing Class III standards.

Most of the sites included the remains of mine surface plants and associated residential features. Analysis of the material remnants has led to an understanding of mining and associated residential occupation on the Holy Moses Vein.

Nearly all of the recorded sites possess value as cultural resources, and most are recommended as eligible for listing on either the State or National Registers of Historic Places. The recommended sites retain a high degree of historical integrity and possess the ambiance characteristic of Western mining. The large mine complexes also encompass standing structures and intact machinery, and possibly buried archaeological deposits. Management recommendations for the elegible sites include stabilizing standing structures, testing buried deposits, and limiting potential disturbance caused by possible environmental remediation efforts to portions of the sites that have already been disturbed.

CHAPTER 1 INTRODUCTION

Project Overview

In 1999 the Willow Creek Reclamation Committee discussed with Mountain States Historical the need to conduct a voluntary cultural resource inventory of the principal historic mine sites within the Creede Mining District. The Willow Creek Reclamation Committee formed in response to the Environmental Protection Agency's (EPA) concern over potential metals contamination entering into local waterways from the Creede district. The Committee consists of representatives from local government, private landholders, the Department of Fish and Game, the U.S. Forest Service, the EPA, and the Colorado Department of Public Health and the Environment. In an attempt to avoid EPA action, the Committee elected to address the potential environmental problems on its own. The Committee and Mountain States Historical assumed that the Creede district's principal historic mine sites are probable contributors of metals, and may therefore be involved in future environmental remediation.

In the worst case, environmental remediation could involve the wholesale removal of waste rock and tailings associated with the historic mine sites, with the cleanup at Leadville, Colorado serving as an example. On a small scale, such action would destroy the historic integrity of individual mine sites, and when considered in sum, such remediation would damage the Creede Mining District's historic fabric and historic visual landscape. The Creede district encompasses one of the West's most intact sets of historic mine and settlement sites, and the loss of historical integrity would be a permanent detriment to the public, and to the local economy, which relies on tourists drawn by the historic sites. In the best case, water diversion systems may be installed at the mines that contribute metals to control run-on/ run-off. Such systems would minimize the impact of remediation to the sites' historic integrities.

The Willow Creek Committee acted in a proactive fashion and contracted with Mountain States Historical to begin conducting an inventory and significance evaluations of the Creede Mining District's principal historic mine sites. The findings have the potential to influence possible remediation plans. The project is divided into a four year span of time during which the mines on the district's three principal ore bodies were inventoried, followed by an inventory of the settlement sites. During the summer of 1999 the mines and selected prospects on the Amethyst Vein were inventoried, and in 2000 the mines and prospects on the Holy Moses Vein were inventoried. In 2001 the mines and prospects on the Alpha-Corsair Vein and other, minor ore bodies were inventoried. The inventory is a voluntary action and was initiated with an emphasis on preservation, and on favorable but objective evaluation of the target mine sites.

The Willow Creek Committee contracted with Mountain States Historical because the consultant specializes in recording, evaluating, and interpreting historic mine sites. Eric Twitty, principal investigator, conducted all fieldwork, analysis of data, and preparation of the report and historical context.

In association with the inventory, Mountain States Historical developed a historical context for the district which includes the principal factors that influenced mining.[1] The context document serves as historical framework for this and future cultural resource work in the district.

Holy Moses Vein Inventory and Report

In 2000, the principal mine and prospect sites on the Holy Moses Vein and along East Willow Creek were inventoried as archaeological and architectural resources. The project area extended along East Willow Creek from the townsite of North Creede, several miles northeast to the Phoenix Mine. The inventory accounted for the five principle historic mines, three selected prospects, and two powerplant sites. Mountain States Historical selected the sites, with the approval of the Willow Creek Reclamation Committee, based on historical maps, archival research, and on-site inspection. Mountain States Historical defined each *mine* as a set of underground workings attributed to a *single mining operation*, and all directly associated *surface plants*. For example, two of the selected mines, the Holy Moses Mine and the Phoenix Mine, featured two openings each that provided access to a maze of underground workings. The Ridge Mine included five openings. The individual openings were equipped with independently functioning surface plants. Each surface plant remnant was inventoried and analyzed separately, and in terms of belonging to the greater mining operation. A surface plant historically consisted of the collection of facilities that supported work underground at a particular mine opening. For a detailed definition of the function of a surface plant, see Chapter 4 of the historical context. The sites encountered on the Holy Moses Vein and East Willow Creek consisted primarily of archaeological features and associated artifacts, and only several sites included standing structures. The cultural resources not directly associated with the selected mines' surface plants were not included in this study.

The findings of the Holy Moses inventory are presented as this report and as Office of Archaeology and Historic Preservation (OAHP) site and structure forms. As part of this effort, the descriptions for each site were presented as interpretations based on the combination of historic research and material evidence. For a detailed description of only the sites' physical compositions and artifact inventories, the reader should visit Appendix I. Between the site interpretations presented in Chapter 7, the evaluations presented in Chapter 8, and Appendix I, the reader can determine the physical characteristics of each site. The site interpretations discuss the use of material evidence to date periods of activity. Appendix I includes tables of dateable artifacts and pertinent references.

Second, in light of possible threats to the historic sites on the Holy Moses Vein and East Willow Creek, the report presents evaluation recommendations in terms of the National and State Registers of Historic Places. The National and State Registers are lists of important historic sites sanctioned by the National Park Service and the Colorado Office of Archaeology and Historic Preservation. Projects involving public lands or public money, such as environmental remediation, must consider their impacts to sites deemed

[1] Twitty, 1999b.

eligible, and seek consultation with the OAHP. Sites recommended as eligible may meet one or more of the Criteria defined by the National and State Registers of Historic Places, and the findings are discussed in Chapter 8.

Third, the report addresses a series of research questions organized into several themes under the topics of the district's mining and milling industries, and residential occupation. The material in Chapter 9 discusses the findings.

Fourth, the findings of the Holy Moses inventory will serve as an important component of an overarching research strategy intended to gather information for a popular publication on the history of the Creede district. Books discussing Creede's history, from discovery to the end of mining in the 1970s, have not been widely available to the public. The archival and cultural resource findings of the Holy Moses inventory will be combined with determinations wrought from the Creede district's other two extant inventories (the Amethyst Vein, and the Alpha-Corsair and other ore systems), as well as a fourth inventory of historic settlement sites.

Fifth, the body of work from the cumulative sum of inventories will be used in an effort to nominate portions of Creede and its mines as one or more historical districts.

CHAPTER 2 EFFECTIVE ENVIRONMENT

The Creede Mining District covers an area of approximately 47 square miles in Mineral County near the upper Rio Grande River in the eastern San Juan Mountains. The district encompasses much of the Willow Creek drainage system, Miners Creek, and land along the Rio Grande River's north side. The region's topography is predominantly mountainous. Extremely rugged terrain rises along the north side of the Rio Grande River Valley and culminates in a series of 12,000 to 13,000 foot-high peaks, which form the Continental Divide. Both the Divide and the Rio Grande valley extend east-west in the vicinity of the mining district. East and West Willow creeks, their tributaries, and Rat and Miners creeks dissect the mountainous area within the district. East and West Willow creeks join to form Willow Creek, Rat Creek drains into Miners Creek, and they flow south into the Rio Grande.

The terrain within the district is typical of that resultant from volcanic activity. Gently sloped terraces and the summits of table top mountains lie between approximately 10,000 and 11,000 feet, and the topography below is steep and rocky. Further, volcanic rock formations manifest as cliffs and pinnacles in the lower, eroded portions of the East and West Willow creek valleys.

Because the Creede Mining District is located in the eastern San Juan Mountains, it lies within rain shadow, and as a result, the ecological communities adapted to dry conditions. The Rio Grande River Valley features stands of juniper-pinion trees and areas of grassland, while the mountain slopes bounding the valley support subalpine fir and spruce forests. Lodgepole pines and fir trees predominate the dry lower slopes, and spruce trees replace the pines with increase in elevation. In addition, stands of aspen trees thrive on flat areas above 8,500 feet. Some of the groves are natural, while many others grew in logged clear-cuts. Because the soil within the district, ranging from silty to sandy loam, is well-drained, ground-cover in the forests is limited to woody, drought-tolerant species such as mountain juniper, holly, and kinnikinnick. Subalpine meadows thrive in open areas between forests, and arctic willows line most of the area's stream channels.

The climate in the district is typical of that in the drier, deep Rocky Mountains. The summers tend to be warm, however the temperatures during the day rarely exceed 85 degrees Fahrenheit, and the nights cool down to the 40s and 50s. The months of June and September are often dry, while thunderstorms punctuate the afternoons July through August. The Fall also tends to be dry, yet the weather has an element of unpredictability. At the least, the temperatures during both day and night are cooler than those of the summer. Cold snaps, snow, and prolonged warm weather are possible during September through November. Winter usually commences during November and lasts until late April. During wet years, periodic storms can deposit up to several feet of snow at a time and send temperatures plummeting below zero degrees. The San Juans occasionally experience dry years in which little snow accumulates and temperatures rise into the 30s and 40s. Because cold air tends to sink, during the winter the mountain canyons channel streams of frigid air, while the areas on the slopes above tend to be much warmer. The prevailing winds in the area blow from the west, and they may carry in storm systems. In all, the climate in the Creede Mining District is hospitable for much of the year, however winter storms and wet summers presented the early settlers with a formidable challenge.

CHAPTER 3 ECONOMIC GEOLOGY

To gain a full comprehension and appreciation of mining in Creede, a brief account of the district's geological history and fabulous ore bodies is important. The San Juan Mountains began to rise approximately 100 million years ago, during the Cretaceous Period, when powerful forces in the earth's mantle forced the region up out of an ancient sea floor. A body of magma intruded the Earth's crust and the heat and pressure caused the overlying sedimentary rocks to metamorphose, fracture, and dome upward. This intense activity abated and the Ancestral San Juan Mountains were eroded almost totally flat, resorting back to a sea floor. The importance of these geological events lay not in the creation of lasting topography, but in the deposition of the minerals sought by miners during the nineteenth century. As the magma body intruded into the overlying sedimentary formations when the Ancestral San Juans formed, the rock strata became fractured and superheated fluids, mostly water, deposited metal ores in the form of veins and chimneys in the cracks and areas of weakness. These particular ores, located in other portions of the San Juans, were not the bodies worked by Creede's miners, but their impact on Creede was crucial, because they initially drew the prospectors who eventually located Creede's rich deposits. Several million years would pass before the ore systems at Creede formed.[1]

After the Ancestral San Juans were uplifted and eroded back down to their base, the area became the focus of intense volcanic activity which created the mountains that exist today. The first eruptive period deposited thousands of feet of andesitic and conglomerate rock strata that geologists have termed the San Juan Formation. When the volcanic activity abated, natural forces made significant headway eroding the strata. Two more violent eruptive periods subsequently occurred, in which the Silverton Volcanic Group formed, followed by the Potosi Volcanic Group. Andesite tuff comprised the Silverton Group and rhyolite comprised the Potosi Group. The portion of the Potosi Series in our area of study is known as the Creede Formation. After the explosive volcanic activity, the San Juan region subsided, creating expansive fault systems. Further, subsidence of the many caulderas associated with the volcanic activity resulted in localized radial faulting. The Creede area was subjected to both types of faulting, laying the groundwork for the formation of the fabulous ore bodies mined during the nineteenth century.[2]

Even though the volcanic activity largely ceased, the San Juan region was by no means geologically quiet. The area experienced periodic upheavals followed by settling, and superheated fluids began infiltrating the fault systems. In many areas the fluids deposited veins of silicic rocks such as gabbro, diorite, quartz, monzonite, and pegmatite in the fractures. In the Creede area, the fluids deposited silver, lead, zinc, and minor amounts of other metals in some of the fractures. Over thousands of years, great fluctuations in the region's groundwater redeposited the metalliferous materials, enriching the zones near the water table. This factor was the primary reason that Creede's ores were located relatively close to ground surface.[3]

The Creede district became host to four principal vein systems resulting from the millions of years of geological processes. The veins were oriented primarily north-south, and they dipped steeply eastward. The eastern-most vein system, termed the Mammoth

Vein, lay under Mammoth Mountain on the east side of East Willow Creek. Unfortunately for some of Creede's prospectors and mining companies, the Mammoth Vein proved to contain only a paucity of economic ore. The Soloman-Holy Moses Vein, the second principal system, lay underneath Campbell Mountain on the west side of East Willow Creek. The Soloman-Holy Moses proved to one of the district's richest ore bodies, and its discovery by Nicholas Creede and associates in 1889 stimulated greater exploration for Creede's mineral wealth. The Last Chance-Amethyst Vein, the district's third important vein system, proved to be an unequaled bonanza for mining companies. The system consisted of one main vein flanked by minor stringers, and it extended uninterrupted for over two miles along the west side of West Willow Creek. The Amethyst Vein proved to be the district's richest ore system, and it was subjected to mining for almost 100 years. The district's last significant ore system, the Alpha-Corsair Vein, lay along the east side of Miners Creek. The Alpha-Corsair Vein was the first to be discovered in the district and it ranked third in importance.[4]

Miners found the ores in these veins to be quite favorable for extraction and milling. Most of the ores consisted of zinc compounds, galena, pyrites, argentite, native silver, and gold in a matrix of plain and amethyst quartz, chlorite, barite, fluorite, and additional sulphates. This mineral blend filled the voids created by faulting in the hard volcanic country rock. Alteration to the country rock abutting the veins was minimal, and as a result the ore broke away easily and cleanly. In addition, the ores tended to be soft, making drilling and blasting easy, and in some places it was so soft that miners extracted it with pick and shovel. In many places the country rock maintained integrity, resulting in sound hanging walls and footwalls, which were the boundaries of country rock overlying and underneath the pitching veins. Several mines on the Amethyst Vein experienced catastrophic cave-ins, which were probably a result of poor engineering and oversight, rather than inherently unstable geology.[5]

The shallow natures of Creede's vein systems lent themselves well to initial exploration through adits. However, as mining companies developed the ore at depth, they realized that shafts were necessary to profitably extract the payrock. Hence the mine workings in the district tend to include both adits and shafts, and most of the workings on each vein system tend to be interconnected. Engineers joined mine workings for three main reasons. First, it allowed for thorough exploration of consolidated mineral claims. Second, interconnected workings provided access and escape routes in the event of danger. However, the most important factor proved to be ventilation. Like other mining districts in volcanic geology, Creede's miners encountered gases such as nitrous and carbon compounds at depth. The gases displaced breathable air, which impeded the extraction of ore. As a result, mining companies were forced to link workings to stimulate the movement of natural air currents where possible, and to employ ventilation fans where necessary.[6]

The ore systems at Creede presented a curious variety of opportunities and obstacles for mining companies. The Soloman-Holy Moses and the Amethyst veins contained huge quantities of silver-rich compounds valued at up to $80 to $100 per ton. Once mining companies exhausted the shallow ores in the principal veins by the end of the 1910s, mining engineers and geologists pooled their knowledge and searched for additional veins, which they periodically encountered from the 1920s to the 1960s during underground exploration. In addition to new discoveries, mining companies found that Creede's seemingly exhausted principle veins offered low-grade ores left by early operations as unprofitable. By working new and old veins, mining companies in Creede and their workers profited from 1891 until the early 1980s.

End Notes

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CHAPTER 4 THE HISTORY OF THE CREEDE MINING DISTRICT

Silver is Discovered

For centuries the San Juan Mountains were the exclusive domain of the Ute Indians. Rugged, remote, and inhospitable, Spanish, then American explorers examined the piedmont areas surrounding the mighty range, but few ventured deep into the mountains. Rumors circulated that the Spanish mined silver in the mountains as early as the late 1700s, and if so, their impact was limited. Then, in 1865, the Utes saw their isolation and peace begin to erode. A party of prospectors led by Charles Baker penetrated deep into the Animas River drainage in search of placer gold. The party encountered minor amounts of the metal near present-day Silverton, and while they did not locate economic quantities of gold, the prospectors' impact was great. The Baker party reported that the San Juan Mountains held great promise for mining, and they proved that the area could be accessed. During the next 10 years other prospecting parties imitated Baker, and in addition to placer gold, they sought hardrock gold and silver, which the San Juans offered in abundance. Their success in finding riches stimulated mining, which led to the growth of settlements such as Silverton, Ouray, Telluride, Lake City, and Rico. Due to the remoteness of the San Juans, and because of the threat posed by angry Ute Indians, mining developed slowly.

The Utes were not hostile at first. They understood that Whites were interested in minerals and not in extensive settlement, and they permitted prospectors to search the high country unmolested. However, as more Whites arrived in the early 1870s, conflict seemed eminent. When faced with the disaster of another Indian war, the federal government employed the typical strategy in which it coaxed the Indians into signing a treaty. In 1873, Felix Brunot, President of the Board of Indian Commissioners, held negotiations with Chief Ouray, and hammered out the Brunot Treaty. According to the agreement, the U.S. Government paid the Utes $25,000 for 4,000,000 acres of mineral-bearing land, and the Utes retained the right to hunt on the ceded territory. With the treaty in effect and the threat of hostile Indians mitigated, isolation became the main impediment to mining in the San Juans. To facilitate the region's development, Colorado road-builder Otto Mears, freight companies, and mining interests all contributed to the development of a network of roads, some barely passable even after completion, between the many settlements in the mountains.[i]

Ironically, the area that became Creede lay just several miles north of one of the most heavily traveled routes into the deep San Juans. Prospectors, freighters, and other travelers followed the Rio Grande River on their way to Lake City and the Silverton area, unaware of the riches that lay near Wagon Wheel Gap, which served as a way stop. Further, the Denver & Rio Grande Railroad graded a line through South Fork, 20 miles south, increasing traffic along the Rio Grande.

After the Brunot Treaty had been negotiated, parties of prospectors felt less inhibited and they fanned out, searching remote and inaccessible areas of the mountains for ores. In 1876, one group including John C. McKenzie and H.M. Bennett, examined the area that became Creede, which was unsettled at the time. After considerable prospecting they discovered silver ore west of where the city of Creede would stand, and they staked the Alpha claim. The party failed to rouse interest in their find, and, still holding optimism for the area, returned on subsequent prospecting forays. In 1878 McKenzie discovered another ore body and staked the Bachelor claim, named after his marital state. Little did McKenzie suspect, as he erected his claim posts, that he was standing on one of Colorado's richest and longest ore veins. After prolonged failure to stimulate interest and arouse investors, Creede's first successful prospectors sold the Alpha in 1885 to brothers Richard and J.N.H. Irwin. McKenzie optimistically retained title to the Bachelor. After attempting to work the ores in arrastras, and after further futile searches, the various parties gave up.[ii]

In 1889, 13 years after McKenzie and Bennett first drew attention to the area, another party of prospectors encountered bonanza ore. In May, Nicholas C. Creede, E.R. Taylor, and G.L. Smith located the Holy Moses claim on Campbell Mountain, which they named after their exclamation of astonishment and surprise at the strike's richness. Nicholas Creede, for whom the district is named, was no ordinary prospector. Creede was born William Harvey in Fort Wayne, Indiana in 1842. He fell in love with a young woman, and during their courtship she left Harvey for his brother. Harvey may have even married his beloved. Horrified, Harvey left home and changed his name to Nicholas C. Creede. The young Creede arrived in Colorado in 1870, lured by the sirens of mineral wealth. Creede successfully prospected in the Collegiate Mountains, and he had better luck than other hopefuls in the range’s Silver Creek area. There, he sold an ore-bearing claim for a little money, and within a short time the purchasing company began turning a handsome profit. Creede felt that he had been taken, and vowed never to sell low again.[iii]

Creede's demise was tragic. After locating the Holy Moses claim, the party of prospectors interested an investment syndicate including mining and railroad magnate David H. Moffat, U.S. Army Captain L.E. Campbell, and Denver & Rio Grande Railroad general manager Sylvester T. Smith. The business trio not only supplied capital to develop the property, but they hired Creede to serve as their professional prospector. Their decision to retain Creede proved wise, because he subsequently staked the Ethel claim, and in 1891 he located the fabulous Amethyst Mine. Creede sold a share of each of his finds to his employers, but remembering his lesson learned in the Collegiates, he kept a substantial portion for himself. Creede had accomplished what other prospectors only dreamed of. He encountered mineral wealth several times and profited handsomely from each. Within a short time Creede retired in Pueblo, then moved to Los Angeles in 1893 to enjoy the mild, dry, sea-level climate. A storm was brewing for Creede in the East, however. By 1897 Creede's estranged wife, of whom little is known, had learned of her spouse's good fortune, and she made it known that she was planning on coming out West to live with Creede. When Creede learned of his wife's intent, he panicked, and in his despair he took an overdose of morphine.[iv]

The word of Creede's find began spreading through Colorado, and prospectors traveled to the King Soloman district, as the area was then known, in 1890 to examine the potential. Several new-comers and seasoned prospectors made further discoveries, lending to the growing curiosity. Veteran prospectors Dick Irwin and Nick Crude, who served as one of Kit Carson's scouts, encountered silver and lead ore near the old Alpha claim. In 1891 a party of prospectors including Theodor Renniger, Ralph Granger, Julius

Haas, and Eric Von Buddenbock, subsisting on a $25 grubstake, set up camp and began their search for wealth. The party encountered samples of float along the banks of West Willow Creek and followed the lead upslope. Unsure of what they had found, the prospectors asked Creede to examine their strike and pass judgement. Creede immediately recognized the richness of the ore, and urged the prospectors to stake claims, which they did under the name Last Chance. Inspired by the party's find, Creede calculated the orientation of the ore body, traveled a short distance north, and staked the Amethyst claim. The Last Chance and Amethyst mines became the district's wealthiest operations.[v]

Creede and his party of prospectors interested the Moffat syndicate in the Holy Moses in 1891. The district was largely unknown to the mining world at that time, and Moffat probably surmised that he and his associates were presented with a mining investors' dream. Moffat's syndicate had the opportunity to buy a cluster of fabulous mines at low prices, before attention from the mining world drove prices up. The Moffat syndicate's interest in Creede's claims lent legitimacy to the area and served as a crack in the dike retaining the waters of further investment.

Shortly after Creede and Moffat's deal for the Soloman, Renniger and his party acquired investors for the Last Chance. Julius Haas sold his share in the claim to the other three prospectors for $10,000. Renniger and Von Buddenbock sold their shares to investors Jacob Sanders and S.Z. Dixon for $50,000 each. Like Creede, the last of the Renniger party, Ralph Granger, refused to completely sell out, even when offered $100,000. Granger, Dixon, and Sanders interested Willard Ward and silver magnate Henry O. Wolcott in the property, and the men formed the Last Chance Mining Company. The activity in the district had finally drawn the attention of the mining industry. The conservative mining periodical *Engineering & Mining Journal* described the finds as "immense", lending fuel for a rush.[vi]

Reports of the Creede district's wealth began rippling first through Colorado, then through the West, and finally to other parts of the nation in 1891. Mining industry workers, professional miners, roustabouts, and hopefuls ventured to the new area, causing the area's population to soar. Most of the newcomers stopped over in one of several camps near the Rio Grande River, and many continued several miles up to the high country to stake claims. By 1891 prospectors determined that the best ore was concentrated in three vein systems, the Amethyst, Holy Moses, and the Alpha, discussed in the geology section above.

East and West Willow creeks served as the principal gateways to the Holy Moses and Amethyst veins, respectively, and camps naturally sprung up at the creeks' confluence. Prospectors established the camp of Creede on East Willow Creek as early as 1890, a camp named Jimtown grew along the main trunk of Willow Creek approximately one mile downstream, and South Creede sprang up downstream from Jimtown. Crude's Camp, also known as Sunnyside, rose to the west near the Alpha ore system. Each town became a commercial center, attracting merchants, the offices of brand new mining companies, and local government. Tides of miners and prospectors coming from and going to the workings ebbed and flowed through the settlements.[vii]

The Creede district's four main camps were typical of the West's boomtowns spawned by mining rushes. The inhabitants focused on making money, and as a result the development of social and physical infrastructures became a secondary priority. Architecture was also a secondary consideration. At first, the camps consisted of a mix of wall tents, log cabins, and rough frame buildings, all with limited floor space. Yet, businesses such as saloons, hotels, and mercantiles abounded. Like other Western mining settlements, Creede's camps grew in topographically inappropriate places. Except for Sunnyside, the other camps were located in the deep and constricted canyon of Willow Creek, which presented traffic problems and the threat of flooding. By 1891 the population of the camps along Willow Creek soared from several groups of prospectors to approximately 1,000 inhabitants.[viii]

The prospecting and mining activity on the Amethyst and Holy Moses veins was as frenetic as that in the burgeoning settlements below. Prospect operations, in varying stages of development, extended for over two miles along both veins. Prospectors blanketed the ground with claims, which restricted the available surface space for each operation. As a result, prospectors and miners explored their claims at depth predominantly through vertical and inclined shafts, instead of adits. Parties of prospectors using primitive hand windlasses worked in the shadows of advanced, heavily equipped steam operations. All sought bonanza ore.

Great distances and a terrain that can be described as treacherous, at best, separated the settlements along Willow Creek from the workings on the veins above. Miners and prospectors found it most convenient to live at or near their operations, instead of making the twice-daily trek. Not only would a commute by foot or horseback have consumed too much time and energy, but also such travel bordered on impossible in adverse weather, especially during the winter. As a result, several small camps formed. When the search for ore gave way to extraction, mining companies erected boarding houses at their mines for the same reasons.[ix]

Creede's boom peaked in 1892 and 1893. The Denver & Rio Grande Railroad graded a line up the Rio Grande River from its main track at South Fork to the settlement known as South Creede. The D&RG RR later extended the rail line to North Creede. During the boom, trains were bringing up to 300 immigrants per day to the district, and the population of the Willow Creek settlements swelled to 8,000. During this time Jimtown and South Creede merged to form the town of Creede, and the original Creede, located on East Willow Creek, became North Creede.[x]

The dramatic increase in population and economic activity fostered a need for a formal local government. The problem with representation lay in the fact that the Creede district overlay the intersection of Saguache, Hinsdale, and Rio Grande counties. In 1893 Mineral County was carved out of the three counties. Ironically, the town of Creede was not the original county seat. The honor went to the townsite of Wason, located on the Wason Ranch south of Creede. The residents of Creede were outraged, and they thought Martin Van Buren Wason, a powerful local rancher and transportation mogul, pirated the county seat, and after a considerable fight, they moved it to Creede.

Not only did the Creede boom offer possibilities to those seeking mineral wealth and jobs at the mines, but the lawlessness and abundant money presented opportunities for gamblers and criminals. People of mythic proportion, both honest and crooked, called early Creede home. Prize fighter Jack Dempsey started his boxing career while a boy in Creede. Bob Ford and Bat Masterson both operated saloons and gambling houses in town, and Poker Alice practiced her questionable card games in Creede. Gambling shark Bob Fitzsimmons had a statue of a man cast in concrete, and buried it in the mud of Farmers Creek. One of his underlings "discovered" the seemingly petrified man, and Fitzsimmons used it for publicity. But Jefferson Randolph "Soapy" Smith was the most notorious criminal to live in Creede. Smith earned his nickname in Denver by playing a con game in which he inserted a $20 bill under the wrapper of a bar of soap and mixed it in with a bushel of ordinary bars. For a small sum of money, he permitted individuals to select one bar from the bushel in an effort to retrieve the salted bar that Smith had buried. Curiously, few people ever won playing Smith's game. By the early 1890s, Smith became a well-known and clever gambler, and was respected in the underworld. Seeing Creede as an opportunity, Smith established himself there, and became involved in local politics which he tied into his ring of organized crime. He reigned for several years, trying to walk a fine line between Creede's honest citizens and his shady syndicate. Smith appeased both sides by permitting gambling, some of which was crooked, as well as prostitution, while squashing petty crime and overt lawlessness. Smith left Creede in 1893 following the death of his friend, Joe Simmons, and in the face of the economic depression caused by the Silver Crash.[xi]

Silver ore poured out of the district's principal mines by 1892, and the towns along Willow Creek began to exhibit signs of mature industrial communities. In the town centers, the ramshackle architecture of the earliest inhabitants gave way to large, stately frame buildings. Six sawmills, operated by the Creede Lumber Company in surrounding forests, supplied lumber. In 1892 Lute Johnson founded the *Creede Candle*, and the famous Cy Warman established the *Creede Chronicle*. The *Candle* published newspapers until 1930. Creede hosted the district's first school, and the town of Creede was officially incorporated. New comers and some of the district's original prospectors, such as C.F. Nelson, sat on local governmental panels. Destruction visited Creede in 1892, when a significant portion of the town burned, and the area near Willow Creek succumbed to flood waters. Activity in the towns continued unabated, however, until the fateful year of 1893.[xii]

To many residents, the experience of life in early Creede was nothing less than exciting. Above the noise, traffic, bustle, talk of mineral riches, and money, stood optimism and the romance of Western mining. This environment spurred Cy Warman to write the famous poem capturing the essence of early Creede:

CREEDE

Here's a land where all are equal –
of high and lowly birth –
A land where men make millions,
dug from the dreary earth.
Here the meek and mild eyed burro
on mineral mountains feed –
It's day all day, in the day-time
And there is no night in Creede.

The cliffs are solid silver
with wond'rous wealth untold;
And the beds of running rivers
are lined with glittering gold.
While the world is filled with sorrows
and hearts must break and bleed,
It's day all day, in the day-time
And there is no night in Creede.[xiii]

During the early 1890s the mines on the Amethyst Vein also began showing signs of maturation. The large operations drew a growing workforce, and they required an infrastructure for fuel, water, and transportation. The town of Bachelor, named for the Bachelor Mine, sprang up on a grassy area at the vein's south end, and the town of Weaver grew deep in West Willow Creek's canyon near the vein's mid-point. Mine workers and merchants serving the area's mines established Bachelor in 1891, and they platted the townsite in 1892. By 1893 the town hosted 8 stores, 10 saloons, assay offices, boarding houses, and several hotels and restaurants. The town center was small, but the residences and boardinghouses associated with the numerous mines, up to several miles away on the Amethyst Vein, were included, peaking the population at a questionable 6,000. Because the town kept a fire engine on hand, Bachelor's most significant fire claimed only several business buildings.[xiv]

The town of Weaver never attained the size or degree of formality that Bachelor experienced. At its peak, the town consisted of a collection of rough frame and log cabins, and a few wall tents, located at the confluence of two deep canyons. Miners and workers of the Amethyst and Last Chance companies, and teamsters constituted the bulk of Weaver's population. The town hosted a school, which reflects the strong presence of an industrial working population. Bachelor and Weaver both thrived until the disastrous year of 1893.

The Mines

The towns of Creede, North Creede, Bachelor, and Weaver would have remained primitive camps were it not for the rich mines on the Amethyst and Holy Moses veins. Between 1891 and 1893 the Creede district's principal mines included the Bachelor, the Last Chance, the New York, and the Amethyst, all of which penetrated the Amethyst Vein. The Holy Moses, the Soloman, and the Ridge mines, also exceedingly wealthy, lay along the Holy Moses Vein. Of this group, the Amethyst and Last Chance mines stood out as the top producers.

The Moffat syndicate owned the rich Holy Moses and Amethyst mines. When the Moffat syndicate purchased the Holy Moses, it formed a mining company with L.E. Campbell as general manager, and it secured the services of a competent mining engineer who equipped and developed the property. Thirty workers and miners erected a surface plant and drove exploratory drifts and crosscuts to block out ore. To the Moffat syndicate's delight, they encountered 18 inches of native silver and galena ore which assayed at $1,000 per ton. Production began, and miners brought 30 tons of ore to the surface per day. By 1893 the value of the ore had dropped to $100 per ton, which was still a handsome return.[xv]

Senator Thomas Bowen, a San Juan mining magnate, purchased the King Soloman Mine and the Ridge Mine from C.F. Nelson, he organized a mining company, and put these properties into production. Like the Holy Moses Mine, miners began developing the King Soloman, and in 1892 they too struck phenomenally rich ore.

On the Amethyst Vein, the Moffat syndicate formed the Amethyst Mining Company to work Nicholas Creede's spectacular find. During the mine's early operating period, Senator Thomas Bowen and L.D. Roudebush bought into the company. The syndicate hired a capable mining engineer who followed standard convention when he developed the property. The engineer equipped the mine with a sinking plant, which he upgraded once miners blocked out sufficient ore. In 1892 the engineer had mine workers erect a large shaft house enclosing a new steam hoist and an 80 horsepower boiler. By this time miners were producing 35 tons of ore per day, and to accommodate this, and the greater volumes anticipated, the mining company financed the construction of an innovative and efficient ore handling system. Miners input raw ore from the mine into an ore sorting house on the surface. There, workers separated waste and deposited the concentrated ore into several holding bins. An aerial tramway transported the ore from the ore sorting house across 2 miles of the most hostile terrain down to another set of holding bins serviced by the D&RG RR at North Creede. This ore handling system permitted the mine to produce ore in economies of scale.[xvi]

The Wolcott syndicate owned the fabulous Last Chance Mine. Henry O. Wolcott was a lawyer, eventually a senator, a promoter of Colorado business, and a member of Denver's elite. The Wolcott family made its fortune in Colorado silver through rich mines in the central portion of the Rockies, and through Colorado business and finance. Henry's brother, Senator Edward O. Wolcott, heavily influenced Colorado business and politics. The Last Chance Mining & Milling Company secured the services of a competent mining engineer, like the Amethyst operation. The engineer probably installed a sinking plant to facilitate mine development, but once this was complete, he had mine workers painstakingly erect possibly the most extravagant production-class surface plant in the district. To achieve ore production in economies of scale, the engineer equipped the mine with a massive direct-drive double-drum steam hoist, which raised and lowered two hoisting vehicles in a three-compartment shaft. The surface plant also included an air compressor, several return tube boilers, a spacious shop, and a massive ore sorting house. Freight wagons hauled the ore to the rail line in North Creede.[xvii]

The Moffat syndicate, which included Senator Thomas Bowen by 1893, purchased the Bachelor Mine from J.C. McKenzie for $20,000 in late 1891 or early 1892. The Bachelor Mine, which lay south of the Last Chance operation, did not experience production until 1892. Miners began developing the property through a tunnel, which prospectors had driven 350 feet during the previous year or two. Miners expanded the underground workings and erected a relatively simple surface plant. The mine would become a substantial producer at a later time.[xviii]

In 1892 A.E. Reynolds purchased the Commodor Mine from McKenzie, and he acquired the New York Mine. A.E. Reynolds was not as well-known as other Colorado mining moguls, however, he invested heavily in San Juan mines, and his capital made many operations in the region possible. The New York Mine occupied ground upslope from and west of the Last Chance property. In fact, the New York claim overlapped a portion of the Last Chance claim, which led to litigation between Reynolds and the Wolcott syndicate. The mine's owner hired an engineer who erected a modest surface plant to facilitate exploration during 1891, and in March of 1892 miners struck rich ore. Unlike many mining Western mining companies, Reynolds was reluctant to see his profits go to lawyers instead of his own coffers. As a result, he formed a cooperative merger with the Last Chance Mining & Milling Company, and they consolidated their holdings.[xix]

Colorado's silver barons were handsomely rewarded for their investments in Creede's mines. Within a year the mines produced $4,200,000 in silver, 50% of which came out of the Amethyst, and 30% of which came from the Last Chance. And to their delight, production increased during 1893.[xx]

In marked contrast to the Creede district's principal mines, the other operations on the Amethyst and Holy Moses veins remained in a primitive state between 1891 and 1893. Nearly all of the additional operations consisted of deep prospects equipped with conventional temporary or sinking-class surface plants. Most of the mining companies on the Amethyst Vein were either searching for or had just encountered ore in 1892, but had not proven the vein's extent. Most operations of similar magnitude on the Holy Moses Vein would prove to be worthless. Because the topographical relief on the south portion of the Amethyst Vein varied, prospecting outfits were able to explore their claims through adits, which required less capital. The topography overlying the vein's north portion, however, was relatively flat, necessitating that prospect outfits sink shafts to search for ore.

During the early 1890s the prospects at Sunnyside, in the western portion of the district, appeared to hold great promise. The strikes made by John C. McKenzie and H.M. Bennett at the Alpha in 1876 led to a close inspection of the area by prospectors during Creede's early boom, and several claims with showings of ore were developed in 1892. The Kreutzer-Sonata Mine, the Monon Mine, and the Sunnyside were the most significant operations. However, bonanza ore failed to materialize, and the excitement on the Amethyst and Holy Moses veins eclipsed the activity at Sunnyside. Further, the Silver Crash of 1893 snuffed out what little interest existed in the marginal properties. Sunnyside would attract attention again at a later time.

Progressive mining engineering and technology came early to Creede. In 1892 John W. Flintham, manager of the Denver Consolidated Electric Light Company, realized the potential electric market that Creede presented. He organized the Creede Electric Light and Power Company and ordered a construction crew to build a small electrical generating plant along the D&RG RR right-of-way in Creede. The plant consisted of a dynamo turned by a steam engine, which was powered by a return tube boiler, all enclosed in a 24 by 95 foot frame building. Creede's plant was modest and capable of generating only enough power to energize electric light circuits and run some simple mine machinery. Despite its modesty, Creede's plant was important to the mining industry, because it was one of the first generating plants erected in the West. More than 20 years would have to pass before the mines in Creede would see electrification to any great extent.[xxi]

The surface plants erected by prospecting outfits to support work in adits typically consisted of a simple blacksmith shop, a mine rail line, a timber dressing area, and often an associated residence. The surface plants associated with shafts included a hoisting system, which ranged from the hand windlasses erected over shallow shafts, to horse whims, to steam donkey hoists, to stationary sinking-class steam hoists and portable boilers. Most of the district's prospect operations never progressed beyond their sinking-class surface plants for economic and for technological reasons, discussed below.[xxii]

During the Creede district's first boom, the mines and the needs of the work force fostered an enormous demand for food, dynamite, tools, and machinery. By 1892, the district's principal mines began producing ore in economical volumes, which had to be delivered to the D&RG RR railhead in North Creede. Pack trains were far too costly and inefficient to manage the district's freight. The need to move the materials of mining required the establishment of a transportation infrastructure throughout the district capable of accommodating wagons. By the mid-1890s all of the principal mines, most of the substantial prospect operations, and the townsites were accessed via roads. The network was probably created by a combined effort. Workers employed by individual mining companies completed feeder roads, and construction contractors funded by subscriptions contributed by the district's businesses and mining companies graded main thoroughfares.

The roads between the towns on Willow Creek and the mines up on the Amethyst Vein handled an enormous volume of traffic. The grades in West Willow Creek's canyon proved especially treacherous, both during construction and while in use. An old-time resident of Weaver recalled how a construction crew was blasting a road above the town, probably to the Amethyst Mine. During one particular incident, a blast sent a boulder rolling downslope, and it bounded toward town. Just as a sick man rose out of bed for a drink of water in a cabin below, the boulder crashed through the roof and crushed the bed in which he had just been laying. While run-away wagons and other accidents were not uncommon on the steep grades to the mines, the worst road in the district was the "Black Pitch", between Weaver and North Creede. Despite precautions such as wheel locks and strong harnesses, wagons broke loose and plunged into the ravine, occasionally killing teamster and team.[xxiii]

The teamsters who plied Creede's roads were described as being rough and rowdy. Most lived in either Creede or Weaver, and they made approximately two round trips per day between the ore holding bins at North Creede and the mines. Teamsters served all of the mines on both veins, except for the Amethyst and Holy Moses mines, which relied chiefly on their aerial tramways to haul ore.

All of the supplies hauled up to the mines, and all of the ore that flowed down from them had to pass through the town of Creede. Local cattle king Martin Van Buren Wason understood this. In fact, he forecasted the need for a central artery to Creede, and graded a toll road to the promising camp in 1891 in expectation of reaping a handsome profit. The road to Creede was not Wason's first experience with toll roads. Wason was born in New Hampshire and became a sailor at an early age. He weathered the dreaded Cape Horn during several sailing voyages, and he spent much time in Central and South America. While in these remote lands Wason served as a captain on a pearl boat, he became a rancher in Argentina, and mined gold in Central America. Wason returned to the United States via California in 1870, and there he acquired a small herd of fine horses. In 1871 he drove his herd, accompanied by Vaqueros, through parts of the West until he arrived in Colorado. On his way from Poncha Springs to the San Luis Valley, Wason arrived at Otto Mears' toll gate on Poncha Pass. Having insufficient money to pay the necessary toll, he was forced to retreat and sneak around the gate by traveling a wide arc through the surrounding mountains. This included making numerous trips to transport supplies and disassembled wagons. When Wason established a ranch on the Rio Grande, he remembered his dependence on toll roads and graded his own, in hopes of making a profit. Wason's road, used by immigrants and freighters bound for mines in the deep San Juans, extended from Wagon Wheel Gap at the south, past his ranch, and terminated north. He linked the road to Creede with his original trunk line.[xxiv]

Wason's greed led to protracted problems with the mining community. He had workers erect a toll gate on his road and charged wagons 75 cents to pass, which was an exorbitant fee. The citizens, and especially the mining companies, were justifiably outraged, and they considered the road to North Creede to be a public thoroughfare. Their outrage reached uncontainable proportions in 1892, and they hung a dummy of Wason in effigy. Wason, fearful, hired Jesse H. Stringley as a guardian. Stringley carried a six-gun and a badge, but the gunfighter was arrested on the grounds of impersonating an officer of the law, and defrocked. Sentiment against Wason continued to be strong, and he was unprepared when the powerful mining interests brought their political and economic might against him. As the mining interests went, so went Creede. F.M. Osgood, M.J. Connolly, Mike Regan, and L.C. Lowe appealed to the Hinsdale County Commissioners to force Wason to turn the road over to public domain. The commissioners, upon investigation, discovered that Wason's underlings had levied tolls against all wagons, and not merely those laden with ore, as his contract with the county had specified. Wason's toll officers were arrested, and in their absence, under the cover of night, some of Creede's men, probably teamsters, dismantled and removed the toll gate. It vanished without a trace. Creede's war against Wason was won, but not entirely over. When Creede attempted to remove the new Mineral County Seat from Wason's under-populated townsite, Wason retaliated by threatening to resurrect the toll gates. The officers of the big mines took political and economic aim at Wason, and he backed down. The war ended when Colorado's governor purchased the road in 1899 for $10,000.[xxv].

Mining at Creede Collapses

The excitement, the search for wealth, and the conversion of the wilderness into an industrial landscape was just beginning to reach a crescendo when the Silver Panic of 1893 struck. Ever since hardrock mining began in the West, the price of silver fluctuated in response to natural market forces and the implementations and revocations of federal price supports. Western senators, such as Creede's Henry and Edward Wolcott, and Thomas Bowen, were instrumental in instituting price support programs. The Bland-Allison Act of 1878 mandated that the Federal Government purchase silver at a guaranteed price, which caused the value of the semi-precious metal to rise to $1.15 per ounce. In direct result, mining in the San Juans intensified. A decrease in the price of silver in 1886 severely hurt mining. In 1890 the Western senators again pushed for price supports and passed the Sherman Silver Purchase Act, which boosted the price of the white metal to $1.05 per ounce. The artificially high price affected Creede, because silver barons such as David H. Moffat, Senator Thomas Bowen, the Wolcotts, and A.E. Reynolds began campaigns to acquire and develop the mines.[xxvi]

The silver tide ebbed in the West in 1893 when reformists repealed the Silver Purchase Act. The price of silver plummeted from around $1.00 to 60 cents. Mining in Colorado, New Mexico, Nevada, and Idaho completely collapsed. The ripple affect caused a panic that overcame at first the West, then other parts of the nation, resulting in an economic depression. Western silver towns, including Creede, were devastated, and Colorado's silver miners faced the challenge of having to seek alternative modes of employment. Lucky for them, Cripple Creek, which was a gold-producing district, was under development and in need of skilled miners. The silver barons lost fortunes, and the less affluent mining investors lost all.[xxvii]

Twilight overcame the Creede Mining District. By the end of 1893 a significant portion of the district's population migrated elsewhere, and only the Amethyst, Last Chance, and Ridge mines continued to operate, albeit at low levels. All of the district's other mines and prospects were either totally abandoned or idle. The towns of Bachelor and Weaver, directly dependent on the Amethyst Vein's mines, lost nearly all of their residents and businesses. Creede and North Creede also lost much of their residents, and the D&RG RR dramatically curtailed rail service. However, Creede possessed two factors unique to other silver mining districts also in economic duress. First, the Amethyst and Holy Moses veins contained amazingly rich ore capable of providing income even at silver's abysmally low prices. Second, the mines' owners were adamant about profiting from their investments. The key to success, they determined, was to produce ore in unprecedented volumes. They employed technology and engineering to achieve production in economies of scale, drastically reducing the cost of mining.

By March of 1894 the Creede Mining District began a slight recovery. Several mines in addition to the Amethyst and Last Chance properties resumed operations, employing a total of 500 mineworkers. During 1894 and 1895 optimistic investors resumed exploration and development of several properties on the Amethyst Vein, which would ultimately net them profits. The Del Monte Mining Company began to deepen its shaft and explore its claim, which lay southeast from the Last Chance Mine. David Moffat, W.B. Felker, Byron E. Shear, and W.H. Byrant used the hard times experienced by investors during the economic depression, and they purchased the Happy Thought Mine, north of the Amethyst Mine, and in 1894 they financed a resumption of shaft sinking on the property. Last, O.H. Poole funded the installation of a sinking class plant and the erection of a 10 stamp mill at the Park Regent Mine, located at the north end of the Amethyst Vein. Most of the miners working at these operations lived in boarding and bunkhouses on-site.[xxviii]

As the national and state economies recovered in the several years following the Silver Crash, mining in Creede resumed. All of the principal mines reactivated, and work resumed at some of the developed prospect operations. The principal producing mines on the Amethyst Vein at this time included, from south to north, the Bachelor, the Commodor, the Del Monte, the New York, the Last Chance, the Amethyst, the Happy

Thought, the White Star, and the Park Regent. The principal active mines on the Holy Moses Vein included the Soloman, the Ridge, the Outlet, and the Phoenix. In all, the number of principal mines active after the Silver Crash increased.

Engineers Come to the Rescue

Mining engineering played a key role in the resumption of profitable mining at Creede in the late 1890s. On an individual scale, the district's mining companies improved their surface plants to facilitate the production of greater volumes of ore at a lower cost per ton. The Amethyst Mining Company installed a larger hoist and set of boilers, which permitted rapid hoisting speeds from greater depths. The Bachelor Mining Company hired a crew of miners to develop its vein through a series of tunnels, permitting the extraction of ore simultaneously through several levels. To efficiently move the great tonnages of pay rock to the railhead at North Creede, Bachelor engineers erected an aerial tramway similar to those that operated at the Holy Moses and Amethyst mines. The Happy Thought Mine installed a bigger hoist like the Amethyst. Many of the large mines which did not have air compressors to power mechanical rockdrills installed the machines to expedite the drilling and blasting process underground.[xxix]

Another engineering tactic that some of Creede's large mining companies exercised involved milling the ore locally. In the late 1890s and early 1900s the Soloman, the Ridge, the Happy Thought, and the Amethyst mining operations erected small ore reduction mills near their mines. The idea was not to produce refined silver bullion, but to reduce and concentrate the metals content, and ship the concentrates to a smelter. Prior to the erection of these mills, Creede's mining companies exported all of its raw ore to smelters at Pueblo and Denver, Colorado, to Joplin, Missouri, and probably to Omaha, Nebraska. The smelters crushed and concentrated the raw ore, then extracted and separated the metals. To turn a profit, the smelting companies levied a per-ton charge for processing. By concentrating the ores on-site, Creede's mining companies not only saved a portion of the smelters' processing fee, but they saved shipping costs, because the heavy, worthless waste rock was removed.[xxx]

O.H. Poole erected the first concentration facility at Creede when he installed a 10 stamp mill at the Park Regent Mine in 1895. Poole's mill, however, was a failure. Poole relied on two batteries of stamps to pulverize the ore, and another mechanical process to concentrate the slimes. The machinery that Poole selected was inappropriate for Creede's silver and lead ore. The mining engineers working for the district's large mining companies had theoretical and practical experience with milling silver ores, and they designed effective facilities. The standard treatment for Creede's ores began with reduction by a primary jaw crusher. Cornish rolls, which were pairs of heavy iron drums, and ball mills pulverized the rock fragments. The rock may have passed through up to three sets of rolls or ball mills, each designed to further reduce the crushed rock. The fines produced by the rolls were sent to concentration tables, which used gravity to separate waste from metal-bearing materials. The tables consisted of iron frames bolted onto the mill floor, and table tops designed to vibrate. The table tops lay at a slight pitch and featured riffles, and as they rapidly vibrated the light waste floated upward and the heavy metal-bearing fines worked their way downward. Creede's mills may have included a series of such tables to further refine the concentrates produced by previous tables in the circuit. The mills' end product consisted of shipping-quality concentrates.

The mills erected by Creede's big producers followed the technological convention of the day, and their sizes and assemblages of equipment were relative to the mining company's volume of production and capital. The Amethyst Mill included several circuits for processing ore, while the Happy Thought Mill consisted of one circuit. Modern electric motors powered the Happy Thought Mill, and electric motors backed up by a steam engine powered the Amethyst Mill. The mills' engineers used common means to transfer power from the motors to the mill machinery. The motors and steam engines turned overhead drive shafts mounted in the buildings' rafters, via canvas belts. Additional belts extended from the drive shafts to the mill machinery. The engineers also followed convention when they designed the mills to rely on gravity to transfer the materials from one step in the concentrating process to the next. To achieve this desired gravity flow, all of the mills were built on terraced hillsides.[xxxi]

In 1901 the Moffat interests added the Humphreys Mill to Creede's roster of concentration facilities. The Humphreys Mill was by far the district's largest, and it represented another attempt to save money by concentrating ore locally. Engineers applied state-of-the-art technology when they designed the mill and selected the appliances. Like traditional mills, the Humphreys facility used gravity to move the rock between stages of reduction, and it included several independent circuits for concentrating ore. The mill, located on the west bank of West Willow Creek at North Creede, began operating in 1902 and it treated ore hauled out of the Nelson Tunnel. While construction workers were completing the mill, D&RG RR track gangs graded a spur line to the mill's base so that finished concentrates could be shipped by train. Engineers erected a hydroelectric plant by the mill to supply power for drive motors. However, they miscalculated the degree to which West Willow Creek's flow fluctuated, and to their chagrin, the creek slowed to a trickle in the winter of 1903. In response, the engineers installed a backup steam plant to see the mill through future winters. The Humphreys Mill operated for well over 10 years, returning the initial investment plus profits to the mill's financiers.[xxxii]

In addition to improvements made to individual mines and the installation of ore reduction mills, the mining interests of Creede applied engineering on a broad scale to boost the volume of production and lower the costs of mining. The mines on the Amethyst Vein faced the problems of a high water table, poor ventilation, and an increase in operating costs with depth. In 1892, when the district was enjoying its first boom, Charles F. Nelson, who discovered the Soloman Mine, organized the Nelson Tunnel Company with the intent of remediating these problems for at least some of the mines. Nelson served as the company's director, A.W. Brounell acted as president, and J.S. Wallace was treasurer. Nelson held visions of using the tunnel as a prospect bore to search for deep ore, of using the tunnel as both a drain and enormous ventilation duct for the mines, and as a haulage way for ore trains. Nelson also promoted the minor benefits of his proposed tunnel, such as serving as an escape route in instances of fire, and acting as a platform from which mining companies could develop deep ore. Nelson proposed establishing a portal and surface plant on West Willow Creek below the Bachelor Mine, and driving the tunnel along the Amethyst Vein. David Moffat's and Henry Wolcott's mines were at once interested. The cost of the project would, of course, be enormous. Nelson expected to cover the costs by charging subscription fees, and levying a toll per ton of ore hauled through the tunnel.[xxxiii]

The Bachelor Mine possessed the first workings that the Nelson Tunnel would encounter, and so Moffat's Bachelor Mining Company naturally was the first operation to subscribe. Nelson had mine workers erect a surface plant consisting of a well-equipped shop, an air compressor that powered mechanical rockdrills, and a generator driven by a Pelton water wheel, on waste rock 400 feet east of the tunnel portal. Miners managed to drill and blast 1,500 feet before the Silver Crash of 1893 brought the project to a halt. This distance brought the tunnel within the Bachelor ground, where tunnel workers encountered ore. Work on the tunnel resumed after the economic depression, and when the tunnel reached 2,100 feet in length, Nelson's contact was fulfilled.

The rate of progress and the discovery of ore were crucial to the success of Nelson's tunnel concept. The Last Chance, New York, and Amethyst mines offered subscriptions when the Wooster Tunnel Company formed around 1897. The Wooster company leased a right of way through the Nelson Tunnel, and contracted to drive a drift from the extant tunnel north to the Last Chance, New York, and the Amethyst properties. Using four heavy piston drills, miners advanced the tunnel six feet per shift, and in 1899 they first reached the Last Chance workings, then the Amethyst workings.

Even though the Wooster Tunnel reached the vicinity of the Amethyst and Last Chance properties, the company required time to make the final connections. Because water was very costly to pump from deep workings, the Amethyst and Last Chance mines allowed their lower passages to flood. This presented the Wooster engineers with a problem. To avoid a life-taking inundation in the tunnel upon breakthrough, the water in the deep workings had to be drained. An engineer had the bright idea of using diamond drills, which were in the developmental stage in the late 1890s, to bore long-holes into the sumps of the Last Chance and the Amethyst shafts. In 1900 trained drillers from the Sullivan Drill Company arrived and began boring holes toward the Last Chance Shaft. In the process, they struck a subterranean body of water pressurized to such a degree that a jet of water forced the drill away from the tunnel face. Much to the disappointment of the engineer in charge, Mr. Rowley, the hole penetrating the Last Chance Shaft failed to yield the volume of water that he anticipated. After inquiry at the Last Chance Mine, he discovered that a great quantity of silt and mud had accumulated in the shaft's sump, forming a barrier. To free the mass, Rowley packed an iron tube with 50 pounds of dynamite and used drill-steels to push it through the long-hole into the Last Chance Shaft. After the charge detonated, a tremendous volume of water jetted through the hole. Once the Last Chance shaft was drained, the process was repeated for the Amethyst Shaft.[xxxiv]

Impressed with the success of the Nelson and Wooster tunnels, the mines farther north along the Amethyst Vein subscribed to another tunnel designed to undercut their workings. In 1900 the Humphreys Tunnel commenced from the end of the Wooster Tunnel. The financing and logistical arrangements for the Humphreys Tunnel were similar to those of the Wooster company. Miners drilled and blasted the passage around the clock for two years, and by 1902 the Humphreys Tunnel reached the Park Regent Mine, which was the northern-most operation on the Amethyst Vein. The aggregate length of the three tunnels totaled 11,000 feet, and all major operations except for the Commodor Mine enjoyed decreased pumping and transportation costs, improved ventilation, and the discovery of new ore. Mining companies found that the savings achieved through the tunnel system offset the cost of the subscription and the $1.00 per ton of ore passing out the mouth of the tunnel.[xxxv]

When construction workers erected the Humphreys Mill, they graded a mine rail line to the Nelson Tunnel's surface plant, and they built a flume alongside the track which supplied part of the mill's water needs. The tunnel served as part of a large system in which ore was mined and sent directly to be milled at North Creede, on the banks of West Willow Creek.

The owners of the Commodor Mine thought that the Nelson Tunnel Company's subscription rates and toll per ton of ore were too costly, and they elected to drive their own haulage way in the late 1890s. The Commodor Mining Company hired an engineer who selected the site for a surface plant and a tunnel portal on the Manhattan claim, only several hundred feet up West Willow Creek from the Nelson Tunnel. However, the Bachelor Mine lay between the proposed tunnel site and the Commodor claim, presenting the problem of trespass. Other locations for the proposed tunnel were out of the question, due to restricted nature of West Willow Creek's canyon. The Commodor Mining Company negotiated with the Bachelor's owners and secured the right to drive the tunnel through their ground, probably for a royalty.

The Commodor interests hired a mining engineer who put a crew to work erecting a surface plant and a crew of miners to work drilling and blasting the tunnel. The surface plant consisted of a shop, an air compressor, and a return tube boiler. By 1900 miners had driven the Manhattan Tunnel, later known as the Commodor No.5, 4,000 feet to the Commodor claim, where they blocked out ore with raises and drifts. After the tunnel was complete, it served as the Commodor's principal haulage way, and the upper tunnel was abandoned, except as an entry to the upper workings.[xxxvi]

The Bachelor and Commodor companies were on good terms, which facilitated the Commodor's right of access through the Bachelor's ground. In 1900 the two companies became even closer when the Moffat Syndicate purchased a controlling interest in the Commodor. The mining industry subsequently recognized the two mines as being one entity, and miners linked the underground workings with numerous passages. As a result, the upper-most tunnel on the Commodor claim became known as Tunnel No.1, the Manhattan Tunnel became known as Tunnel No.5, the Nelson Tunnel was unofficially termed No.4, and Tunnels No.2 and No.3 pierced the ground upslope. In the combined effort to extract ore efficiently, the mine's engineer installed a Pelton wheel at the Commodor No.5, which turned a generator and an air compressor, and the top two tunnels were abandoned.[xxxvii]

The Creede district experienced steady production until 1907, when a recession forced most of the mines to temporarily close. After the economy recovered, mining continued. During this time, the application of engineering and technology had a significant impact on the population of the district. Because mining was intense between around 1896 and 1910, the towns of North Creede and Creede thrived. The need for workers at the Amethyst Mill and on the Amethyst tramway ensured that Weaver maintained a small population. However, the completion of the Nelson, Wooster, and

Humphreys tunnel series rendered the surface plants on the surface above the Amethyst Vein obsolete. The Nelson Tunnel became the principal access to the mines, and the population of miners and teamsters shifted from the town of Bachelor, which included the disbursed bunk and boardinghouses at the mines, down to Creede. Only a few residences up high were maintained. In 1900 approximately 1,150 people lived in Creede and North Creede, 343 people lived in and around Bachelor, and 84 lived in Weaver.[xxxviii]

Between 1896 and 1910 most of the mining companies focused their efforts on developing and extracting the known ore deposits. By around 1910 these bodies began to show signs of exhaustion, and within several years many of the marginal mines closed. Not only did the district suffer from depleted ore bodies, other silver-lead mining districts such as Joplin, Missouri, Leadville, Colorado, and some of those in Idaho were presenting significant competition, which kept metals prices low. As Creede's mines closed, people left the district. The populations of Creede, North Creede, and Bachelor decreased dramatically between 1905 and 1915. By 1910 Weaver became almost totally deserted.

Contrary to the trend of the implosion of mining on the Amethyst and Holy Moses veins during Creede's second boom, activity spread to several outlying areas on the fringes of the district. As the economy improved during the late 1890s and early 1900s, investors became interested once again in the prospects at Sunnyside. An unknown mining company developed the old Corsair property, and they began shipping silver ore during 1902 and 1903. Captain Free Thoman, who owned the Sunnyside Tunnel, interested investors Albert Damm, Jeff McAnelly, Perry Learnard, and M.H. Akin of Fort Collins in his operation. They supplied capital, which Thoman used to drive a tunnel 750 feet, where miners encountered a small ore vein. The Kruetzer-Sonata and Monon properties saw further exploration, and they eventually produced a little ore.

Two more promising prospects far up West Willow Creek also attracted attention around the turn-of-the-century. Miners began sinking a shaft on a promising lead on the Captive Inca property in 1903, and another company drove a tunnel on the Equity claim. The Captive Inca proved to be worthless and it was abandoned by 1912, however the Equity Mine produced ore for several years beginning in 1912.[xxxix]

The outbreak of World War I benefited Creede's faltering mining industry. The war fostered a heavy demand for industrial metals, creating a profitable environment for Creede's mining companies. While the high metals prices resuscitated mining, the renewed activity was nothing like that of years past. The need to handle greater tonnages of ore than before while cutting production costs convinced the mining operations to spend capital on advanced technology. Electrification was the most cost-effective improvement that the mining companies could effect. While Creede boasted of being served by one of the West's earliest power plants, until the 1910s electric technology was not advanced enough to significantly benefit mining. However, when Creede experienced its World War I revival, the technology was sufficiently advanced.

In 1917 a new power plant was built in Creede, possibly by the Creede Tribune Mining Company, which leased the Amethyst Mine. The plant was a state-of-the-art affair, and it consisted of four Heine water tube boilers which powered a massive 500 horsepower steam engine and 225 kilowatt dynamo. A second engine and dynamo were kept on stand-by. The mining operations on the Amethyst Vein used the electricity underground to power small hoists and ventilation fans, and to light stations. The

Amethyst Mine proved to be the greatest beneficiary of electricity. In 1918 the Creede Exploration Company leased the mine and installed an electric hoist and motor-driven compressor at the shaft to facilitate work above the Nelson Tunnel level.[xl]

The American Smelting and Refining Company (ASARCo), part of the Guggenheims' industrial metals mining and milling empire, organized the Creede Exploration Company in 1918 to lease properties along the Amethyst Vein and extract what little ore remained, and to search below the Nelson Tunnel level for more deposits. During previous years the Moffat syndicate's engineer had miners drive a central shaft within the Commodor workings, and it penetrated ground below the Nelson Tunnel level, which Creede Exploration used for deep exploration. In 1918 miners unwatered the shaft and equipped it with a double drum electric hoist which worked two skips. After several futile years of searching, ASARCo gave up on deep ore. Uneconomical quantities had been found, but they were too poor in content. Faced with worthless properties, ASARCo sold its holdings to individual mining companies.[xli]

During the 1890s, when rich ore lay in the ground, mining companies purchased claims, hired crews of miners, and extracted ore under the umbrella of their corporate structures. The depletion of rich ore, the inefficiencies of large company structures, and high operating costs discouraged such an operating strategy after around 1900. The growing trend in Creede, as well as other Western mining districts, was for the mining companies to cease operations and lease either the entire mine to a second-party company, or lease portions of the ore body to individual miners. The payment schedule included either a royalty per ton of ore, or a flat fee. This scheme shifted the burden of minimizing operating costs from the mine's owner to the lessee. Under this system, lessees had every incentive to minimize the capital that they put into the operation since they had no allegiance to the mine itself, and they extracted the maximum ore in minimal time. While lessees were able to make a profit where large, cumbersome mining companies could not, their tactics proved problematic for the long term state of the mine. Lessees rarely conducted exploration for new ore bodies because it was "dead work", as they termed it. They also avoided investing in maintenance and the long term well-being of the mine's infrastructure. It was under this environment that mining in Creede continued during the 1910s.

During World War I mining and leasing companies were producing ore from the other mines on the Amethyst Vein. The Mineral County Mining & Milling Company extracted ore from the Happy Thought property, which they concentrated in the Humphreys Mill. A succession of lessees profitably worked the Last Chance ground, and more lessees mined the Park Regent and the Del Monte properties. In 1915 Norman Corson organized a company that did well mining the Bachelor ground. During the 1890s and 1900s the Moffat and Bowen interests gutted their mines on the Holy Moses Vein, and interest in these properties lagged. The only mine on the Holy Moses Vein that possessed profitable ore during World War I proved to be the King Soloman. The leasing outfit William Wright & Co. profitably extracted ore and milled it at the Soloman Mill until 1918.[xlii]

The demand for industrial metals was high enough, and milling technology sufficiently advanced to make the ores at Sunnyside and at the Equity Mine, high up West Willow Creek, economically viable. After successful exploration, lessees A.B. Collins and

H.R. Wheeler brought the Monon Mine into production in 1916. In 1918 the Manitoba Leasing Company took over operations at the Monon and profitably extracted ore until 1921. The Creede Equity Mining Company began drilling and blasting ore in the Equity Mine in 1918 and quit in 1919.[xliii]

Decline

The declaration of armistice in 1918 halted war-related industrial production, which caused metal prices to tumble. Mining at Creede once again became unprofitable, and the district fell on hard times. The end of the war proved to be the death knell for the marginal properties, and a near end of surface prospecting along the Amethyst and Holy Moses veins. By 1920 all mines but the Bachelor became completely quiet, many never to be worked again. With the subsidence of activity, irreversible decay set in. The surface plants of nearly all mines fell into total disrepair, and shafts and tunnels became unstable, except for the Nelson, Commodor, and Bachelor operations.

The few miners that remained in Creede glimpsed a ray of hope in 1922. Western senators passed the Pittman Act, which mandated that the federal government purchase silver at $1.00 per ounce, in hopes of bolstering a failing Western mining industry. The principal mining operations in Creede geared up for production, and activity at the Bachelor, Commodor, Del Monte, Happy Thought, Last Chance, and New York properties resumed with vigor. All work was conducted through the Nelson and Commodor No.5 tunnels. The Ethel Leasing Company reopened the Soloman on the Holy Moses Vein. The high price for silver stimulated some prospecting, and knowledgeable district residents searched new ground. A find was made near Windy Gulch northwest from Creede, and local interests concluded that it was a lead-silver-zinc vein missed by the prospectors of years past. The Pittman Act expired in 1923, and Creede entered another dark period. Some mining activity continued, however. The Commodor Mine continued to produce, and lessees spent a short time in 1925 exploring the Bachelor ground. In 1925 E.J. Lieske, Dr. Thomas Howell, and C.N. Blanchett formed the Bulldog Leasing, Mining, and Milling Company to explore and develop the new vein discovered above Creede. The property already featured a tunnel 1,050 feet long, which they drove further. The operation collapsed in 1926.[xliv]

The last significant mining endeavor of the 1920s occurred at the Amethyst Mine. The company's leading engineer determined that economic ore still lay in the upper levels of the Amethyst and surrounding properties. Hauling the ore out, however, would have constituted a great cost. After years of neglect, the Nelson Tunnel and the raises and chutes necessary for transferring the ore needed expensive improvement. The surface plants and shafts of the Amethyst, Last Chance, New York, and Happy Thought mines were in a hopeless state. The engineer elected to drive a new haulage tunnel from the company's property at Weaver on West Willow Creek, instead of effect the required improvements. In 1928 miners began work on what then they named the Sloane Tunnel, later known as the Amethyst Tunnel. The passage provided easy access to the Amethyst and surrounding properties, and it permitted mining of low-grade ore shunned by earlier operations as being uneconomical. The tunnel saw only two years of service before mining at Creede once again ceased.[xlv]

Paradox: Boom During the Great Depression

Ironically, under the presidency of one of the World's greatest mining engineers, Herbert C. Hoover, the Crash of 1929 brought the nation to its economic knees. The subsequent Great Depression destroyed what little was left of mining in Creede. The victory of Franklin Delano Roosevelt over Hoover in 1932 for U.S. President set in motion a chain of events that spelled a revival of mining in the West, including Creede, on a scale not seen since the close of the Gilded Age. In an effort to devalue the U.S. dollar, in October of 1933 Roosevelt enacted a plan in which the Federal Government bought gold at relatively high prices. When price declines began to interfere which this scheme, Roosevelt and Congress passed the Gold Reserve Act early in 1934, which set the minimum price for gold at $35.00 per ounce. In 1934 Roosevelt signed the Silver Purchase Act into law, which monetized silver and set the price for the metal artificially high. Creede experienced a boom unlike anything seen since the Gilded Age. Most of the principal mines on the Amethyst Vein, the Soloman Mine on the Holy Moses Vein, and the few producers at Sunnyside underwent further exploration and production.[xlvi]

Lessees began exploring the Bachelor, Commodor, and Amethyst mines, and they initiated production shortly afterward. Miners accessed these three properties through the Bachelor tunnels, through the Commodor No.5, and the new Amethyst Tunnel, respectfully. The Nelson Tunnel, which was long-neglected, was no longer used. Miners began drilling and blasting pockets and small stringers of ore in the gutted Amethyst Vein's hanging wall. Because capital remained scarce during the Depression, miners working deep underground revived the old practice of hand-drilling, while miners working for the large operations, such as at the Commodor and Amethyst mines, had the luxury of using mechanical rockdrills. Miners completed nearly all other work underground with hand-labor. In addition to work underground, small companies leased the rights to sort through the waste rock dumps associated with the large mines for low-grade ore tossed out by earlier operations as uneconomical.

When miners had proven that ore still existed in these mines, investors eager for profit began a campaign to acquire the principal mines on the Amethyst Vein. In 1935 the Emperius Mining Company purchased the Commodor and Bachelor mines and the Nelson Tunnel. In 1937 Emperius leased the Last Chance and New York properties, and in 1939 it completed its game of Monopoly when it purchased the Amethyst Mine. Ore extracted from the upper levels of the New York and Last Chance were hauled through the Last Chance No.2 Tunnel, located near the abandoned Amethyst Shaft. Miners brought ore extracted from the lower levels of the above two properties through the Amethyst Tunnel.[xlvii]

Table 4.1: Summary of Mining on the Amethyst Vein

Mine Name	Relative Size	Location on Vein	Operating Years of Surface Plant	Operating Years of Property
Amethyst	Very Large	Central	1891-1920	1891-1920; 1928-1929; 1934-1950s.
Annie Rooney	Small	Central-South	1891-1892	1891-1892
Bachelor	Very Large	South	1878; 1885; 1891-1893; 1895-1923; 1925-1929; 1934-1940; 1944	1878; 1885; 1891-1893; 1895-1923; 1925-1929; 1934-1940; 1944
Commodor	Very Large	South	1891-1893; 1895-1910s; 1916-1920; 1923-1929; 1934-1940; 1944-1983	1891-1893; 1895-1910s; 1916-1920; 1923-1929; 1934-1940; 1944-1983
Del Monte	Medium	South-Central	1891-1893; 1890s	1891-1893; 1895-1900s; 1916-1923
Happy Thought	Large	Central	1891-1893; 1894-1907	1891-1893; 1894-1917; 1922-1923; 1928
Last Chance	Very Large	Central	1891-1893; 1895-1896; 1898-1910s	1891-1893; 1895-1896; 1898-1920; 1923; 1937
Nelson Tunnel	Very Large	South	1892-1893; 1896-1929; 1935	1892-1893; 1896-1929; 1935; 1945-1950s.
New York	Medium	South-Central	1891-1893; 1895-1902	1891-1893; 1895-1900s-1915; 1923; 1934-1940
Park Regent	Medium	North	1892-1893; 1895; 1898-1912	1892-1893; 1895; 1898-1912; 1916-1917
Sunnyside	Small	South-Central	1892-1893	1892-1893
White Star	Small	North	1892-1893; 1890s	1892-1893; 1890s-1917

Table 4.2: Summary of Mining on the Holy Moses Vein

Mine Name	Relative Size	Location on Vein	Operating Years of Surface Plant	Operating Years of Property
Holy Moses	Very Large	Central	1891-1893; 1895-1910; 1934; 1953-1958	1891-1893; 1895-1910; 1934; 1953-1958
King Soloman (Soloman)	Large	South	1891-1893; 1895-1918; 1922-1923; 1934; 1945; 1950-1952	1891-1893; 1895-1918; 1922-1923; 1934; 1945; 1950-1952
Outlet Tunnel	Medium	North	1890s; 1956-1958	1890s; 1956-1958
Phoenix	Small	North	1891-1893; 1900; 1951-1960s	1891-1893; 1900; 1951-1960s
Ridge	Medium	South	1891-1893; 1890s-1900s; 1943-1949	1891-1893; 1890s-1900s; 1943-1949

Table 4.3: Summary of Mining on Upper West Willow Creek

Mine Name	Relative Size	Location on Vein	Operating Years of Surface Plant	Operating Years of Property
Captive Inca	Medium	South	1902-1905	1902-1905
Equity	Medium	North	1900s; 1912; 1918-1919; 1927-1929; 1953	1900s; 1912; 1918-1919; 1927-1929; 1953

Table 4.4: Summary of Mining on the Alpha-Corsair Ore System

Mine Name	Relative Size	Location on Vein	Operating Years of Surface Plant	Operating Years of Property
Corsair	Medium	South	1883; 1901-1904; 1922; 1925; 1933-1934; 1939	1883; 1901-1904; 1922; 1925; 1933-1934; 1939
Kreutzer-Sonata	Medium	North	1892-1893; 1926	1892-1893; 1926
Monon	Medium	South	1890s; 1916-1921; 1925; 1938-1940; 1953	1890s; 1916-1921; 1925; 1938-1940; 1953
Sunnyside Tunnel	Medium	Central	1892-1893; 1901	1892-1893; 1901

Within a year Emperius invested capital to locate additional ore veins, which the company's engineers were sure lay to either side of the Amethyst Vein. During the following years miners in fact encountered new ore, which ensured the company's continued profitability. Then, in 1938 Emperius miners discovered the OH Vein, which was the most significant find since the initial discoveries of ore in the district. Previous mining companies on the Amethyst Vein shortchanged themselves by focusing time and effort on gutting the known ore bodies and neglecting exploration, leaving the discovery of the OH ore body to miners drilling and blasting four decades later.[xlviii]

Because Creede's ores possessed a lower value than times past, Emperius continued to emphasize production in economies of scale. The company ensured that the surface plants at the Commodor and the Amethyst mines were fully equipped. Miners working underground used rockdrills when driving exploratory workings in hardrock, and they drilled by hand when working in softer ores. Miners used other pieces of power equipment such as electric and compressed air hoists at winzes and to scrape blasted ore out of stopes with drag-lines. Mules, which were inexpensive to maintain, pulled trains of ore out of the Commodor and Amethyst tunnels. The surface plants of both of these operations, and the Last Chance No.2 Tunnel, included large ore sorting houses where mine workers manually concentrated the ore and separated out waste.

Like times past, mining men in Creede sought to mill the ores locally in hopes of saving the shipping and processing fees associated with exporting payrock to distant smelters. In 1937 T.P. Campbell, W.B. Jacobson, and a man named Mr. Weber organized Creede Mills, Incorporated, which erected a flotation mill south of the town of Creede. While the flotation process was not new to mining in 1937, Creede's past mills had not applied the concept. The process reduced the ore to a slurry, as other mills had done, and it relied on oils and foaming agents in tanks to "float" the pulverized metalliferous fines away from the waste. The mill proved successful, and Emperius added it to its Creede empire in 1940.[xlix]

The resurgence of mining stimulated by FDR's programs reversed the trend of the exodus from the dying Creede district. In 1930 the town's population dropped to around 334, and during the following decade it increased to 587. The proliferation of the automobile and truck permitted miners in the 1930s to live in Creede and commute to the centers of activity at the Commodor and Amethyst tunnels. Except for a few isolated residences, the townsites of Bachelor and Weaver had been long-abandoned. The Creede business district experienced another fire in 1936, which would have probably precipitated the town's final abandonment, were it not for the profitable mining.[l]

Unlike World War I, the outbreak of World War II curiously did not foster a district-wide resurgence of mining in the Creede district, despite the need for war-related industrial metals, but interest increased, none-the-less. On the Amethyst Vein, Emperius miners continued drill and blast ore deep within the Commodor, Bachelor, and Amethyst properties, and they may have continued to work the lower levels of the Last Chance ground through the Amethyst Tunnel. In response to anticipated production, in 1943 Emperius invested much capital reconditioning unsound portions of the Commodor No.5 Tunnel, and in 1945 the company did the same to the Nelson Tunnel, which had been neglected for decades. In 1945 the New Ridge Mining Company reopened the old King Soloman, after 11 years of inactivity, and another group of lessees reopened the Ridge Mine in 1943. Reopening both properties on the Holy Moses Vein required considerable capital, because the King Soloman had been idle since 1934, and Ridge was abandoned in the 1910s. The mines that were active at Sunnyside during the Great Depression closed in the 1930s, probably due to the exhaustion of economic ore. In 1940 the partnership of Larson & Soward leased the mine, conducted some exploration, extracted a little ore, and shut their operation down.[li]

Table 4.5: Population of the Creede Mining District, 1890-1960

Population Center	1890	1892	1900	1910	1920	1930	1940	1950	1960
Mineral County	Not Extant	Not Extant	1,913	1,239	779	640	975	693	424
Creede	1,000	8,000	938	711	500	334	587	433	424
North Creede	Part of Creede	Part of Creede	235	122	Part of Creede	Part of Creede	Part of Creede	Part of Creede	Part of Creede
Bachelor	0	0	343	179	0	0	0	0	0
Weaver	0	0	84	0	0	0	0	0	0

(Data collected from: Schulze, 1976 and from Nolie, 1947:59)

The Last Boom-Bust at Creede

Mining at Creede experienced a boom-bust cycle yet again following the end of World War II. War-related production slowed, and the price for industrial metals sagged. The ore bodies in the old mines were becoming truly exhausted and exploration conducted by both Emperius and by partnerships failed to discover new ore. The end of mining at Creede seemed to be in sight. However, the economic boom of the 1950s created a strong market for industrial metals once again, and improved milling technology made ores of even lower grades economical. Not only did this prolong the lives of Creede's active mines, a wave of partnerships and lessees closely examined many lifeless but formerly productive properties.

During the late 1940s the Emperius Mining Company was the only significant operation active at Creede. In times past Emperius extracted ore from various levels in the Commodor, Bachelor, Amethyst, and Last Chance properties. Following the post-war slump in metals prices, the company curtailed its operations and used only the Commodor, Nelson, and Amethyst tunnels. The company abandoned all other surface facilities.

The wave of interest in Creede's mines began rising in 1950. The long-idle mines on the Holy Moses Vein attracted the most attention. In 1950 the Mexico Mining Company leased the King Soloman property and conducted underground exploration. The TOC Development Corporation assumed the lease and produced $20,000 of ore by 1952. In 1951 the Outlet Mining Company reopened the Phoenix Mine, conducted exploration, and by 1956 had extracted an impressive $500,000 in lead and silver. In 1953 the Sublet Mining Company leased the Holy Moses Mine, and it leased the Outlet Tunnel in 1956, where the outfit conducted underground exploration. The lessees began shipping ore from the Holy Moses in 1954. In light of the success miners were experiencing with some of the district's long-abandoned properties, lessees and investors became interested in the prospects at Sunnyside and those on upper West Willow Creek. Lessees reopened the Equity Mine in 1953, which lay abandoned since 1929. They proved unsuccessful and the mine closed again. Another group of hopefuls reopened the Monon Mine also in 1953. They encountered small veins which were rich enough to pique their interest, but not sufficient enough to be profitable. The lessees chased the ore stringers for the next five years before they finally gave up.[lii]

Mining in Creede experienced one last contraction in the late 1950s. All of the operations that were active during the 1950s shut down permanently, except for the Outlet Mining Company which continued underground exploration at the Phoenix Mine, and the Emperius Mining Company which continued to profit from the seemingly endless bodies of ore under the Commodor and the Amethyst properties.

During the 1960s the culture of the Creede Mining District entered a dichotomous state. The people, the economy, and the physical landscape retained characteristics derived from 70 continuous years of underground mining based on traditional Gilded Age methods, while the modern world was beginning to exert a substantial influence. The Emperius Mining Company continued to work the Commodor and the Amethyst properties, and the Bulldog Mine, long idle, began production. Improved technology permitted a greater tonnage of ore produced per miner, but both mining companies continued to drill and blast using traditional methods. Both mining companies also began to use heavy equipment, such as bulldozers and front-end loaders, instead of hand-labor on the surface. On the other hand, Creede's economy began to enjoy a higher income from tourists that in times past, and the culture began changing to accommodate the passers-through. During the 1960s a movement began in which tourists ventured from urban and suburban centers to historic mining towns to commune with the material culture of the American West. Creede, with its dozens of intact historic mine sites and ghost towns, was well prepared to satisfy the waves of tourists. The transition from mining to tourism accelerated during the 1970s.

The end to mining in Creede finally came in the 1980s. After almost a century of mining, all of the mines shut down. Exhaustion of ore was partly to blame, the skyrocketing costs of underground operations were heavily at fault, and competition from mining operations in other countries and the associated low metals prices contributed heavily. Mining constituted a significant portion of Creede's cultural fabric, and the closing of the mines was a hard blow to the area. However, Creede survived well because tourism continued to grow, and the town served as the region's commercial and economic hub. Despite Creede's transition from one of America's greatest silver mining districts to a historical destination that draws tourists from across the West, the cultural fabric created by almost 100 years of mining remains intact. The heritage that is Creede's, as well as that of a special time and place in American history, lives on through the people, the town of Creede, and the surrounding historic mine sites.[liii]

Previous Cultural Resource Work

In the early 1990s, the Colorado Department of Minerals and Geology inventoried some of the sites included within the Holy Moses project area. In 1990 Robert Kirkham and Leanne Sander recorded the Ridge Mine under Smithsonian site number 5ML201. They also recorded the Soloman and Phoenix mines, two unrelated operations separated by great distances, under site number 5ML200. Mine closure activities drove the Division of Minerals and Geology to conduct the cursory recordation. Why one site number was used for two separate sites remains unknown. Despite important attributes and associations, the Division recommended the above sites as not eligible for the National Register of Historic Places. In 1974 Lindsey Hartman recorded the Holy Moses Tunnel under site number 5ML104. A review of records at the State Historic Preservation Office revealed that this documentation lacked basic information such as site maps, artifact inventories, and feature descriptions. Mountain States Historical re-recorded the sites using the original site numbers for reporting, and it obtained new site numbers for previously unrecorded but associated components of the above mining operations.

Table 4.6: Previous Cultural Resource Work

Site Number	Mine Name	Recorders	Date
5ML104	Holy Moses Tunnel	Lindsay Hartman	1974
5ML200	Phoenix Mine, Soloman Mine	Robert Kirkham and Leanne Sander	1990
5ML201	Ridge Mine (Main Haulageway only)	Robert Kirkham and Leanne Sander	1990

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CHAPTER 5 OBJECTIVES AND RESEARCH DESIGN

Objectives

The inventory of historic mine and prospect sites on the Holy Moses Vein and East Willow Creek attempted to meet two sets of objectives. First, the environmental issues discussed in the introduction posed the very real possibility that the sites face physical threats that could compromise their integrities and preservation. In this light, the first category of objectives involved directing sufficient time, resources, and effort to give the sites due process. Past inventories within other historic mining districts, usually driven by compliance with cultural resource laws, demonstrated that sites are not always thoroughly and objectively researched, recorded, evaluated, nor interpreted. Insufficient time and haste, political pressures applied by involved parties, and the unfamiliarity of cultural resource specialists with the nuances of mine sites, contributed to inadequate work. The primary objectives related to the above issues include:

- To thoroughly research and record each principal, privately owned mine site on the Holy Moses Vein, and along East Willow Creek. For a description of research and recordation efforts used for the inventory, see Chapter 6. The surface archaeological and architectural remnants of the sites were recorded thoroughly, however buried deposits, such as privy pits and refuse dumps, remain unaddressed.
- To determine the eligibility recommendations of the sites to the National and State Registers of Historic Places based on physical integrity and the application of the National Register Criteria. A truly objective application of the Criteria necessitated an interdisciplinary approach wedding history and archaeology. First, the sites were examined for their physical integrity. Second, archival information was reviewed to ascertain the sites' associations with significant persons, events, and trends in history. Third, the sites were analyzed to determine whether they possessed unique characteristics or were sound examples of a site type. Fourth, the sites were considered for their potential to yield important data. Last, all sites, whether they met the Criteria or were ineligible, were noted for their potential to serve as components of the visual landscape of a historic district. For the evaluation recommendations, see Chapter 8.
- To consider the possible impacts to each site by future environmental remediation efforts. The impacts could take two forms: treating or stopping drainage effluent, and preventing metals from mobilizing out of waste rock dumps.

The second set of objectives related to historic preservation and public history. Few mining districts have been subjected in entirety to a systematic inventory of mine, prospect, mill, and settlement sites. The Holy Moses inventory is the second part of a three phase project to inventory all of the principal mine sites, selected prospect sites, and associated settlements on the Creede district's three main ore systems. The inventory is also part of a greater project seeking to inventory the above with the addition of the principal townsites and settlements to characterize all of the district's principal resources. Therefore, the information gathered during the Holy Moses inventory serves as a crucial component of the two projects. The inventory of the principal mine, prospect, and mill sites is driven in part by threats posed by possible environmental remediation. The inventory that includes the townsites and settlements is driven by an effort to gather data for a book on the district's history, to nominate the collection of sites as a historic district, and to aid the community in planning for growth and development. Specifically, the objectives of the Holy Moses inventory include:

- To determine the history of each principal historic mining, prospect, and milling operation on the Holy Moses Vein, and those on East Willow Creek.
- To determine trends illuminated by a study of the cumulative group of the above sites between the time of their initial discovery and the end of mining. The histories and trends will be assembled by weaving together archival and physical information gathered during recordation.
- To characterize the nature of residential occupation at each site. Archival information pertaining to residential occupation at specific sites is scant, leaving site recordation and analysis as the principal source of data.
- To make meaningful the information gathered from the archival research and recordation of the sites by discussing their interpretations, and overall trends and themes in a report. Individual site interpretations are in Chapter 7, and Chapter 9 discusses the trends and themes, as well as addressing the research questions posed below.
- To view the histories of the sites, and the overall trends and themes of the inventoried sites in the contexts of the district's history, Gilded Age culture, economics, politics, and the mining industry.
- To identify, but not record, residential sites for the future inventory of townsites and settlements within the mining district.
- To gather qualitative information for a book to be published on the history of the Creede Mining District. The book will detail the district's mining and milling industries, and social development from initial discovery to the end of mining in the 1970s. The book will rely on the combination of archival research and site analysis. The sites on the Holy Moses Vein and on East Willow Creek form an important body of data for such work.
- To gather qualitative and quantitative data to help determine the area, and specific sites and resources therein, worthy of nomination as a historical district. The inventory of sites on the Holy Moses Vein and on East Willow Creek is the second part of the four-phase effort aimed at achieving this goal.

Research Design

During the past several decades, scholars and popular writers alike produced numerous books and publications exploring facets of mining in the West.[1] Most of this work is of a general nature, and the authors relied on archival research as the primary source of information. Aspects of Western mining that pertain to industrial,

[1] Francaviglia, 1991; King, 1977; Spence, 1993; Smith, 1974; Smith, 1977; Wallace, 1976; Watkins, 1971; Wyman, 1989; Young, 1987, for a mere sample.

technological, and social issues received little documentation in the past, and because of this they remain under-studied due to a lack of traditional archival information. Such topics provide fertile ground for research through the study of material culture found amid historic mine and associated settlement sites. The remnants of structures, machinery, infrastructures, domestic and industrial refuse, and buried features and deposits serve as a rich source of information capable of conveying that which archival data currently can not. The sites inventoried on the Holy Moses Vein and on East Willow Creek possess such archaeological characteristics capable of answering many questions regarding the area's mining industry, and associated social patterns. The trends revealed by the Holy Moses inventory can be applied to other portions of the Creede district, and may be extrapolated to metals mining elsewhere in Colorado and the mountainous West.

A research design was constructed to meet the objectives of researching, recording, evaluating, and interpreting sites on the Holy Moses Vein and East Willow Creek. The research design combines methods from the academic disciplines of history and archaeology. In terms of a region's mining industry and associated settlement, both disciplines have the potential to compliment each other to provide a holistic perspective. Historical documentation of a region's mining industry tends to be incomplete and can only provide qualitative data considered important at the time it was recorded. Archaeological evidence, both surfacial and subsurface, is likewise incomplete, lacking facts such as the names of companies and individuals, but it can offer both qualitative and quantitative information not recorded in historical documentation.

A strategy for gathering information forms the research design's first portion. In keeping with an interdisciplinary approach, the strategy first required exhaustive archival research, followed by thorough site recordation. Archival research can reveal documented facts pertaining to the Creede Mining District, the sites to be inventoried, and economic and social trends within and outside the district. Some of this information formed the basis for a historical context produced in 1999.[2] Mine-specific information provides chronologies of events, persons, institutions, and property developments associated with the inventoried sites. Overall, the information provides a framework that compliments, and helps identify, the material evidence on-site.

Fieldwork, the second stage of the overall research strategy, followed the archival investigations. The sites were intensively recorded, and the archival information assisted in identifying some features and artifacts. Recordation involves delineating site boundaries, mapping all features, describing the features individually, and inventorying artifacts associated with each feature. The artifacts were categorized as being structural, industrial, or domestic in nature, and features were noted for their functions and dates of construction. The associated artifacts proved crucial in defining feature function, and dates of construction and use. The date ranges of age-sensitive artifacts were determined by consulting references, and are tabulated by site in Appendix 1. The artifacts were also noted for attributes reflecting function, gender, ethnicity, health, and consumerism. For a detailed description of the archival and field research methods used during the inventory, see Chapter 6. When the fieldwork came to conclusion, the bodies of historical and

[2] Twitty, 1999b.

archaeological information were combined and discussed in the form of the site interpretations in Chapter 7.

The information collected through the interdisciplinary approach of archival research and recordation facilitated the evaluation of the sites according to the National and State Registers of Historic Places. The archival research proved crucial for the sites' evaluation under Criteria A and B, because it revealed associated persons, events, and broad historic trends. Site recordation and analysis proved crucial for evaluation under Criteria C and D. The material evidence determined whether a site was a unique example or a type, and whether it had the potential to offer additional information of importance.

A series of hypotheses, research questions, and sources of information capable of making the inventoried sites meaningful forms the research design's second portion. Again, an interdisciplinary approach, relying on historical and archaeological data, is important for accurate interpretation of the sites in terms of the questions.

The research questions fall into two general domains. The first pertains to mining operations, which is a subject many cultural resource inventories in mining districts tend to address in a cursory fashion. Little is currently known about how mines and prospects were actually operated, how engineering was applied, and the influences of economic, political, and environmental factors. Few publications currently exist that focus on the application of technology, the operations of mines, prospects, and mills of various sizes, and material evidence remaining today.[3] In this context, a body of research questions organized under the domain of mining operations provides an opportunity to explore this interesting topic.

The second category of research questions falls under the topic of residential occupation, settlement patterns, and social and cultural issues. Archaeological work in mining districts traditionally focused on the analysis of residential occupation, and as a result a quality body of data, mostly in the form of reports, exists. Some of the research questions below are modeled after or are variations of those posed by other researchers in their archaeological reports. Because residential occupation and associated cultural and social issues were poorly documented in historical records, material evidence serves as a prime source of information for these important aspects of mining history. As a result, findings determined from additional archaeological studies, such as the Holy Moses inventory, are always welcome contributions.

Research Domain: Mining and Milling Operations

Mining, milling, and prospecting relied on engineering, technology, and methods that left distinct archaeological evidence visible today. Nearly every mining and prospecting operation erected a *surface plant*, which was the collection of facilities that supported activity on the property. Surface plants consisted of a group of *components* that included structures, activity areas, machinery, and topographical alterations. Most of the materials and equipment of value were usually removed following a site's abandonment; leaving specific types of material evidence that can clearly represent a site's makeup. Structures left structural material, foundations, and building platforms.

[3] For a sample of such works: Francaviglia, 1991; Meyerriecks, 2001; Twitty, 1999a.

Machinery often was anchored to foundations, and by analyzing a foundation's size, footprint, and construction material, the exact type of machine can be ascertained. Activity areas are represented by and can be determined from artifacts, topographical alterations, and spatial location amid a mine's surface plant. For example, an area where miners prepared timbers for use underground can be identified by stacks of raw logs, cut log scraps, wood chips, flat ground on which to work, and a location near the mine opening.

Because materials, equipment, machinery, and other items of value were removed almost immediately following a mine's abandonment, few mine sites existing today remain truly complete and intact. The evidence, archaeological in nature, left by a surface plant's components can clearly represent the makeup of a historic mining or prospect operation. Based on building footprints, machine foundations, topographical alterations, spatial arrangements, and artifacts, the site can be accurately reconstructed in a virtual sense, and changes over time charted. In this light, a site retaining archaeological integrity can clearly represent a site type, and whether it possesses unique characteristics. As such, sites lacking structures, machinery, and equipment represent engineering and can be recommended as eligible for the National and State Registers under Criterion C, provided the material remnants permit an accurate reconstruction of the site.

While archaeological remnants represent most surface plant components, the material evidence is primarily surficial. The environment of and activities amid surface plants were not conducive to the buildup of buried deposits, however, a few exceptions exist. Occasionally, mining companies erected privies for the surface crew's personal use, and the pits remaining today, if substantial, may contain meaningful artifact assemblages different from those lying in domestic privies. The artifact assemblages in industrial privies could include work-related items miners accidentally dropped, as well as industrial refuse, and items purposefully thrown in under secrecy.[4] As another exception, mines that relied on steam power often feature dumps of boiler clinker, which is a residue created by burning fuel coal. The dumps can possess subsurface depth and include industrial artifacts. A mine's surface crew often threw refuse into depressions in waste rock dumps, and the deposits became buried by rock over time.

While evidence of structures, activity areas, and machine foundations are important for the virtual reconstruction of a mine's surface plant, artifacts associated with specific features are crucial for determining a feature's function, the intensity of activity, when the feature was built, and when it was used. By far, most artifacts associated with surface plant remnants fall into structural and industrial categories. Mine sites often include only a paucity of the domestic artifacts that archaeologists traditionally use to determine occupation dates. While little work has been done to develop such assemblages into a meaningful body, they are capable of a significant contribution to the understanding of a site's history. In terms of function, artifacts can convey the application or existence of certain surface plant components and technologies. For example, the presence of blacksmith-related artifacts, such as forge clinker, forge-cut iron scraps, and cut pipe scraps can define an otherwise generic building platform as having supported a mine shop. In other cases, certain artifacts reflect the presence of portable,

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[4] In 1994 Western Cultural Resource Management excavated a privy pit at the Joe Dandy Mine in the Cripple Creek District, recovering personal items that miners carried at work. The information is available the company files.

free-standing pieces of equipment that are otherwise not represented by physical features. For example, boiler clinker, water-level sight tube fragments, and pipe fittings can reflect the application of a portable, steam-powered donkey hoist at a shaft mine lacking any structural evidence of a mechanical hoist.[5]

Specific types of artifacts, and the overall artifact assemblages at sites, can reflect trends regarding engineering, capital investment, sophistication, and duration of occupation. Artifacts such as rockdrill parts, drill-steels, air hoses, electrical hardware, drive pulleys, and other heavy machine parts indicate a high degree of engineering and mechanization. When viewed in the context of conventional engineering and equipment, such items can reflect an advanced operation. A high density of industrial items, usually designed for long-term use, represents an operation of lengthy duration.

Like many types of domestic artifacts, specific types of structural and industrial artifacts were manufactured for defined periods of time, and can therefore reflect periods of industrial operations at mine sites. Some common dateable structural and industrial artifacts encountered at mine sites are tabulated below.[6]

Table 5.1 Dateable Structural Artifacts

Artifact	Description	Date Range
Cement, Natural	Pale yellow, or white to pinkish, crumbly. White precipitate on surface.	1850s-1920
Cement, Portland	Grey to white, firm.	1910s-Present
Cinderblock	Rectangular, hollow, concrete block.	1930s-Present
Corrugated Sheet Steel Siding	Sheet steel featuring broad corrugations.	1890s-present
Nail, Cut	Tapered, square-shanked nail.	1850s-early 1890s
Nail, Wire	Common round nail.	1890-Present
Window Glass, Amethyst	Light amethyst tint.	Pre-1920
Window Glass, Aqua	Light aqua tint.	Pre-1920
Window Glass, Lime	Light lime-green tint.	Late 1910s-1950s
Window Glass, Selenium	Light golden-yellow tint.	Late 1910s-1950s

Table 5.2: Dateable Industrial Artifacts

Artifact	Description	Date Range
Air Hose: Rubber-Fiber Compound	Black, red, or grey, 1 to 2 inches diameter, rubber with built-in fibers.	1930s-Present
Air Hose: Rubberized Canvas	Black or red, 1 to 2 inches in diameter.	1920s-1950s
Air Hose: Steel-Spiral Wrapped	Rubberized canvas hose wrapped with steel wire.	1870s-1910s
Battery Core: Dry Cell	Carbon rod, ¾ inches in diameter.	1890s-1930s
Battery Core: Wet Cell	Ribbed carbon rod, ¾ inches in diameter	1880s-1910s
Blasting Powder Keg	Corrugated body, small-mouth internal thread opening with zinc bung. Approx. 10 in. diam, 12 in. high.	1860s-1890s
Blasting Powder Keg	Corrugated body, small-mouth opening with push-in bung. Approx. 10 in. diam, 12 in. high.	1890s-1910s
Boiler Water Level Site Tube	Heavy glass tube ½ inches diameter	1870s-1920

[5] A discussion of material evidence remaining from specific surface plant components can be found in Twitty, 1999a, published as the book *Riches to Rust* in 2002.

[6] Adapted from Twitty, 1999a:362-363.

Table 5.2, cont.

Carbide Drum: 25 pound	Corrugated body, wide-mouth internal thread opening. Approx. 8 in. diam, 12 in. high.	1910s-1950s
Carbide Drum: 100 pound	Corrugated body, wide-mouth internal thread opening. Approx. 12 in. diam, 20 in. high.	1910s-1950s
Drill-Steel: Hand	Hexagonal rod less than 1¼ inches diam, single blade.	1850s-1910s, 1930s
Drill-Steel: Piston Drill	Hexagonal rod 1¼-2 inches diam, star bit, round butt.	1870s-1910s
Drill-Steel: Hammer Drill, Heavy	Round rod 1¼-1½ inches diam, star bit, round butt with lugs, hollow.	1910s-1960s
Drill-Steel: Hammer Drill, Light	Square rod 1¼-1½ inches diam, star bit, square butt, hollow.	1910s-1960s
Drill-Steel: Sinker Drill	Hexagonal rod less than 1¼ inches diam, hexagonal butt with collar, hollow.	1910s-Present
Drill-Steel: Stoper Drill	Cruciform rod less than 1¼ diam, star bit, cruciform butt.	1890s-1920s
Dynamite Box	Assembled with cut nails, 18 inches long	1870s-1890
Dynamite Box	Assembled with wire nails, 18 inches long	1890-1905
Dynamite Box	Assembled with lock-corner tabs, 18 inches long, panels 3/8 inches thick.	1895-1905
Dynamite Box	Assembled with lock-corner tabs, 18 inches long, panels ½ inches thick.	1905-1960
Electrical Insulator: Porcelain	Types: Cleat, Knob, Tube, Pony	1890s-1950s
Electrical Insulator: Glass Pony	Bell-shaped, threaded socket.	1880s-1960s
Lamp: Carbide	Brass water tank, steel reflector	1910s-1950s
Lamp: Miner's Candlestick	Candle thimble, spike, hook	1870s-1910s

In a cumulative sense, the sites on the Holy Moses Vein are an archaeological representation of a significant portion of the Creede district's mining industry. The industry was tied to and dependent on a complex web of economic, political, industrial, technological, and commercial systems. The arenas of politics, commerce and the economy influenced each other, and they impacted Creede's mining industry. The mine sites on the Holy Moses Vein and East Willow Creek have the potential to provide information capable of revealing the influences of the above arenas, as well as productivity, investor confidence, the influence of geology, geographic location, and the actual application of technology and methods. Here, archival research and analysis of the sites' material evidence combine to offer a holistic perspective on the research questions posed below.

Technology and Mining Methods

1. Hardrock mining technology apparently relied on machinery, equipment, and facilities uniformly applied throughout the West. Rapid communication, widespread marketing by mine suppliers, and mobility of mine industry workers, probably caused changes and evolution of technologies on an industry-wide basis, rather than regionally. Did the inventoried operations follow technological convention during

the different times they operated? To address this question, the surface plants of the sites and periods of operation must be reconstructed based on archival information and site analysis. The operations at each site can then be compared to then-current technologies and methods.

2. A mine can be described as being like an iceberg, in which the underground workings formed the bulk of the operation, and the surface plant served as the visible cap. A surface plant, therefore, should be proportional to the complexity of the underground workings. Large, well-equipped surface plants should have served mines with extensive underground workings, and prospects should have been equipped with small, simple surface plants. Are the surface plants associated with the inventoried prospect and mine sites proportional to the underground workings? Addressing the question requires several steps. First, the surface plants for the inventoried sites must be reconstructed from site analyses and archival information. The surface plants must then be compared to the underground workings as determined from several sources. Archival data may include site descriptions, underground maps, and production figures. Second, material evidence in the form of waste rock dumps can reflect the extent of underground workings, with large dumps representing extensive workings. Third, the presence of ore storage facilities or transportation systems intended to handle high volumes of payrock can reflect extensive workings. Last, the presence of multiple mine openings are typical of mines with significant workings.
3. Prospect outfits tended to install surface plants consisting of what engineers knew as *temporary-class* facilities, which were simple, portable, inexpensive, and labor-intensive. Prospect operations did so to minimize capital expenditures until they proved the existence of ore. On the other hand, mining companies with proven ore reserves erected what engineers knew as *production-class* surface plants to facilitate ore production in high volumes while minimizing operating costs. Large mines erected advanced production-class plants capable of handling great tonnages of ore. Mining engineers defined the duty classification of many surface plant components, which are discussed in the historical context. Do the inventoried sites follow the trends of temporary-class and production-class surface plants for mines and prospects? If not, why? To address the question, surface plant components must be determined based on material evidence, and the surface plants reconstructed. The natures of the surface plants can then be compared to the type of operation.
4. Profitable, heavily capitalized mining companies usually relied on technology to permit workers to maximize ore production. The complexities of applying advanced technology exceeded the capacity of most mine workers, and as a result these companies required the services of mining engineers. Marginally productive mines employed engineers with limited education and experience, while large, profitable companies employed well-trained engineers. What does the spectrum of inventoried sites reflect about the expertise of engineers? Archival information may feature passages for engineering or engineers. Otherwise, the surface plants of the inventoried sites must be analyzed to determine trends regarding engineering. Generally, trained engineers were apt and able to apply advanced, complex technologies, which manifest as certain surface plant components. Engineers with limited experience tended to follow convention, and were able to contrive relatively simple surface plant facilities.

5. Mining in the West featured a workforce consisting of different ethnicities. Did any ethnicities influence the way surface plant facilities were constructed, equipped, and organized among the inventoried sites? For example, Italians and Cornish were known to use rock as construction materials, rather than wood. The Cornish favored the use of Cornish pumps to de-water mine workings, which were installed adjacent to shafts. American, Cornish, British, and German engineers were known for systematic development of properties, while Mexican miners tended to follow ore bodies and extract payrock as they encountered it. Discerning the above characteristics, as well as other surface plant components that deviated from convention can suggest the influence of ethnicities.
6. Popular mining history suggests that electricity had a significant impact on the West's mining industry, especially in the Rocky Mountains, by the 1890s. To what degree did electricity impact mining on the Holy Moses Vein? How extensively was electricity applied, and what was the power source used for? When did electricity actually become popular? To chart trends regarding the impact of electricity, first its application must be determined for each site. Archival records may document the use of the power source, which must be confirmed by material evidence. Artifacts such as electrical insulators, electrical wire, light fixtures, and motor parts represent the use of electricity. Determining exactly how electricity was used requires the analysis of machine foundations and mechanical artifacts. Motors and motor-driven machinery required foundations with specific footprints, and they also left telltale machine parts such as drive pulleys and canvas belt remnants. The presence of large switch panels that accommodated complex fuse and switch assemblies also represents the use of electricity to power machinery. Last, the presence of large machines, represented by foundations, in combination with the absence of evidence of steam-power, can reflect the use of electricity.
7. Popular mining history indicates that the hardrock mining industry celebrated the rockdrill, which miners used to bore blast-holes. Further, many historians indicate that the rockdrill was widely embraced and universally accepted during the 1880s because it increased production. To what degree were rockdrills actually employed on the Holy Moses Vein and East Willow Creek, and what types of operations used the machines? Analysis of industrial artifact assemblages and machine foundations can determine which mining operations relied on rockdrills. Foundations specific to compressors, compressed air pipes extending underground, and items such as drill-steels and air hoses reflect the use of rockdrills. Archival information may include passages to the use of such machinery.
8. Shops were critical surface plant components where blacksmiths, machinists, and carpenters maintained and manufactured tools, and manufactured hardware and woodwork. Small mines and prospects had simple needs, while large, profitable mines required shops capable of handling a high volume of work and specialized tasks. Did the inventoried mines and prospects feature shops concurrent with the needs of the operation? How were the shops equipped? Archival information rarely discusses the nature of a specific mine's shop facilities, leaving a site's material evidence as the prime body of data. Shop size can be determined from standing structures or from building platforms in cases where structures no longer exist. Ascertaining how a shop was equipped can be accomplished by examining the

features and artifacts associated with the shop building or the shop platform. Some shop appliances, such as drill-steel sharpening machines and lathes, left specific foundations. Forges left distinct mounds of fine gravel impregnated with anthracite coal. Machine parts such as drive pulleys and canvas drive belt remnants, and insulators, reflect the use of power appliances. Forge-cut iron scraps and cut pipe scraps can exhibit characteristics of machining or hand-work. The nature of the shop can then be contrasted against the overall mining operation.

Economics, Finance, and Ore Production

9 Mining in the Creede district was a function of the price of silver. Due to political decisions and overproduction, the price of silver plummeted in 1893, precipitating the great Silver Crash and subsequent economic depression. Silver attained an all-time low price, forcing mines throughout the West to close and bringing a halt to prospecting for new ore bodies. The price of silver increased briefly in 1922 with the signing of the Pittman Act, and in 1934 with the establishment of the Silver Purchase Act. How did these trends manifest among the mines and prospects on the Holy Moses Vein and East Willow Creek? The operating timeframes of the inventoried sites must be determined through archival research and the analysis of material evidence, then compared to the district's cycles of boom and bust. The most important material evidence capable of determining when a mine operated consists of dateable structural, industrial, and domestic refuse. In some cases, identifying the presence of specific machines, represented by foundations, can also denote periods of operation.

10. In addition to silver, Creede's mines were rich with industrial metal ores that included lead and zinc. The markets for these metals followed slightly different trends than that of silver. The demand for lead and zinc increased around 1900 and soared during World War I. The demand slowed during the early 1920s, increased, and collapsed during the Great Depression. Lead and zinc became strategic metals during World War II, and the heavy need stimulated an interest in these ores. The market slowed after the war, and increased again during the 1950s. Do the inventoried sites reflect these market trends? To address the question, not only do the operating timeframes of the mines need to be determined, but also the type of ore mined should be identified. Dateable artifacts and archival research can identify when the inventoried mines operated, and archival research and examination of mineral specimens can suggest the type of ore miners sought.

11. Capitalists were usually interested in acquiring properties that offered a significant potential for ore at least, and proven ore reserves at best. Did a strong alliance exist between the profitable mines and powerful capitalists? Were mines equipped with advanced surface plants associated economically and in terms of ownership with wealthy capitalists? Were the inventoried prospects allied with investors of limited means? The first step to identifying such trends requires determining which mines were productive, and the degree of productivity. In general, mines with well-developed surface plants were usually productive. To confirm production, the surface plant remnants existing today must feature evidence of ore storage facilities. Second,

archival materials often chronicle production for many large and small operations, and they may note associated investors.

12. Since equipping and developing a mine was a function of capital, were the inventoried mine sites poorly equipped during the capital-scarce times of the Great Depression? Productive mines were often worked sporadically over the course of decades, leaving a spectrum of material evidence. Surface plant features and artifacts must first be attributed to a site's various operators, and changes to the surface plant determined. Surface plant components and artifacts isolated to the Depression-era can then be interpreted in terms of capital investment and investor confidence.
13. Many capitalists that owned mines with proven ore reserves were interested in realizing maximum profits in minimal time, and with minimal costs. Following the advice of engineers, capitalists tended to equip proven mines with production-class surface plants that achieved production in economies of scale while minimizing operating costs, usually in the forms of energy consumption and labor. Were the surface plants of the productive operations on the Holy Moses Vein and East Willow Creek equipped to produce ore in economies of scale? To what degree were the mines mechanized? The constitution of the sites' surface plants must first be reconstructed based on material evidence and archival research. In general, large surface plants and mines with multiple openings were intended to facilitate the flow of high volumes of ore, and certain surface plant components represent ore production in economies of scale.
14. Archival research revealed that many of the Creede district's mines were leased by companies from property owners. When did this practice begin and why? How does the leasing system manifest in terms of material evidence? Lessees tended to invest little in a given property for a few important reasons. First, lessees often suffered from limited capital reserves, which they prioritized toward meeting immediate needs and not toward long-term goals, such as property improvements. Second, lessees focused their time on profitable work rather than on erecting and maintaining facilities. Last, since leases were for a finite period of time, lessees were beholden to themselves and not to the mine they worked. As a result, to minimize financial investment and time, they used salvaged and substandard materials and equipment, which should manifest in the remnants of the inventoried mines' surface plants.
15. In most cases, mines that produced ore required ore storage facilities amid their surface plants. Further, highly productive mines usually included a facility to separate waste from metalliferous material, either manually or mechanically. The lack of an ore storage facility can define an underground operation as a *deep prospect*. Do the mines and prospects on the Holy Moses Vein and East Willow Creek exhibit these characteristics? Material evidence, such as structure remnants, can be used to reconstruct the surface plants of the inventoried sites, and illustrate whether they featured ore storage facilities. Mines determined, by material evidence, to be productive can then be compared to findings based on archival research.

Geology

16. Geology directly impacted how a property was developed. According to conventional engineering, steep slopes, high topographical relief, and horizontally oriented ore bodies favored development through tunnels and adits, while relatively flat terrain and vertically oriented ore bodies favored development through shafts. Do the inventoried sites follow this trend? Site examination can determine which operations relied on shafts as points of entry underground and which relied on adits. The assemblage of sites can then be viewed in the contexts of the region's topography and the geology of ore bodies.

Geographic Location

17. The geographic location of a property may have influenced to what degree it was equipped and developed. In this context, properties close to improved transportation arteries should have required less capital and were more profitable because importing materials and exporting ore cost less. Not only did a remote location prove to be an economic impediment, but also rough terrain probably governed the types and sizes of materials and equipment hauled to the site. Were the easily accessed mines and prospects on the Holy Moses Vein and East Willow Creek better-equipped and more developed than those in inaccessible, remote locations? The answer to this question can be derived from the analysis of material evidence. Sites close to improved transportation systems should exhibit characteristics of well-equipped surface plants, and a wastefulness of materials. Distant sites should be equipped to a lesser degree, and possess fewer artifacts, as materials were re-used. Two exceptions may manifest, however. Distant sites with a high potential for productivity may feature specialized transportation systems specifically equipped to maximize production, such as aerial tramways. They also may have employed electricity, which was a power source easily wired over hostile terrain.
18. Building materials and machinery cost more to transport to remote locations than to easily accessed properties. Did the remote operations on the Holy Moses Vein and East Willow Creek rely heavily on local materials to minimize costs? Trends regarding the use of building materials can be ascertained by the analysis of structures and structural remnants. The use of materials must be viewed in the context of the expansion of transportation networks.
19. Properties close to commercial and economic centers, such as settlements, often received greater publicity and were easier to promote than those in remote locations. Therefore, proximal properties were likely to hold the interest of capitalists. Are the inventoried sites closest to the towns of Creede and North Creede allied with prominent capitalists, while the farthest sites allied with capitalists of modest means? Archival research can determine which mines were allied with wealthy capitalists, and investors of modest means. The assemblage of sites can then be examined in terms of their geographic location.

Physical Climate

20. The physical climate had the potential for a significant impact on the composition and arrangement of surface plants, and when a property was operated. Investors expected productive mines to operate throughout the year. Therefore, in harsh climates such as in the Creede district, critical surface plant components had to be sheltered in heated buildings and the components arranged closely together. Prospect outfits, on the other hand, may have worked their properties on a seasonal basis. Because of this, and a lack of capital, the critical plant components were not buttressed against adverse weather. How did mining and prospect companies adapt their operations to the climate? Based on material evidence in the forms of structures, building platforms, machine foundations, and activity areas, the spatial arrangement of the sites' surface plants can be ascertained.
21. Large, productive mines were usually active throughout the year to maintain profitability, and so had to be accessed at all times to permit the input of supplies and output of ore. How did profitable companies facilitate the input of supplies and the output of ore? How did prospect operations respond? The transportation systems used by mining companies manifest as pack trails, roads, railroads, and aerial tramways. The viability of each system depended on the topography, distance, and quality of construction.
22. Inclement weather, especially snow and extreme cold, governed whether workers could commute to a mine or prospect from a distant residence. Given the above, how did mining companies and prospect operations ensure the availability of a workforce? This question provides a transition from the topic of mining technology to that of residential occupation. Examining sites for evidence of residential occupation should reflect whether workers lived on- or off-site. Evidence manifests as building platforms featuring assemblages of domestic artifacts.

Ore Concentration

23. Some large mines erected mills on-site to treat ores that miners brought to daylight. Converting silver into ore into refined metal required first physical crushing, concentration where metalliferous material was separated from waste known as *gangue*, followed by smelting. In some cases, roasting was required prior to concentration. Did the large mines on the Holy Moses Vein erect mills capable of refining ore into silver bullion? If not, what was the nature of the mills? The answer can be derived from the combination of archival research and examination of the material evidence on-site. Archival materials may indicate what type of facility a mill was, and the processes employed. The analysis of the material evidence can accomplish the same, confirming or denying archival information. Of note, facilities that converted ore into refined bullion should feature evidence of smelting in the forms of slag, furnace remnants, and fuel residue dumps of significant volume.
24. During the 1870s and 1880s geologists, assayers, and millmen experimented with a variety of concentration processes for silver ores found in the San Juan Mountains. By the 1890s the mining industry found that a few processes proved effective, with regional variations adapted to the ores of specific mining districts. What were the

processes used to concentrate the ores mined from the Holy Moses Vein? Were these processes effective for ores from elsewhere in the Creede district? In many cases, the adaptation of ore concentration processes was noteworthy enough to warrant documentation. Therefore, archival research can play heavily into answering these questions. However, the details of how specific mills were engineered and equipped may not have been documented, leaving site analyses as the other key source of information to determine trends regarding milling.

25. The concentration of silver ores required different processes than those of gold ores. Since the Creede district's mines extracted silver ores, any mills present should have employed processes known for their success with such material. Did the mills associated with the sites on the Holy Moses Vein and East Willow Creek in fact employ processes and engineering specific to silver ores? First, archival information and site analysis can determine which mines extracted silver ore, and which ones featured mills. The same sources can then be used to determine the processes employed by each mill.
26. Some large, profitable mining companies employed a vertical integration strategy in which ore was not only extracted, but processed in-house to prevent profits from going to independent mills. Did the profitable mines on the Holy Moses Vein employ such vertical integration? To address the question, archival research is necessary to first identify the most profitable mines. Archival research can then be used to determine whether these operations also featured ore concentration mills. Last, site analysis must be employed to confirm whether the operations in fact featured concentration mills.
27. The 1890s saw a shift in the nature of the silver ore mining companies produced. Improvements in engineering and technology, and a greater affordability of machinery permitted companies to extract ores of previously uneconomical grades. How does this trend manifest in milling features on the Holy Moses Vein and East Willow Creek?

Research Domain: Residential Occupation

The second category of research questions pertains to residential occupation associated with the mine and prospect sites on the Holy Moses Vein and East Willow Creek. Many of the sites featured associated residential complexes where miners and prospectors lived. When intact, complexes usually consisted of one or more residential buildings, associated privies, refuse dumps, and activity areas. As with the surface plants that supported activity at the mines, the residential materials and items of value were quickly removed following a property's abandonment. However, much currently remains capable of conveying information regarding social issues and the nature of residential occupation. Structural materials, foundations, and graded platforms clearly represent the types, sizes, and arrangements of buildings. The consumption of goods and food, and disposal of unwanted items, generated assemblages of artifacts that reflect trends regarding the nature of the sites' residents.

The artifacts associated with residential complexes are a direct reflection of the natures of the populations, and when the complexes were occupied. Important aspects poorly documented in archival material pertaining to a site's residents, such as gender, ethnicity, socio-economic status, household, diet, and health are often represented by the refuse and other items left after a site was abandoned. Artifacts can be viewed as occurring in three principal types of deposits. First are items associated with structural features and activity areas. Second are refuse dumps, and third are privy pits. Refuse dumps and privy pits represent primitive organized disposal practices. At many residential complexes associated with mines, refuse dumps often possess little subsurface depth and are, therefore, usually surfacial. Privy pits, however, often possess depth and can contain sets of artifacts not represented on ground-surface, as privy users may have intentionally discarded items under secrecy. The testing, subsequent excavation, and analysis of privy pits can reveal important information not represented by the refuse on ground-surface. Residential features inhabited for a long time may also feature buried deposits, and those inhabited for a short time often do not. However, the only sure way to ascertain the presence of subsurface deposits lies with planned testing.

Analysis of the residential occupation of historic mine sites is more conventional than the study of mining operations. The research questions posed below are geared toward contributing to the growing body of data regarding residential occupation and social issues specific to the Creede district. The trends may be extrapolated to other metal mining districts in the mountainous West. The research questions fall into four topics, including the makeup of the populations at the sites, housing, socio-economic divisions, and diet and health.

Population Makeup

1. Large mines were operated by capitalized companies that employed crews of workers, while small mines and prospects were operated by only a few workers. Can the numbers of workers at the large mines be determined by the material evidence? If so, did all workers live on-site? Identifying the number of workers at a site can be calculated by the total floor space represented by standing structures and residential building platforms. Most workers required a minimum of 60 square feet each for bedding and possessions, and additional space for cooking and other domestic activities. Families usually required more floor space than individual workers.[7] The residential buildings' total square footage can be compared to the numbers of workers documented in archival materials.
2. Popular history suggests that single men dominated the mining industry, and few if any women except for prostitutes were present. Historical and archaeological studies of populations mining districts reveal that women were in fact present, and they served as hostlers, cooks, and maids, which were jobs Victorian society deemed acceptable for women. Did women live at the mines on the Holy Moses Vein and East Willow Creek, and if so, did they hold a greater presence at the large operations where jobs accepted by society were available? Were families present?[8] The identification of women can be determined primarily from the analysis of domestic artifact assemblages. Some types of items, such as decorative tableware, cut-glass

[7] Carrillo, 2001:6; Hardesty, 1988:13; Mehls, et al:1995 present similar research hypotheses and sources of data. In Curtiss, 2001:23, Bureau of Land Management archaeologist Julie Coleman Fike presents a similar question.

[8] Mehls, et al:1995, Curtiss, 2001, and Carrillo, 2001 present similar research hypotheses and sources of data. Ringhoff, 2002 discusses the presence of families amid Hinsdale County's mines.

fragments, and other decorative artifacts, suggest the presence of women, while other items, such as women's boot remnants and corset parts, directly represent their presence.[9] In addition, archival information may feature documentation of women at certain properties.

3. Little is currently known about the ethnic makeup of Creede's workforce. Popular literature indicates that the workforce across the mountainous West was highly mobile and comprised of European ethnicities including Slavs, Italians, Irish, British, Canadians, Germans, and Swedes, among others.[10] Other ethnicities were also present in the mining industry, but to a lesser degree due to segregation. Such ethnicities include Hispanics, Chinese, and Native Americans. Do the inventoried mine and prospect sites reflect the presence of ethnicities, and if so, what occupations did they hold?[11] Determining the presence of ethnicities is a difficult proposition, and can be accomplished through the analysis of structural remnants, artifact analysis, and archival research. Ethnic groups different from the Euro-American culture that dominated hardrock mining, such as Chinese, Hispanics, and Native Americans, had the potential to leave distinct artifacts and material use patterns. However, European and American ethnic groups shared similar cultural aspects in terms of household, diet, consumer goods, and dress. In this light, the material evidence left by European ethnic groups appears similar to that left by American groups, however, some differences can be ciphered out of artifact assemblages. European ethnic groups may have preferred familiar European consumer goods and foods, which may by represented by bottled goods, types of meat, tablewares, and other items. In addition, some groups may also have employed traditional construction practices, such as the propensity of Italians to erect rockwork foundations, walls, and structures.

<u>Housing</u>

4. In many cases, well-capitalized mining companies provided housing for work crews. Studies of historic mine sites in Colorado revealed that companies distant from independent settlements erected boardinghouses for crews, while mines near settlements did not offer housing because the workers preferred to live in independent settlements. Do the mines and prospects on the Holy Moses Vein and East Willow Creek follow this trend? If so, why? The inventoried sites can be analyzed to ascertain whether they included residential complexes, and how many workers lived on-site. The assemblage of sites with and without associated residences can be viewed in terms of their geographic location relative to independent settlements.
5. To ensure the presence of a workforce, capitalized mining companies attempted to strike a balance between providing a tolerable living environment while investing minimal capital on housing. Do the residential buildings among the inventoried sites reflect this trend? Did the capitalized companies provide housing superior to that at small mines? Did the housing of the above differ from the accommodations at prospect operations? Based on material evidence, the natures of residential buildings

[9] Carrillo, 2001:6; Hardesty, 1988:77.

[10] Discussed in Wyman, 1989, and other works on the histories of specific regions.

[11] Carrillo, 2001 discusses a possible link between ethnicity and socio-economic status, and how both manifest in the archaeological record. In Curtiss, 2001:23, Bureau of Land Management archaeologist Julie Coleman Fike presents similar questions, and Ringhoff, 2002 discusses identifying cultural identity through material evidence.

can be reconstructed, in the event sites lack standing architecture. The structural remnants and associated artifacts can be analyzed to determine whether housing featured amenities such as electric lighting, plumbing, abundant space, and adequate heat.

6. The Creede district's mining industry was subjected to boom and bust cycles. Large and productive mines experienced periodic activity, while unprofitable prospects generally closed after failure. Do the settlements follow the trends of boom and bust of their associated mines? Do the settlements mirror the periods of activity of their associated mines? First, the date ranges of occupation must be determined through dateable domestic artifacts. Second, the dates of occupation can then be compared to when the associated mine operated, as determined from analysis of industrial and structural artifacts, and archival information.
7. The popularization of the automobile in the 1930s offered workers the potential to commute from distant residences. During this time and afterward, did workers on the Holy Moses Vein and East Willow Creek in fact rely on automobiles to commute from distant residences? To answer this question, the residential complexes associated with the inventoried sites must be analyzed to establish their dates of occupation. The dates of occupation can then be compared to when the mine operated, as determined through the examination of structural and industrial artifacts and features, and archival information.

Socio-Economic Status

8. Popular literature indicates that large mines, like factories, were staffed by a socially stratified workforce.[12] Does the material evidence at the mines on the Holy Moses Vein and East Willow Creek reflect a difference between the socio-economic status of laborers and management? Did management live separately from the workers? Does a correlation between ethnicities and socio-economic status exist?[13] Addressing such questions requires several steps. First, the artifact assemblages associated with each feature representing a residence at a given mine must be analyzed in terms of socio-economic indicators. Artifact assemblages attributed to relatively high status could include high quantities of decorative items, butchered bones left over from costly cuts of meat, evidence of expensive, fine goods, and items consumed as benchmarks of status. The reverse would be true of artifact assemblages attributed to a low status. The artifact assemblages attributed to workers should include slightly different items than those attributed to management. Mine workers generated refuse in the forms of heavy boots, lunchpails, candlesticks, miners' felt hats, and other durable articles. The artifact assemblages of each feature representing a residence can then be compared. In the event a site offers standing architecture, the residences of management may feature amenities, greater space, and a location away from the mine surface plant. Last, the artifact assemblages can be analyzed to ascertain ethnic groups.
9. Little is known about the socio-economic status of the crews that worked prospect operations. Does the material culture reflect the status of workers at unproductive

[12] Discussed in Wyman, 1989, among other sources.

[13] Curtiss, 1998, and Mehls, 1995 present similar research hypotheses and sources of data.

prospect operations? The artifact assemblages and structural features of the residential complexes at the prospect sites can be analyzed in terms of socio-economic status.

Diet and Health

10. The improvement of transportation systems in the Creede district potentially increased the variety of available goods while lowering costs. Were the diets of residents different during the district's initial boom period from those of workers in the wake of improved transportation?[14] First, the dates of a site's residential occupation must be established based on dateable artifacts. Afterward, diet can then be determined by artifact analysis. Items suggestive of diet include types and quantities of food cans, butchered bones, fruit pits, nut shells, kitchen utensils, and bottle fragments.
11. Popular history suggests that miners ate a poor diet based on canned food. Does this assumption hold true for prospect operations? Does it hold true for the crews of productive mines? If not, why? What did the typical diet at each type of operation consist of? Diet can be determined by artifact analysis. Items suggestive of diet include types and quantities of food cans, butchered bones, fruit pits, nut shells, kitchen utensils, and bottle fragments.
12. Many European-based ethnicities were employed in the mining West, and they retained some cultural traditions, including a preference for certain foods and consumer goods. Does the material evidence at the inventoried prospect operations and mines reflect the presence of ethnicities identified by certain foods? Some ethnic foods involved imported bottled goods and types of meat, which may be represented in the artifact assemblages associated with residential complexes.
13. Popular history portrays mine workers as living in the clutches of vices such as a heavy consumption of alcoholic beverages and tobacco. Does the material evidence support this assumption?[15] Did workers at prospect operations consume more or less liquor than those employed by organized mining companies? What factors possibly account for the trend? The analysis of the artifact assemblages associated with residential complexes has the capacity to reflect the degree of consumption of substances of pleasure. Liquor and beer bottle fragments, and earthenware jug fragments, represent the consumption of alcoholic beverages. Tobacco tins and cans indicate the use of tobacco, and medicine bottles and vials may suggest the recreational use of drugs. The quantity of vessels compared with the number of individuals, represented by residential building floor space, and compared with the density of other domestic items such as food cans, suggests the degree of consumption of substances of pleasure.
14. How does the material evidence reflect the health of workers? What diseases were present?[16] Water-born pathogens were poorly understood, and food preservation was

[14] Mehls, et al:1995 and Curtiss, 2001:23 present similar research hypotheses and sources of data.
[15] Mehls, et al:1995 discusses the "mythic portrayal" of mine workers and heavy alcohol and tobacco consumption, and the use of material evidence to represent actual trends.
[16] In Curtiss, 2001, Bureau of Land Management archaeologist Julie Coleman Fike presents a similar question.

difficult and also poorly understood, fostering an environment for gastro-intestinal diseases. Are these represented by the material evidence? Was there a high degree of mining industry-specific illnesses, such as silicosis and injury? The use of mechanical rockdrills were attributed to the rapid development of silicosis. Does the material evidence reflect a high rate of silicosis among the crews of mines that employed rockdrills? The artifact assemblages associated with residential complexes can offer evidence suggestive of treatments for illnesses. Often, medicine bottles were embossed with product or product manufacturer names, which reflect a general category of ailment. Pill, salve, and bandage tins also reflect the treatment of ailments and physical injuries. Some medicines were intended for respiratory problems, and a few were marketed specifically for what was known as *miner's consumption*, the dreaded silicosis. Mines known to have employed rockdrills may feature evidence of the use of respiratory medicines.

Project-Specific Research Questions

The mine, prospect, and associated settlement sites on the Holy Moses Vein and East Willow Creek offer an excellent opportunity to study a significant portion of the Creede district's mining industry. While the sites feature a wealth of archival and material evidence, they may not be capable of addressing the entire list of research questions posed above. Therefore, some of the most pertinent questions are selected from the research domains of mining and milling operations, and residential occupation. The questions, hypotheses, and sources of data, presented in abbreviated form below, are the same as those listed above. Addressing the research questions requires analyzing each inventoried site separately, as well as cumulatively.

Research Domain: Mining and Milling Operations

1. Did the inventoried operations follow technological convention during the different times they operated?
2. Are the surface plants associated with the inventoried prospect and mine sites proportional to the underground workings?
3. Do the inventoried sites follow the trends of temporary-class and production-class surface plants for mines and prospects? If not, why?
4. What does the spectrum of inventoried sites reflect about the expertise of engineers?
6. To what degree did electricity impact mining on the Holy Moses Vein? How extensively was electricity applied, and what was the power source used for? When did electricity actually become popular?
7. To what degree were rockdrills actually employed on the Holy Moses Vein and East Willow Creek, and what types of operations used the machines?
8. Did the inventoried mines and prospects feature shops concurrent with the needs of the operation? How were the shops equipped?
9. Did the mines and prospects on the Holy Moses Vein and East Willow Creek follow trends regarding fluctuations in the price of silver?

11. Did a strong alliance exist between the profitable mines and powerful capitalists? Were mines equipped with advanced surface plants associated economically and in terms of ownership with wealthy capitalists? Were the inventoried prospects allied with investors of limited means?
14. Archival research revealed that many of the Creede district's mines were leased by companies from property owners. When did this practice begin and why? How does the leasing system manifest in terms of material evidence?
17. Were the easily accessed mines and prospects on the Holy Moses Vein and East Willow Creek better-equipped and more developed than those in inaccessible, remote locations?
18. Did the remote operations on the Holy Moses Vein and East Willow Creek rely heavily on local materials to minimize costs?
21. How did profitable companies facilitate the input of supplies and the output of ore? How did prospect operations respond?
23. Did the large mines on the Holy Moses Vein erect mills capable of refining ore into silver bullion? If not, what was the nature of the mills?

Research Domain: Residential Occupation

1. Can the numbers of workers at the large mines be determined by the material evidence? If so, did all workers live on-site?
2. Did women live at the mines on the Holy Moses Vein and East Willow Creek, and if so, did they hold a greater presence at the large operations where jobs accepted by society were available? Were families present?
3. Do the inventoried mine and prospect sites reflect the presence of ethnicities, and if so, what occupations did they hold?
5. To ensure the presence of a workforce, capitalized mining companies attempted to strike a balance between providing a tolerable living environment while investing minimal capital on housing. Do the residential buildings among the inventoried sites reflect this trend? Did the capitalized companies provide housing superior to that at small mines? Did the housing of the above differ from the accommodations at prospect operations?
7. The popularization of the automobile in the 1930s offered workers the potential to commute from distant residences. During this time and afterward, did workers on the Holy Moses Vein and East Willow Creek in fact rely on automobiles to commute from distant residences?
8. Does the material evidence at the mines on the Holy Moses Vein and East Willow Creek reflect a difference between the socio-economic status of laborers and management? Did management live separately from the workers?
10. Popular history suggests that miners ate a poor diet based on canned food. Does this assumption hold true for prospect operations? Does it hold true for the crews of productive mines? If not, why? What did the typical diet at each type of operation consist of?
11. Were the diets of residents different during the district's initial boom period from those of workers in the wake of improved transportation?

12. Does the material evidence at the inventoried prospect operations and mines reflect the presence of ethnicities identified by certain foods?
13. Popular history portrays mine workers as living in the clutches of vices such as a heavy consumption of alcoholic beverages and tobacco. Does the material evidence support this assumption?[17] Did workers at prospect operations consume more or less liquor than those employed by organized mining companies? What factors possibly account for the trend?
14. How does the material evidence reflect the health of workers? What diseases were present? Water-born pathogens were poorly understood, and food preservation was difficult and also poorly understood, fostering an environment for gastro-intestinal diseases. Are these represented by the material evidence?

[17] Mehls, et al:1995 discusses the "mythic portrayal" of mine workers and heavy alcohol and tobacco consumption, and the use of material evidence to represent actual trends.

CHAPTER 6 RESEARCH METHODS

Archival Research

Prior to the initiation of fieldwork, Mountain States Historical conducted extensive archival research to obtain information pertaining to the operators, the owners, the miners, and the physical makeup of the historic mines. Mountain States Historical examined archives and publications at the Colorado School of Mines, the U.S. Geological Survey, the Archives at Norlin Library on the CU Boulder campus, the Colorado Historical Society's Stephen S. Hart Library, Colorado State Archives Mine Inspectors' Reports, Denver Public Library, and Boulder Public Library. Only a paucity of information was found on the Creede district in general, and less was located on the specific mine sites. The most informative reference sources included geological reports, general histories of the Creede district, Sanborn insurance maps, and district summaries in the *Engineering & Mining Journal* and *Mining & Scientific Press*.

Field Methods

Each mine complex was defined as the archaeological features, standing structures, and artifacts directly associated with a particular shaft, tunnel, or adit. Historically, these collections of facilities supported work underground, and the mining industry recognized them as a *surface plant*. Some of the sites also included directly associated residential complexes where mine crews resided.

The surface plants and residential complexes associated with the principal historic mine sites on the Holy Moses Vein were recorded in a manner surpassing the *Class III* procedures defined by the U.S. Department of the Interior and by the Colorado State Historic Preservation Office. Mountain States Historical *recorded* each site with the intent of gathering sufficient information to reconstruct and interpret the histories of the mining operations and their residents. First, the surface plants and associated residential complexes were identified. The remains, documented individually as *features*, ranged from physical evidence suggesting the former existence of a plant facility or activity area to standing structures. The mine sites and their constituent features were mapped using a pocket transit. Each feature was assigned a number, then described with text. The artifacts associated with each feature were tabulated with the descriptions. Artifacts were noted for ethnic, gender, and socio-economic attributes, as well as dateable characteristics. Standing structures were subjected to additional documentation including scaled floor plans, Historic Architecture and Building Survey forms, and photography of the exteriors, and when appropriate, the interiors. Overview photographs were taken of each site for context. Where possible, archival data was consulted to help guide examination and interpretation of the remains encountered at the mine sites.

CHAPTER 7 SITE SUMMARIES AND ANALYSES

Chapter 7 consists of summaries of the principal historic mines and selected prospects recorded on East Willow Creek. Archival information and field data have been interwoven to produce complete histories of each operation, and each summary is concluded with an analysis and interpretation. The timeframes of activities and occupations of the sites was developed from both archival research and the analysis of dateable artifacts. Archival references are footnoted, while the dateable artifacts are merely noted in the chapter's text. Appendix I includes tables of the dateable artifacts for each site, and references. Each site features a plan view illustrating the associated features as they appear today. The plan views show the scale in feet, and the reader should refer to the Master Legend, included in the first pages of the report, for an interpretation of the symbols used on the maps.

Carbonate Tunnel
Site 5ML350

The Carbonate Tunnel is located on a steep slope punctuated by bedrock cliffs on the northeast spur of Campbell Mountain. While all of the associated structures and equipment were removed long ago, the site retains a high degree of historical integrity and ambiance. Archaeological remains in the forms of an adit, a waste rock dump, a residential platform, a blacksmith workstation, prospect pits, and associated artifacts characterize the complex.

Mining Operations

The Carbonate Tunnel site represents an effort on the part of prospects to locate the fabulous Holy Moses Vein. During the Creede district's boom era, they excavated at least four prospect pits in a promising area and subsequently drove a prospect adit north into a bedrock outcrop. According to archival sources, geologists examined the Carbonate Tunnel in 1912 and found that the prospectors advanced the adit only 100 feet before abandoning operations.[1]

The existing remains of the Carbonate Tunnel site reflect the geologists' 1912 observations. The adit's waste rock dump is relatively small, indicating that the underground workings were shallow. The prospectors erected a crude hewn log cribbing cell to retain waste rock and prevent loose material from cascading down to the valley floor below.

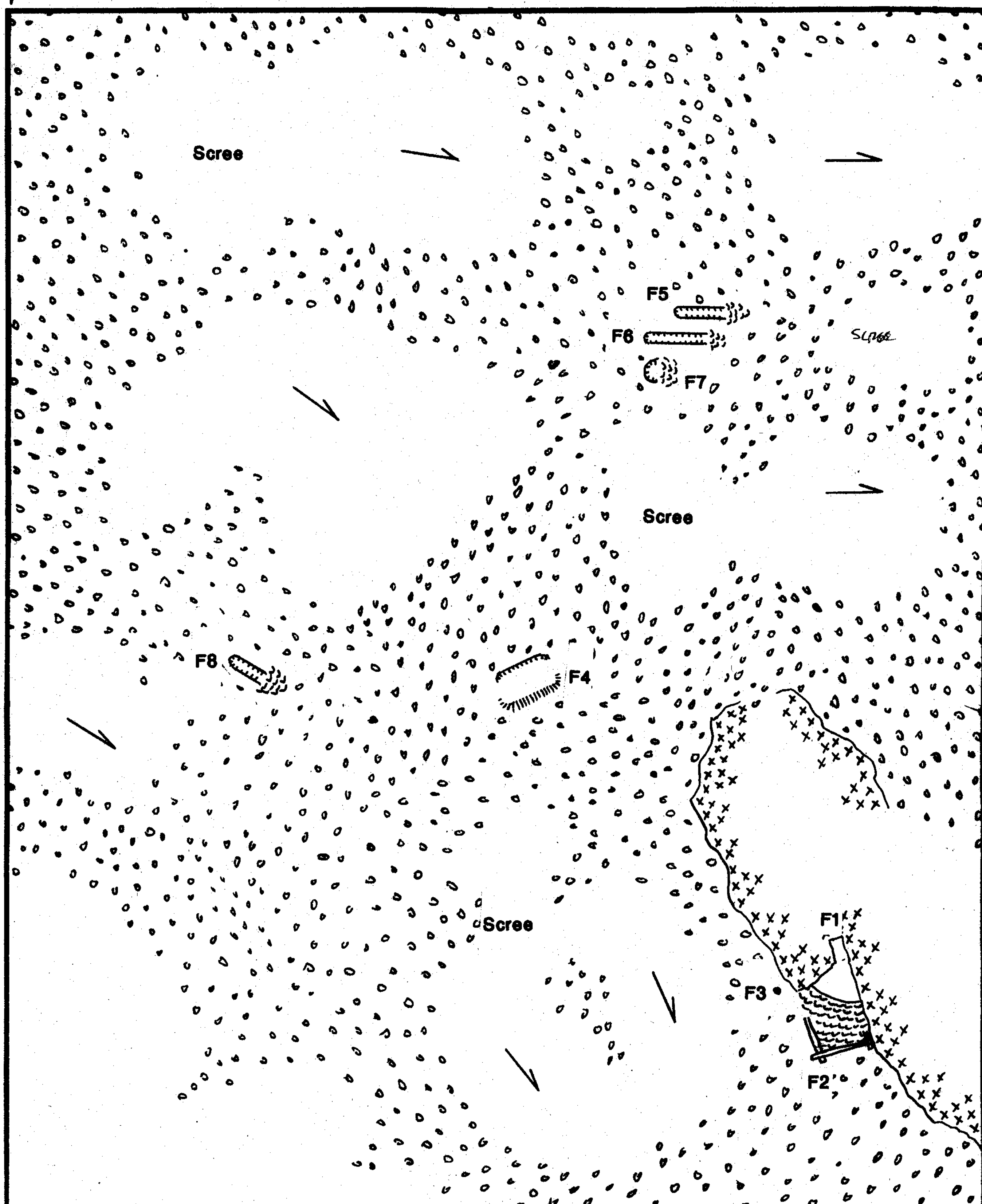
The prospectors erected a temporary-class surface plant featuring only several basic facilities. A lack of evidence of a mine rail line indicates that they transported waste rock out of the adit in wheelbarrows. The workers maintained tools at a blacksmith workstation located on the hillslope adjacent to the adit portal. They fashioned an anvil block from an in-situ tree stump, and they heated iron items in a free-standing pan forge placed adjacent. The lack of level ground indicates that the work area was small and probably an open-air affair. The stump currently remains, and no evidence of additional surface plant components exists.

[1] Emmons & Larsen, 1923:182.

CARBONATE TUNNEL
Site 5ML350
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO

N

Scale: 15 ft =



Residence

Because the Carbonate Tunnel was remote, the prospectors lived on-site. They graded a cut-and-fill platform (Feature 4) upslope from and northwest of the adit for a residential structure. The lack of structural material indicates that the platform, 8 by 12 feet in area, probably supported a residential wall tent.

The residents disposed of refuse in the manner typical of Western mining camps. They threw unwanted domestic items downslope from the tent platform, which manifests today as a sparse scatter. The artifact assemblage associated with the platform consists primarily of food cans and some bottle glass. The site lacks evidence of a privy pit, suggesting that the prospectors merely found a secluded place for personal use.

Carbonate Tunnel Site Analysis

In terms of mining operations, the Carbonate Tunnel exemplifies a typical shallow, short-lived, labor-intensive prospect operation. Overall, the remains reflect a severely limited investment of capital, yet an earnest attempt at exploring the property. The paucity of artifacts, the lack of a developed surface plant, the small waste rock dump, and shallow underground workings reflect a brief occupation. The absence of evidence of an ore storage facility reflects a lack of production. Dateable artifacts in the forms of wire nails, food cans, and bottle fragments suggest that prospectors worked the site between the early and mid-1890s.

The artifact assemblage associated with the tent platform reflects the nature of the site's residents. A single prospector may have driven the tunnel. The tent platform's square footage totaled 106. At the time the tunnel was driven, workers required at least 60 square feet of living space, not including areas for cooking, storage, and other domestic activities.[2] The presence of food cans and the absence of miscellaneous decorative domestic items represent single miners working at a remote location. The miners ate a diet similar to that consumed in other nascent Western mining districts. The food cans reflect the consumption of preserved vegetables, fruits, and meat, which was probably supplemented with grain products. A small quantity of bottle glass indicates that the inhabitants did not openly drink much liquor, consume condiments, or rely on medicines.

The artifact assemblage associated with the platform reflects a relatively brief occupation during the early to mid 1890s. Almost twice as many food cans made with lapped side seams as those made with inner-rolled and soldered side seams reflects an early to mid-1890s date. During the 1890s the canning industry phased out vessels made with lapped side seams in favor of those assembled with inner-rolled and soldered side seams. The only clearly dateable bottle fragment on-site was an applied packer finish. During the 1880s bottle makers phased out applied finishes in favor of lipping-tooled finishes. Hence, the applied finish reflects an early date.

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[2] Hardesty, 1988:13.

The Carbonate Tunnel presents an interesting case for determining the length of a prospect site's occupation based on the quantity of food vessels. According to archival information, prospectors drove the tunnel to a length of approximately 100 feet, then abandoned work.[3] Through drilling and blasting by hand, progress for driving a tunnel of the Carbonate's size, in the somewhat dense volcanic rock, averaged approximately two feet per day, or more.[4] Therefore, prospectors required between around 30 to 50 days to drive the Carbonate Tunnel. The assemblage of artifacts associated with the tent platform includes almost 30 food cans, and more vessels may have been present under scree. If a single prospector lived in the tent, then he probably consumed one can of food per day.

Holy Moses Mine
Sites 5ML104 and 5ML351

The Holy Moses Mine, located near the Holy Moses Vein's central portion, was one of the Creede district's earliest and richest metals producers. The mine consisted of a series of stopes and underground workings originally accessed through several shafts, and later by the Holy Moses Tunnel. In 1974 Lindsey Hartman recorded the Holy Moses Tunnel as Site 5ML104, and it lies on the north flank of Campbell Mountain near East Willow Creek. The shaft was recorded in conjunction with the year 2000 inventory as Site 5ML349, and it is located directly upslope. In terms of physical setting, the Holy Moses shaft complex lies on a steep slope wooded with an evergreen forest. The slope is punctuated by bedrock outcrops, and it drops off in a series of abrupt bedrock cliffs. The Holy Moses company erected an associated residential complex on a natural terrace upslope and northwest. The Holy Moses Tunnel occupies a steep scree slope overlooking East Willow Creek's canyon.

In terms of historic character, the Holy Moses shaft complex consists of the remains of a series of related shafts and stopes, an aerial tramway remnant, a residential complex, and pack trails. The Holy Moses Tunnel site encompasses the remains of a small, recently active adit operation. The shaft complex retains a high degree of historic integrity and it possesses a unique ambiance. Earth moving, mining, and adit closure activities within recent decades severely impacted the tunnel site. The shaft complex features partially intact structures and possibly archaeological deposits.

<u>Mining Operations</u>

In 1889, Nicholas C. Creede, E.R. Taylor, and G.L. Smith strayed a short distance off the Rio Grande River, one of the San Juans' most heavily traveled wagon routes, and began prospecting East Willow Creek. In May, while the snow was still melting off the north-facing slopes, they encountered notably rich specimens of silver ore in the drainage. They began systematically searching the west slopes overlooking the creek,

[3] Emmons & Larsen, 1923:182.
[4] Twitty, 2001:42.

and found a bonanza vein which ensured them great riches. In the excitement of the astonishing discovery, one of the party's members uttered the phrase "Holy Moses"! The party staked two claims, which they named after their triumphant exclamation. In an effort to realize the wealth that the vein offered, the party of prospectors interested an investment syndicate including mining and railroad magnate David H. Moffat, U.S. Army Captain L.E. Campbell, and Denver & Rio Grande Railroad general manager Sylvester T. Smith. Creede and G.L. Smith sold the claims to Moffat's group for $70,000, and Moffat began developing the property at once.[5]

The Moffat syndicate formed the Holy Moses Mining Company with L.E. Campbell serving as manager, and it hired a crew of 30 miners and workers who erected a surface plant and began extracting ore. To the Moffat syndicate's delight, the Holy Moses Vein cropped out on ground-surface, permitting miners easy and immediate access to the ore. Still, the company's engineer directed miners to sink several small shafts on the vein to develop and block out sections of the mineral body.

Although the ore was ready at hand, the vein was located on the brink of impenetrable bedrock cliffs, which discouraged easy transportation to and from the canyon floor. In response, the company elected to install an aerial tramway that moved the prized payrock almost effortlessly to a mill erected at Senator Thomas Bowen's Ridge Mine a half-mile south. In 1892 workers completed a Bleichert double rope system capable of handling 110 tons of ore per shift.[6]

While workers were completing the mine's surface facilities, miners sinking shafts on the vein struck ore that assayed at $1,000 per ton, which may have been the richest ever encountered in the Creede district. The ore declined in value to $100 per ton with depth, which was still considered to be of bonanza quality. During the year miners extracted 30 tons of payrock per day, and by 1893 they had shipped 1,100 tons.[7]

While the ore's initial quality was of epic proportions, miners discovered that it decreased significantly with depth. In addition, the vein underlying the claims had only limited quantities of ore. These factors troubled the Moffat syndicate, and before they concluded what to do about the unforeseen problems with their fabulous Holy Moses Mine, the Silver Crash of 1893 caused the market for the white metal to collapse, and the syndicate suspended operations in the wake of the resulting economic depression. When the economy recovered by the mid-1890s, the syndicate saw no reason to reopen the depleted Holy Moses Mine, and the property remained quiet for the remainder of the decade.

When the Creede district experienced a revival of mining in the late 1890s and most of the large operations boomed, the Holy Moses attracted little attention. Then, around 1900, the Second Chance Leasing Company attempted to make the mine pay once again. Because the surface facilities associated with the series of stopes and shafts on the vein were in disrepair and difficult to access, the company drove a tunnel from the flank of Campbell Mountain to intersect the old workings at depth. They drove the tunnel 1,300 feet and struck the dark and quiet stopes that held rich ore in times past. For several years the company extracted ore left by the previous operation, and sent it to the

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[5] Emmons & Larsen, 1923:3; Henderson, 1926:56; Lallies, 1892; Mumey, 1949:9, 33; Wolle, 1991:320.

[6] Emmons & Larsen, 1923:175; Mumey, 1949:33.

[7] EMJ 11/92 p470; Emmons & Larsen, 1923:175.

Soloman Mill for concentration. The Second Chance operation ceased work after several years because it mined out the profitable ore, and the Holy Moses was abandoned again.[8]

While the Creede district's other mines saw sporadic activity during the 1910s and 1920s, the Holy Moses Mine remained quiet. When President Franklin Delano Roosevelt signed the Silver Purchase Act in 1934, which boosted silver's price, many of the district's mines were examined for their production potential, including the Holy Moses. The interested party failed to find profitable ore and the Holy Moses remained idle.[9]

The post World War II boom economy fostered a heavy demand for industrial metals, and improved milling technology made low-grade ore profitable. In this context the Sublet Mining Company, consisting of 8 workers, examined several properties located on Holy Moses Vein's mid-section, including the Holy Moses in 1953. Sublet's miners felt that the mine's remaining ore might be profitable, and in 1954 began extraction through the Holy Moses Tunnel. For four years a small party of miners managed to turn a profit, and in 1958 they, like the operations before them, exhausted the payrock that was once part of one of Colorado's richest claims.[10]

Today the Holy Moses shaft and tunnel complexes (Sites 5ML351 and 5ML104) reflect the intensive activity of Moffat's mining company during the 1890s, and the work conducted by the subsequent outfits. In terms of mining operations, the shaft complex includes mine workings in the form of a series of shafts and open stopes, an upper aerial tramway terminal, remnants of the tramway system, and a cluster of bunk and boardinghouses, which are discussed under residential occupation below.

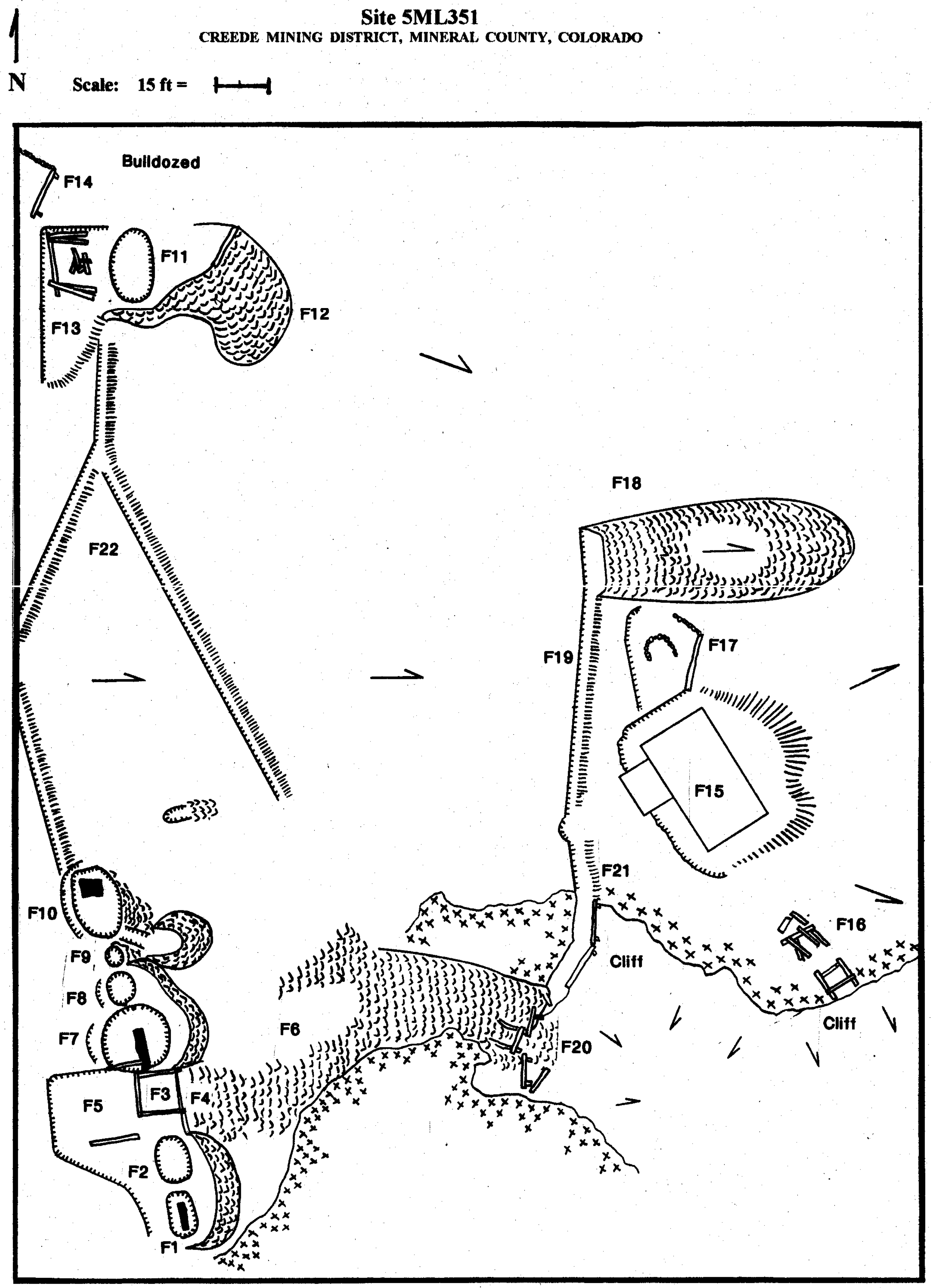
When the Holy Moses company's miners began developing the vein around 1891, material evidence existing amid the shaft complex indicates that they worked the ore body where it cropped out on ground-surface, as well as sinking several shafts to access deeper portions of the vein. The south portion of the site currently features a series of six open stopes with waste rock piled downslope. Miners generated the waste rock when they cleared overburden off the vein, and they drilled and blasted the ore downward and hauled it up in buckets. Working an ore body from the top down presented difficulties by inhibiting access and the removal of payrock, which slowed the tonnage of ore that the miners brought to daylight. Experienced mining engineers preferred to mine ore from the bottom up, and in following this convention, the Holy Moses company's miners sank a shaft on the vein near the center of the open stopes.

[8] Colorado Historical Society Records, MSS Box 640, v24:40; EMJ 9/21/01.
[9] Ratte & Steven, 1965:11.
[10] Colorado State Archives, Mine Inspectors' Reports, Box 104053: Holy Moses.

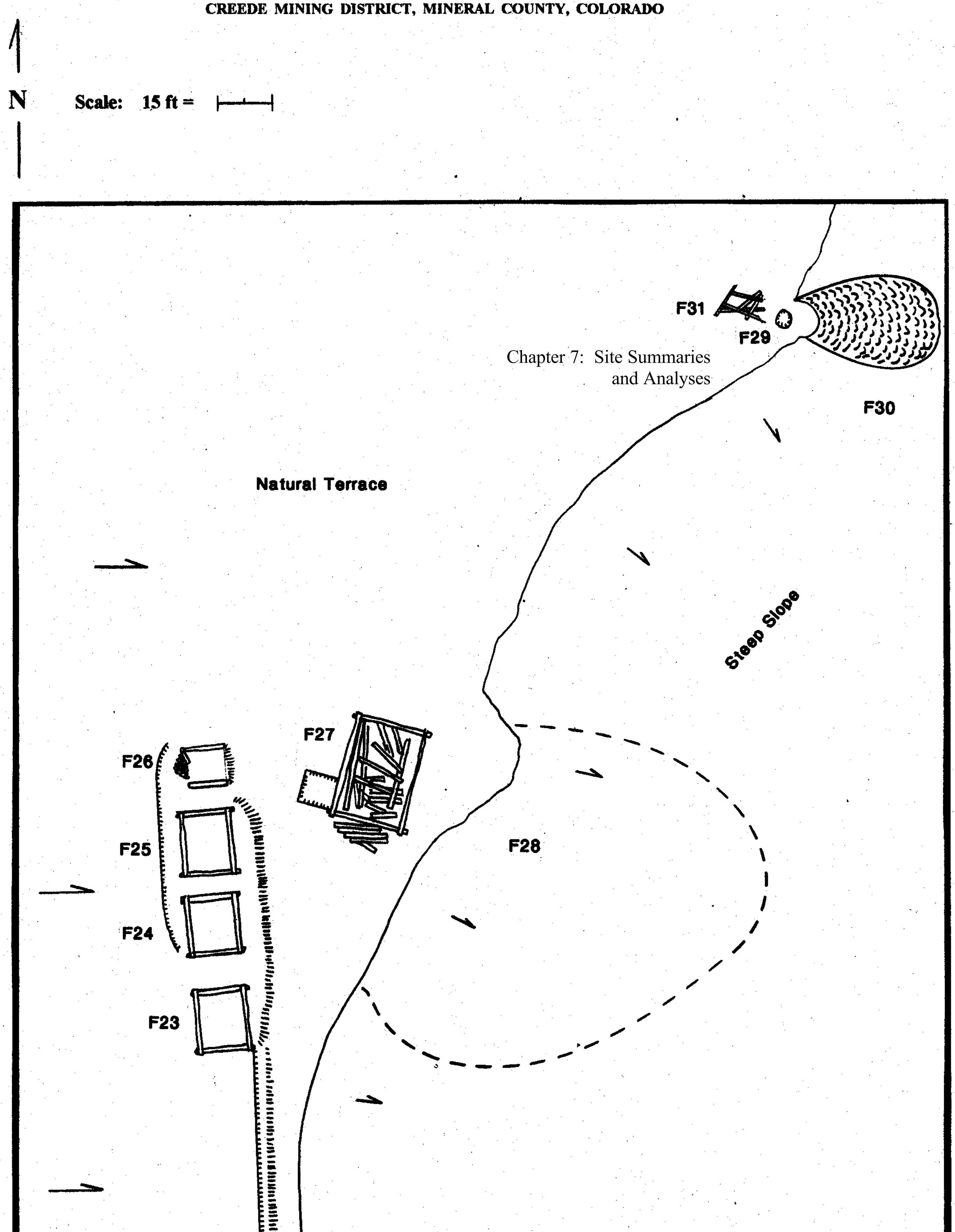
HOLY MOSES MINE: SHAFT COMPLEX

Site 5ML351

CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



HOLY MOSES MINE: RESIDENTIAL COMPLEX
Site 5ML351
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



Chapter 7: Site Summaries
and Analyses

HOLY MOSES TUNNEL
Site 5ML104
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO

N

Scale: 15 ft =

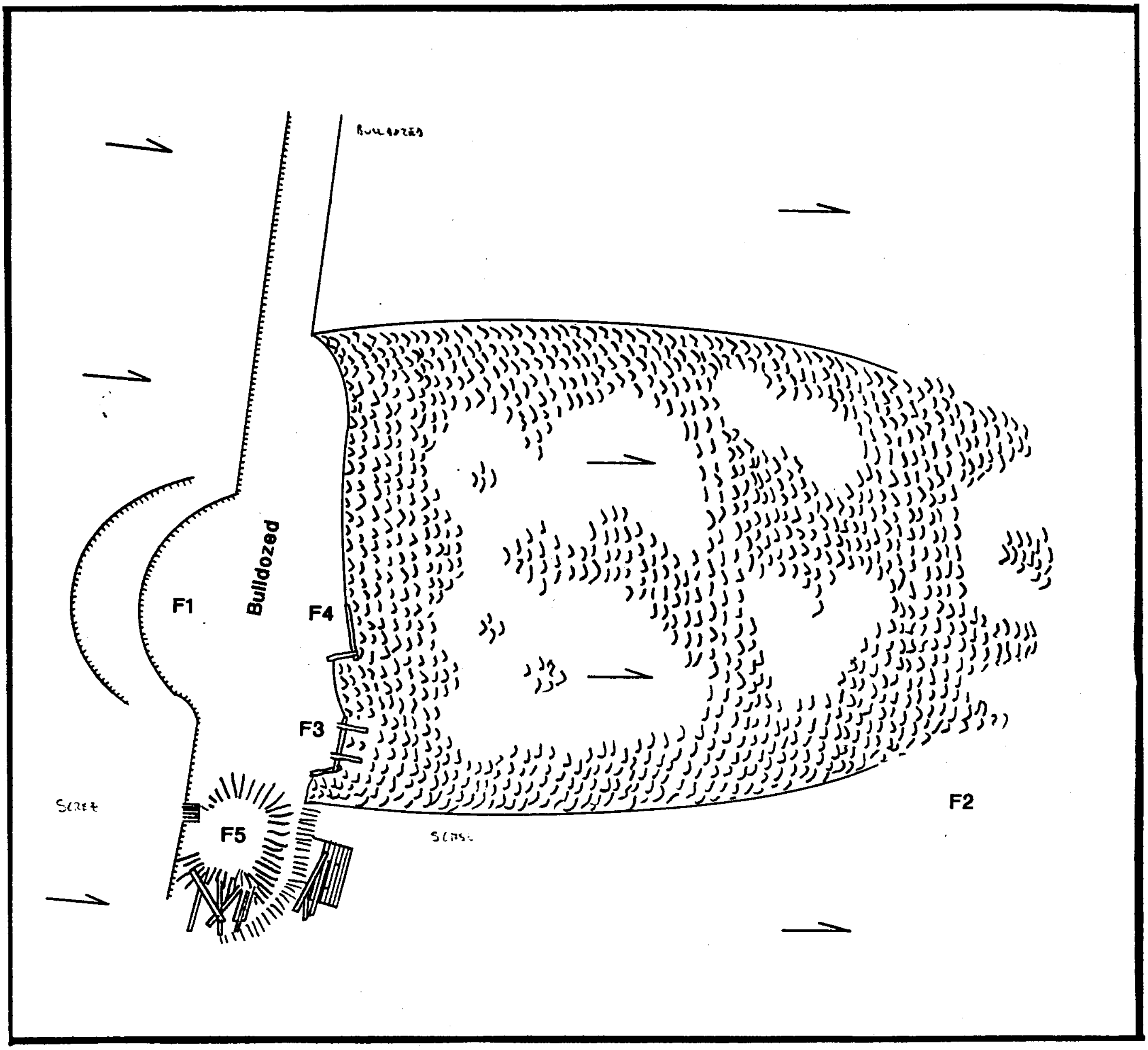


Figure 7.3 This south view depicts the log shaft house that stood over the Holy Moses' southern shaft. The right portion of the log structure stands over Feature 5 (Shaft House Platform), and the left portion stands over Feature 4 (Shaft House Remnant). The structure was erected around 1891. Note the tripod headframe extending out of the left portion of the roof. Courtesy of Colorado Historical Society.

Figure 7.4 The photo captures the east faces of the three standing residential cabins. Feature 23 is at left, and Feature 25 is at right. The cabins were erected around 1891. Author.

The shaft (Feature 3) is 4 by 8 feet in area and miners lagged the walls with closed hewn log cribbing. The shaft featured a single large compartment, and it was typical of those sunk by prospect operations. Mine workers erected a log shaft house to shelter both the mine opening and a hoisting system that raised an ore bucket out of the workings. The shaft house featured two components. One portion of the structure, 20 by 20 feet in area, stood on a platform (Feature 5) west of the shaft, and it enclosed the hoist. The second portion, 12 by 12 feet in area, enclosed the shaft collar. The shaft house's western component has been removed, but the component (Feature 4) enclosing the shaft remains partially intact. Workers constructed the building with logs assembled with dove-tailed joints, and the north wall featured an access doorway, the east wall featured a doorway for ejecting waste rock, and the south wall featured a fixed-pane window. A combination of cut and wire nails indicate that mine workers erected the structure in either 1891 or 1892.

Evidence on the western portion of the shaft house platform indicates that a horse whim served as the mine's hoist. Mine workers constructed a rock-lined pit for the whim, and they excavated a trench that accommodated the hoisting cable from the pit toward the shaft. The whim has been removed.

The Holy Moses company had miners sink a second shaft (Feature 11) north of the cluster of open stopes to provide access to deep ore on the vein's north portion. They installed a hoist to serve the shaft, and they erected another log shaft house (Feature 13) to enclose the hoisting system. The shaft house was 25 by 25 feet in area and it sheltered a small blacksmith shop, in addition to the hoist. The shop, located in the shaft house's south portion, consisted of portable appliances.

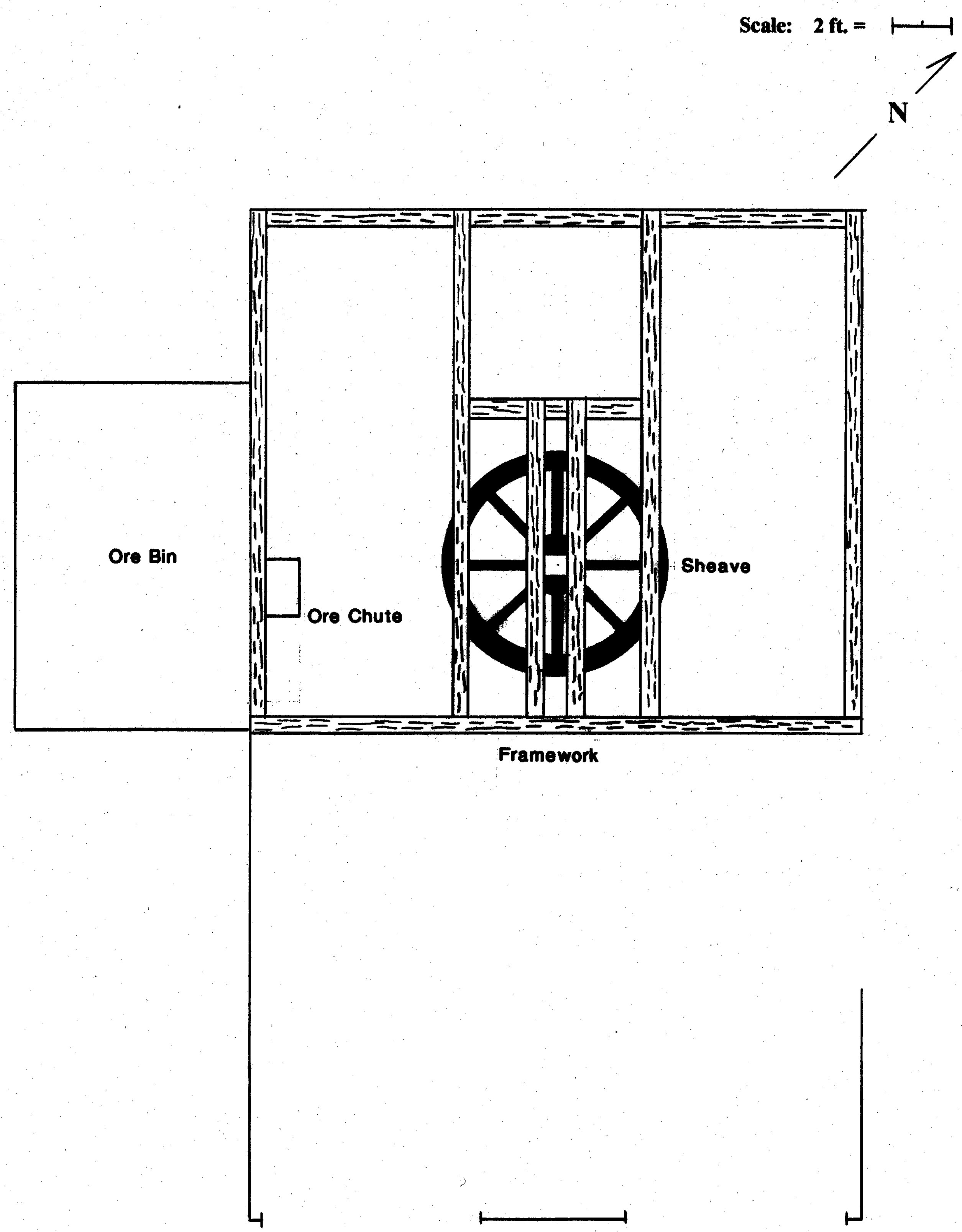
The Holy Moses shaft complex featured an elaborate, labor-intensive system for transporting ore from the two shafts to the aerial tram terminal, where workers sent the payrock down to the mill at the Ridge Mine. When the Holy Moses miners brought the vein's fabulous ore to daylight, they transferred it from the ore buckets at both shafts into ore cars. The miners pushed the loaded cars to ore chutes, where they emptied the cars' contents. The chutes directed the payrock downslope to transfer stations where workers loaded the rock into ore cars on a rail line that traversed the hillslope above the tram terminal. The rail line linked the two transfer stations, and mine workers constructed the bed by cutting it out of the hillslope, and they blasted a bench where it crossed bedrock. One station (Feature 20) lay downslope from the south shaft, and the other station (Feature 18) lay downslope from the north shaft. Near the rail line's mid-point, mine workers discharged the loaded cars into another chute that directed the ore into a receiving bin in the aerial tram terminal. Little is currently left of the transfer stations, the rail bed (Feature 19), and the ore chutes leading up to the shafts.

The aerial tram terminal and portions of the Bleichert Double Rope System erected by the Holy Moses company in 1892 stand downslope from the mine workings. The Bleichert system utilized a *track rope* spanning a series of tram towers, and a separate *traction rope* that tugged ore buckets around a circuit. The track rope was fixed in place and the buckets coasted over it on special hangers featuring guide wheels. Bleichert Double Rope tramways relied on top and bottom terminal stations where the buckets were filled and emptied, and they ran by gravity. In the upper terminal, mine workers uncoupled the buckets when the vehicles arrived, they pushed them across a hanging rail, and stopped them underneath chutes where the buckets were filled with ore. Once full, a mine worker recoupled the buckets onto the cable, and the buckets left the upper terminal. Workers in the bottom terminal uncoupled the buckets and emptied them.

The top terminal at the Holy Moses shaft, which stands in dilapidated condition, is a small single-story frame building, and it enclosed the tram system's sheave and braking systems. The terminal is front-gabled structure, 21 by 36 feet in area, with an 8 by 12 foot ore bin attached to the west side. Workers constructed the building's post-and-girt frame with hand-hewn 8x10 beams, and they erected raw log rafters over the structure. The workers sided the frame with boards and battens, and clad the roof with corrugated iron. The structure stands on a foundation of timber footers placed on an earthen platform. The sheave system consists of an 8 foot cable sheave anchored to a framework made of heavy timbers. The framework features a rectangular assemblage of beams 11 feet long, 6 feet wide, and 6 feet high encompassing the sheave, and it is tied into the terminal's general frame. The sheave rotated in machine bearings bolted to the rectangle's central beams, and the structure is braced by diagonal timbers that countered the horizontal force exacted by the traction cable. A brakeman's station was located on a platform over the framework. The brakeman stopped the tram by pulling a long lever, which transferred movement to a strap brake via linkage rods. Hanging bucket rails for the tram buckets, made from a combination of factory-made iron, and custom-made wood, are bolted to the building's support frame. The Holy Moses' tram terminal currently stands in poor condition. Much of the support frame has succumbed to dry rot, most of the roof is missing, and the siding has fallen away. The framework anchoring the sheave is rotting, and it lists east. The ore bin has collapsed, and some of the planks have been removed.

Several towers that supported the tram system's cables remain south of the terminal. One of the towers (Feature 16), which has collapsed, is located on the edge of a cliff near the terminal. The tower consisted of a hewn log framework approximately 6 feet wide and 20 feet long. Two sets of idler pulleys bolted to cast iron frames at both ends of the tower guided the tram buckets as they passed by the structure. The other tower, of the pyramid variety, stands on a rock cornice far south of the terminal. The tower stands in dilapidated condition, and it is not depicted on the site plan view.

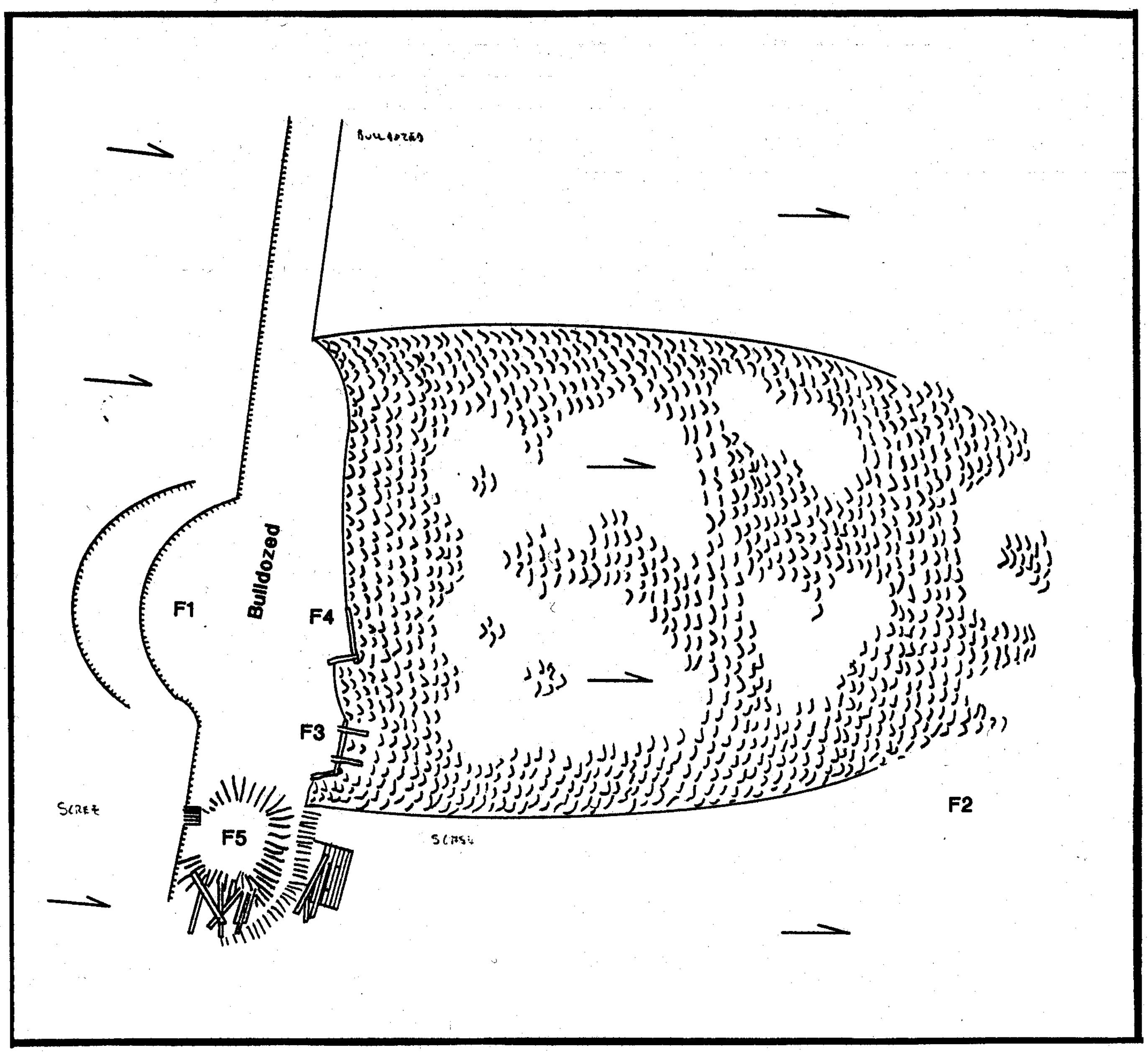
HOLY MOSES MINE
SITE 5ML351
Feature 15: Aerial Tramway Terminal
Floor Plan
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



HOLY MOSES TUNNEL
Site 5ML104
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO

N

Scale: 15 ft =



The Holy Moses Tunnel (5ML104), driven to strike the vein at depth, penetrates the hillslope below and northeast of the shaft complex. Few traces remain from the late 1890s operation that drove the tunnel. The site saw heavy alteration in the 1950s when the Sublet Mining Company reopened the mine, and afterward someone used a bulldozer to scrape down the waste rock dump. Despite the bulldozer disturbance, it appears that the Sublet operation worked the Holy Moses Tunnel according to traditional methods. It used ore cars on a rail line to transport materials into and out of the tunnel, and it erected a small frame shop building adjacent to the tunnel portal. Log cribbing, trestle remnants, and structural debris left by Sublet remain at the site. A platform located far south of the tunnel appears to be the only evidence left by Second Chance company when it drove the tunnel in the late 1890s. Mine workers cut the platform, 12 by 18 feet in area, out of a scree slope at the base of a bedrock outcrop, probably for a wall tent. They located the platform at the outcrop's base to afford protection against rock fall. Except for one large food can, the lack of domestic refuse suggests that the platform was not residential in nature. The food can is a hole-in-cap vessel manufactured with an inner rolled side seam, and mine workers opened the can a hopper opener. These characteristics indicate that the can dates between the late 1890s and the 1910s.

<u>Residence</u>

When the Holy Moses company hired a crew of miners to begin developing the property in 1891, it erected a series of four log cabins and a boardinghouse for the crew. The four cabins were built in a single row facing east, and the boardinghouse stood to the north. Three bunkhouses currently stand, and one of the cabins and the boardinghouse lie in ruins. The structures stood on small cut-and-fill platforms that workers graded on a natural wooded terrace north of the shaft complex.

The three standing cabins are almost identical in size and construction. Mine workers constructed the cabins with raw logs assembled with square-notch joints. They chinked gaps between the logs with mud retained on the inside by log strips, and on the outside by dimension lumber strips. The east and west walls feature 32 inch-wide doorways, and the southern two structures feature no windows. The center structure features windows in the east and west walls. The roofs, which collapsed, were side-gabled and supported by log beams clad with corrugated iron. The walls stand on log footers placed on earth. The cabins' interiors featured log framing for single-mattress bunk beds.

Few artifacts, except for structural materials, were associated with the cabins. Some food cans lay downslope from the eastern-most structure, and all featured a few bottle fragments. It appears that the areas surrounding the structures are unlikely to possess buried archaeological deposits.

The northern cabin in the row served as an assay office, as indicated by assay muffle and crucible fragments, and a stone chimney. Mine workers assembled the structure from raw logs assembled with square-notched joints. The cabin, only 10 by 10 feet in area, completely collapsed. Cut and wire nails associated with all of the structures reflect construction during the early 1890s.

Like the cabins, mine workers constructed the boardinghouse with raw logs assembled with square-notch joints chinked with mud. A front-gabled roof, supported by three log beams, covered the structure, and the walls featured doorways and windows. The main portion of the structure was 20 by 30 feet in area, and a 9 by 9 foot root cellar, where perishable foods were stored, extended off the east side. The boardinghouse completely collapsed. Cut and wire nails reflect construction during the early 1890s. Like the cabins, only a handful of domestic artifacts were associated with the boardinghouse remnant. The items consisted primarily of food cans and some bottle fragments.

The mine's residents disposed of their domestic refuse in the manner typical of Western mining camps. They dumped cans, bottles, and other forms of trash downslope from the buildings, and they relied on privies for personal use. The refuse, located north of the structures, currently manifests as a dump (Feature 28), and no privy pits could be identified. The dump, approximately 100 feet in diameter, features a primarily surfacial deposit of hundreds of food cans, numerous butchered bones, some personal items such as boot remnants, and relatively little bottle glass. The dump possesses little potential for buried deposits.

Holy Moses Mine Site Analysis

The Holy Moses Mine experienced a brief but highly productive life. Contrary to the mine’s richness and the capital available from the Moffat syndicate, which owned the property, the site represents a poorly-engineered, labor-intensive operation. A mine of the Holy Moses’ richness owned by wealthy investors should ordinarily be expected to be heavily developed and well-equipped. The Holy Moses company developed the vein by sinking two small shafts, and miners worked the vein from the surface downward in areas. Both shafts were equipped with simple sinking-class hoisting systems capable of raising only limited quantities of ore to daylight, and once miners proved significant ore reserves, the company effected few improvements. The trend of investing little in the Holy Moses Mine’s infrastructure contrasts starkly against the Creede district’s other wealthy mines, which were well-equipped and heavily mechanized.

The remains comprising the site reflect short-term operation. The light density of durable industrial items reflects brief occupation and a reliance on hand-labor to carry out production. The small waste rock dumps associated with the shafts and the open stopes indicate that the Holy Moses’ miners focused their efforts on extracting payrock and minimizing exploration and development work. The small quantity of waste rock also suggests that the underground workings are limited in extent, and that activity underground was brief.

Despite its seeming unwillingness to spend capital on an advanced surface plant to serve the mine, the Holy Moses company erected a costly and efficient transportation system in the form of the aerial tramway, and an assay shop to track the quality of ore. However, in contrast to the tramways associated with the other large mines in Creede, the system at the Holy Moses Mine was simple and primitive, and it reflects a minimal investment of capital.

The feature and artifact assemblages associated with the residential complex reflect the nature of residential occupation and housing. The Holy Moses company erected a series of three rough log cabins and a boardinghouse of like construction on a natural terrace near the shafts. In general, the accommodations were primitive, crowded, dark, and featured few amenities. The cabins were small, low, and vernacular in construction with no adornment. One of the southern cabins features the remnants of a vernacular bunkbed nailed to the interior wall. The paucity of domestic refuse associated with the three residential cabins indicates that workers prepared little food themselves, and ate meals in the site's boardinghouse, instead. The cabins, therefore, served as bunkhouses, and were probably furnished primarily with bunkbeds and heating stoves. The boardinghouse was larger and higher than the cabins, it may have featured a loft for sleeping quarters, and included cooking and dining areas.

The mine's crew was divided among socio-economic and labor positions. Architectural elements attributed to the three cabins suggest that the superintendent lived separately from the mine crew. The southern two cabins were simple and featured only doorways in the east and west walls, and no windows. The center residential cabin (Feature 25) on the other hand, featured a doorway and a window in the east wall, and another window in the west wall. The superior lighting and ventilation, and the single entry suggest inhabitation by a worker with a higher status than the others.

The square footage of the residential buildings reflects the approximate number of residents. Each cabin featured 270 square feet. Given that a worker required 60 square feet for bedding and personal possessions, the southern two structures accommodated up to five workers each. The superintendent's cabin may have accommodated up to two residents, if the superintendent was permitted more space than the other workers. The superintendent may have used some of the extra space for administrative purposes. The boardinghouse featured 600 square feet, not including the storage cellar. The structure may have also featured a loft, as was common, contributing to the building's total square footage. It remains unknown how much space the company provided for the cooking and dining areas. Given the above, it seems likely that the boardinghouse accommodated at least eight residents. In total, the residential complex could have housed approximately 20 residents, while archival information indicates that in 1890 or 1891, the Holy Moses company employed up to 30 workers at one time. Where the excess workers lived remains unknown.

The assemblage of artifacts associated with the residential complex represents trends regarding gender and socio-economic status. The assemblage includes numerous male-specific items including boot remnants, a miner's candlestick, plain tableware fragments, and almost a total absence of miscellaneous and decorative domestic items. Such an assemblage reflects a population predominated by single miners, and an absence of women. The residential complex lacks any evidence of the consumption of goods that served as indicators of a high socio-economic status, such as decorative and costly items. The artifact assemblage also lacks evidence suggestive of a strong presence of workers of ethnicities other than Euro-Americans.

The assemblage of food-related artifacts indicates that the Holy Moses' crew ate a Victorian diet, high in fats and carbohydrates, similar to that consumed in other Western mining districts. The abundance of food cans and butchered bones reflects the consumption of meals that emphasized preserved vegetables and fruits, and fresh meats.

Further, the bones consisted primarily of cuts for stews and roasts. The above foods were undoubtedly supplemented by baked goods, represented by a baking pan, as well as beans, potatoes, and grains. A great number of cans which contained institutional quantities of food, and an abundance of large butchered bones, indicate that the mine crew ate communal meals prepared by a cook. Further, heavy china plate, cup, and bowl fragments, known as *hotelware*, reflect the use of durable, plain tableware in a dining hall setting. Many cans contained milk, which mine workers may have used in coffee or tea.

The trash dump includes relatively few bottle and earthenware vessel fragments, most of which belonged to liquor bottles and jugs. The relatively limited number of vessels represented indicates that the mine's inhabitants drank little liquor on-site, and consumed few medicines. The minimal consumption of medicine suggests that the crew's health was sound.

The artifact assemblage associated with the residential complex reflects an occupation primarily between the early and mid-1890s. The set of food cans includes twice as many vessels made with lapped side-seams as those constructed with inner-rolled and soldered side-seams. During the 1890s food packers phased out vessels made with lapped side-seams in favor of those made with inner-rolled seams. One bottle base with a makers' mark dates between around 1880 and 1910, and a dynamite box panel with a printed label dates between 1889 and 1892.

The Holy Moses Tunnel site, which suffered significant disturbance, reflects limited production and a very modest investment of capital. The Second Chance Leasing Company drove the tunnel around 1900, and the Sublet Mining Company used it during the 1950s, and both operations appear to have been similar in scale and duration. The Sublet company erased nearly all evidence left by the Second Chance company, indicating that the Second Chance's surface plant was small. The Sublet company's surface plant featured few components, and they were small and incapable of handling high volumes of ore. The site's overall artifact density is low, reflecting limited capital, brief occupations by both companies, and an emphasis on hand-labor. Last, workers employed by both the Second Chance and Sublet outfits lived off-site.

Mammoth Tunnel
Site 5ML353

The Mammoth Tunnel lies on the east side of East Willow Creek approximately one-quarter mile north of the townsite of North Creede. The site includes the remnants of the surface plant associated with the tunnel, as well as the foundations of an early, unrelated powerhouse. Miners drove the tunnel into a scree slope above the creek, and workers built the powerhouse on the west edge of the creek. The mountainside around the site is vegetated with evergreen trees, and the banks of East Willow Creek are lined with willows. Erosion and creep of the scree slope impacted the remains of the adit, and erosion caused by East Willow Creek damaged the powerhouse foundation and deposited alluvium over the steam engine and dynamo foundations.

Mining Operations

The Mammoth Tunnel is a grand, if not misleading name, applied to a shallow prospect adit. Miners drove the adit in search of ore bodies suspected to exist underneath Inspiration Point and Mammoth Mountain, after the Creede district's initial boom. In the late 1890s three interests merged their properties, formed the Mammoth Consolidated Mining Company, and began driving the adit in 1899. David Moffat, Walter Cheesman, and L.E. Campbell owned the Mammoth claim. Philip Feldhauser, T.E. Schwartz, N. Thatcher, W.H. Combs, and the estate of Job A. Cooper owned the Mary Anderson claim. Dr. Buchtell, Oney Carstarphen, D.J. Hutchinson, and Daniel Skinner owned the Nancy Hanks claim. Miners drove the adit in an effort to examine the claims at depth, and they in fact struck geology suggestive of ore, which aroused interest. With no ore bodies forthcoming however, operations were abandoned, and the property became quiet after a short time.[11]

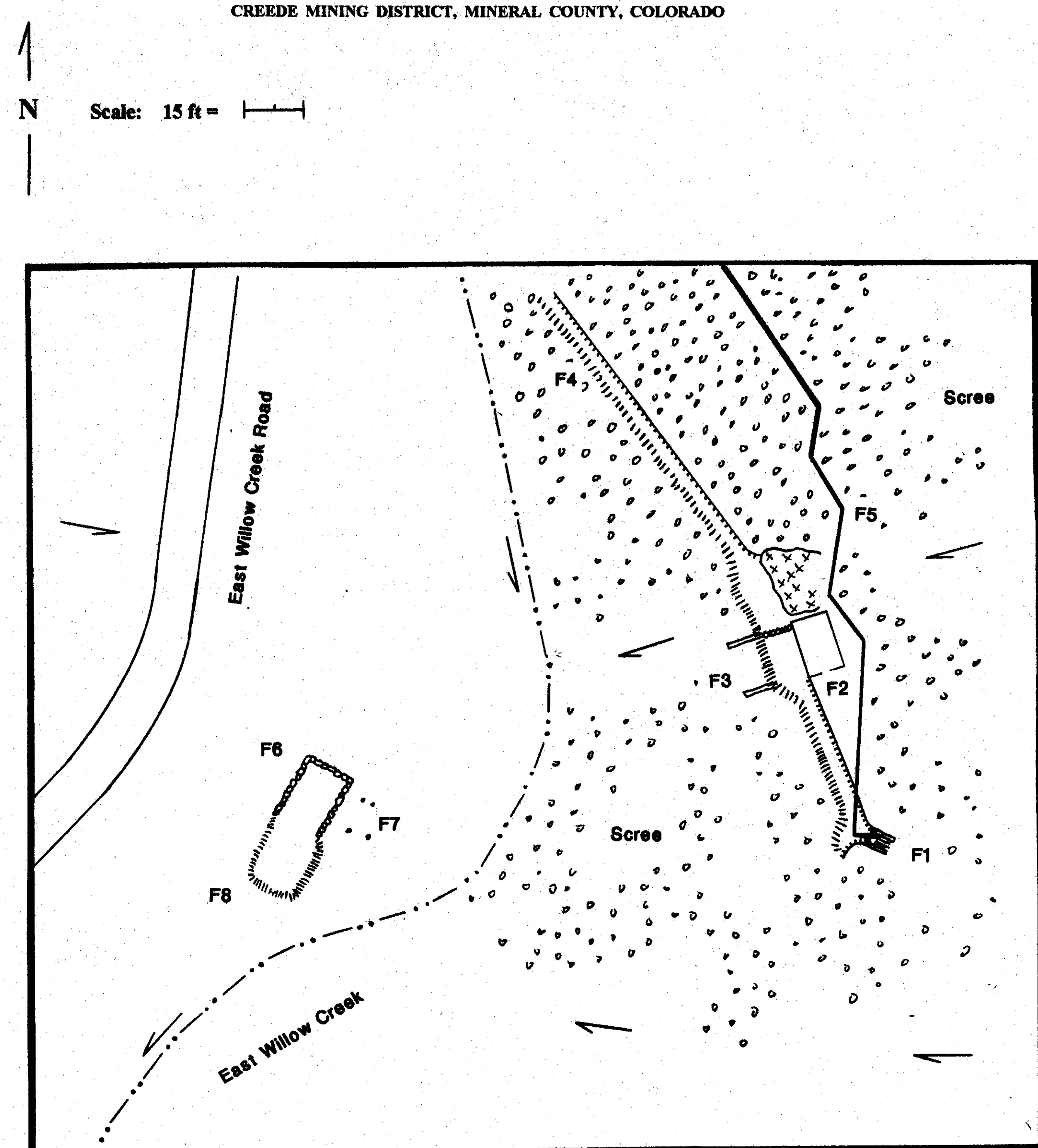
When World War I broke out, the demand for industrial metals stimulated a revival of activity in the Creede district. Mining outfits reopened most of the proven mines, and hopeful prospectors began examining properties that offered a potential of production. During this time, an unknown group of lessees reopened the Mammoth Tunnel and sporadically conducted minor exploration between 1916 and 1919. The lessees' efforts met with no success, and the adit was abandoned.

The first operation that initially drove the adit tapped a heavy flow of groundwater, which poured out of the portal. In later years, the water was proven to be of a quality higher than that encountered in the mines penetrating the highly mineralized Holy Moses and Amethyst ore bodies. Recognizing the water's purity, during the 1930s the town of Creede plugged the adit and piped the water to the City Tower Dam for municipal use.[12]

Today, the Mammoth Tunnel site features remnants of the surface plant left by the Mammoth Consolidated Mining Company. The adit portal manifests as collapsed timber sets partially buried by scree, and the pipeline that carried Creede's water extends outward and traverses north across the hillslope. A pack trail links the adit with several building remnants (Features 2 and 3) located slightly downslope and north. Mine workers constructed one building on a platform that they cut out of the scree slope, and they erected the other on a timber foundation extending out over the slope. The buildings served as storage and as a shop where a blacksmith maintained tools and manufactured hardware. The pack trail continues down from the building remnants to the valley floor. Ventilation tubes lying downslope from the adit indicate that miners working underground supplied themselves fresh air with a blower. A lack of machine foundations indicates that the device was small and powered by hand.

[11] *EMJ* 2/25/99 p243.
[12] Colorado Engineers' Reports: Box 31301, Misc. Mineral County.

MAMMOTH TUNNEL
Site 5ML353
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



A powerhouse, unrelated to the Mammoth Tunnel operation, stood on the west edge of East Willow Creek near the prospect operation. The remnants existing today include a boiler foundation, a steam engine foundation, and a platform (Features 6-8). The boiler supplied steam that powered an engine, which in turn drove a dynamo. The engine foundation currently manifests as a cluster of anchor bolts buried by alluvium. Because all of the bolts are not visible, the engine's and dynamo's exact sizes and types remain indeterminate. The boiler foundation consists of a 9 by 18 foot pad of rubble contained by dry-laid rock walls. A brick setting, that enclosed a return tube boiler, stood on the foundation. The boiler shell was approximately 5 feet in diameter and 16 feet long, and it had the potential to deliver up to 80 horsepower, which was sufficient to power a large engine.[13] The powerhouse was probably built by one of Creede's early electric companies.

Residence

No evidence exists to suggest that the miners driving the Mammoth Tunnel lived on-site. Rather, they probably made the short commute by foot from the nearby town of North Creede.

Mammoth Tunnel Site Analysis

The remnants comprising the Mammoth Tunnel site are typical of short-lived, unproductive prospect operations. The waste rock dump is extremely small, indicating that the underground workings were shallow. The lack of a developed surface plant and an ore storage facility reflect a lack of ore production. The Mammoth outfit provided a mechanical blower to ventilate the underground workings, and worker accomplished all other labor by hand. The few dateable artifacts associated with the adit reflect activity between the mid-1890s and 1905, and abandonment by the end of World War I at the latest.

The powerhouse was a small facility capable of generating enough electricity for a few lighting circuits and possibly a few small mill machines. The structure was small, and it enclosed one boiler, a steam engine, and a small dynamo. The lack of a boiler clinker dump, residue generated by firing a boiler with coal, reflects brief operation. The powerhouse was constructed in the bed of East Willow Creek, which is a poor location subject to flooding.

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[13] Twitty, 1999a:256.

Outlet Mine
Site 5ML301

The Outlet Mine site consists of a tunnel complex located on Forest Service land near the north end of the Holy Moses Vein. The site lies at the east base of Campbell Mountain on the west side of East Willow Creek, near the Holy Moses Mine. The surrounding mountainside is blanketed with scree punctuated by evergreens and aspen trees, and arctic willows and grass lines East Willow Creek a short distance downslope. While the property saw activity during the Creede district's boom-era, ore production during the 1950s and 1960s erased all evidence of early operations. In 1998 U.S. Forest Service regional archaeologist Vince Spero recorded the site as 5ML301 in conjunction with an inventory of mine sites on public lands within the Creede district. Because Spero adequately recorded the site, it was not re-recorded as part of the Holy Moses inventory. Since the mine was a prominent operation on the Holy Moses Vein, an analysis of the site is included in this report.

Mining Operations

During the early 1890s, East Willow Creek attracted the attention of many prospectors. In 1889, Nicholas Creede discovered the famous Holy Moses Mine, in 1890 Charles Nelson located the Solomon and Ridge mines, and during the same time other prospectors staked additional promising claims. During the wave of prospecting activity, an unknown individual staked a claim near the Holy Moses property and drove an adit upslope from East Willow Creek in hopes of striking the Holy Moses Vein. During the early 1890s the effort was abandoned without success, possibly due to the economic depression caused by the Silver Crash of 1893.

Activity at the property may have resumed during the late 1890s, although no records exist. By 1912 prospectors drove the adit to a length of 1,172 feet in hopes of tapping two identified veins. Ore was not forthcoming and operations were abandoned, and the property remained idle for decades.[14]

In the early 1950s the Outlet Mining Company took an interest in the northern portion of the Holy Moses Vein. In 1951 the outfit began work on the Phoenix claim, which was another prospect that lay idle for decades. The Outlet company struck ore and profited from the Phoenix Mine for several years. In an attempt to expand its operations, the Outlet company acquired what became the Outlet Mine in 1955 with the intent of driving workings toward the known ore deposits underneath the Phoenix Mine, a short distance northwest.

In preparation for anticipated production, the Outlet company erected a surface plant and enlarged the adit to accommodate an electric locomotive. The surface plant consisted of a frame building 20 by 30 feet in area divided into a compressor room and one for generators. The Outlet company contracted with the Sublet Mining Company to enlarge the adit, originally 4 by 6 feet in-the-clear, to 7 by 8 feet, and drive exploratory

[14] Emmons and Larsen, 1923:182.

workings. Sublet was also engaged in mining the Holy Moses Tunnel, a short distance south.[15]

During the late 1950s the Outlet company began experiencing economic difficulties. In 1956 it closed the Phoenix Mine following the exhaustion of ore. After investing $120,000 in the Outlet Tunnel, the company extracted only $23,000 worth of ore in 1957. Production continued through 1959, although the actual quantity of ore extracted is unknown. During 1959 and 1960 the Outlet company drove exploratory workings in an attempt to locate new ore bodies, and the effort proved futile. In 1960 the Outlet company declared an end of operations and closed the Outlet Tunnel permanently.[16]

The Outlet Mine site currently features remnants from the 1950s activity. The site features a substantial waste rock dump, the tunnel portal, an engine platform, a structure remnant, a mine rail line, and an ore chute.[17] The tunnel portal features cap-and-post timber sets erected by the Outlet company's miners to support loose ground. The engine platform features an assemblage of a V-cylinder compressor and its drive engine. Structural debris lies scattered around the site. No evidence of operations pre-dating the 1950s exists.

Residential Occupation

The site lacks evidence that the mine crew lived near the operation. Rather, they commuted from a distance residence.

Outlet Mine Site Analysis

The Outlet Mine site represents a fairly profitable, well-equipped, well-capitalized operation that adapted late twentieth century technology to traditional underground mining methods. The surface plant consisted of a number of production-class components, and its constitution was very similar to that erected by the Outlet company at the nearby Phoenix Mine. In particular, the Outlet company installed a transportation system capable of handling high volumes of rock. Mine workers enlarged the tunnel and laid rail lines capable of accommodating an electric locomotive, which pulled trains of cars. Further, the company installed a generator system to recharge the locomotive's batteries. The air compressor was a V-cylinder unit, which was a substantial, modern piece of equipment. The waste rock dump associated with the tunnel is substantial, indicating that the underground workings are fairly extensive. While the ore sorting facility was not designed to handle high volumes of payrock, its nature reflects some production. The Outlet company apparently erected a small cluster of buildings that enclosed the compressor and generators, and probably a locomotive charging station. One of the buildings also probably served as a shop.

[15] Colorado Mine Inspectors' Reports: Box 104054, Outlet Mine.
[16] Ibid.
[17] Spero, 1999.

Phoenix Mine
Site 5ML200

The Phoenix Mine features shaft and tunnel complexes located at the north end of the Holy Moses Vein. The site lies high on the slope of an unnamed ridge on the west side of East Willow Creek, approximately one-quarter mile north of the Holy Moses Mine. The mountainside around the site is vegetated with a sparse evergreen and aspen forest. While the mine was one of the Creede district's early discoveries, activity during the 1950s erased all evidence of early operations. In 1990 Leanne Sander and Robert Kirkham, employed by the Colorado Division of Minerals and Geology, recorded the site as 5ML200 in conjunction with a mine closure project. Due to a lack of data from this effort, the site was rerecorded as part of the 2000 inventory of mines on the Holy Moses Vein.

Figure 7.8 The photo depicts the south elevation of the shaft house standing over the Phoenix Shaft. The structure consists of corrugated iron siding nailed to the headframe (Feature 3) at center, an A-frame extending behind the headframe, and framing to the left. The framing enclosed the hoist, which was anchored to a timber foundation (Feature 4) that manifests as the bench-like structure. The timber structure underneath the headframe upended an ore bucket, and directed the bucket's contents into a waiting ore car. The Outlet Mining Company built the structure in the 1950s. Source: Author.

Mining Operations

The year 1890 was of great significance to prospector Charles Nelson. At that time, acting on rumors of the Holy Moses strike made by Nicholas C. Creede's party the previous year on East Willow Creek, he trekked to the area and discovered what became the wealthy Ridge and Soloman mines. Nelson also examined the area north of Creede's Holy Moses Mine and located promising ground which he named the Phoenix. Nelson sold his holdings, including the Ridge, Soloman, and Phoenix, to Senator Thomas Bowen in either 1890 or 1891.[18]

Bowen hired crews of miners to develop the Ridge and Soloman properties, and he ordered a small party of miners to explore the depths of the Phoenix claim. The miners sank a shallow shaft and found little to suggest the existence of ore bodies on the scale of Bowen's other properties. The seeming barrenness of the claim caused Bowen to pause, and he turned his attention to his other profitable mines and abandoned operations on the Phoenix claim. Undoubtedly, the Silver Crash of 1893 discouraged the expenditure of further capital on the unproven claim.

The Phoenix property remained undeveloped for eight years, until, in 1900, W.G. Boyle & Company leased the claim and began conducting underground exploration through the shaft. Like Bowen's miners, the Boyle outfit failed to strike economic ore, despite a strong suspicion that the Phoenix overlay an extension of the famed Holy Moses Vein.[19]

Despite increases in the price of silver and industrial metals during World War I, 1922, 1934, and World War II, mining outfits were unwilling to risk capital developing the unproven Phoenix claim. By the 1950s, the Holy Moses ore systems were well-understood, milling technology had improved rendering low-grade ores profitable, the economy was sound, and advances in mining technology lowered operating costs. Within this context, the Outlet Mining Company felt that it could profit handsomely from the Phoenix claim, where previous outfits had failed. In 1951 the Outlet company undertook substantial underground exploration and finally encountered ore. The Outlet company did well, drilling and blasting $500,000 worth of payrock up to 1956, when miners exhausted the ore body. Certain that they would strike payrock again, miners pursued a campaign of extensive underground exploration during the following year or two, to no avail. With no ore in sight, the Outlet company abandoned operations and closed the Phoenix Mine permanently.[20]

Because all of the significant activity at the Phoenix Mine occurred during the 1950s, few traces of the initial exploratory work conducted during the early 1890s and in 1900 are visible at the site today. While the original shaft sunk on the claim remains intact, the associated surface facilities appear to have been constructed by the Outlet operation during the 1950s. The Phoenix Tunnel, driven by the Outlet company to intersect the shaft, lies downslope, and it features the remnants of a production-class surface plant.

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[18] Lallies, 1892; Mumey, 1949:43.

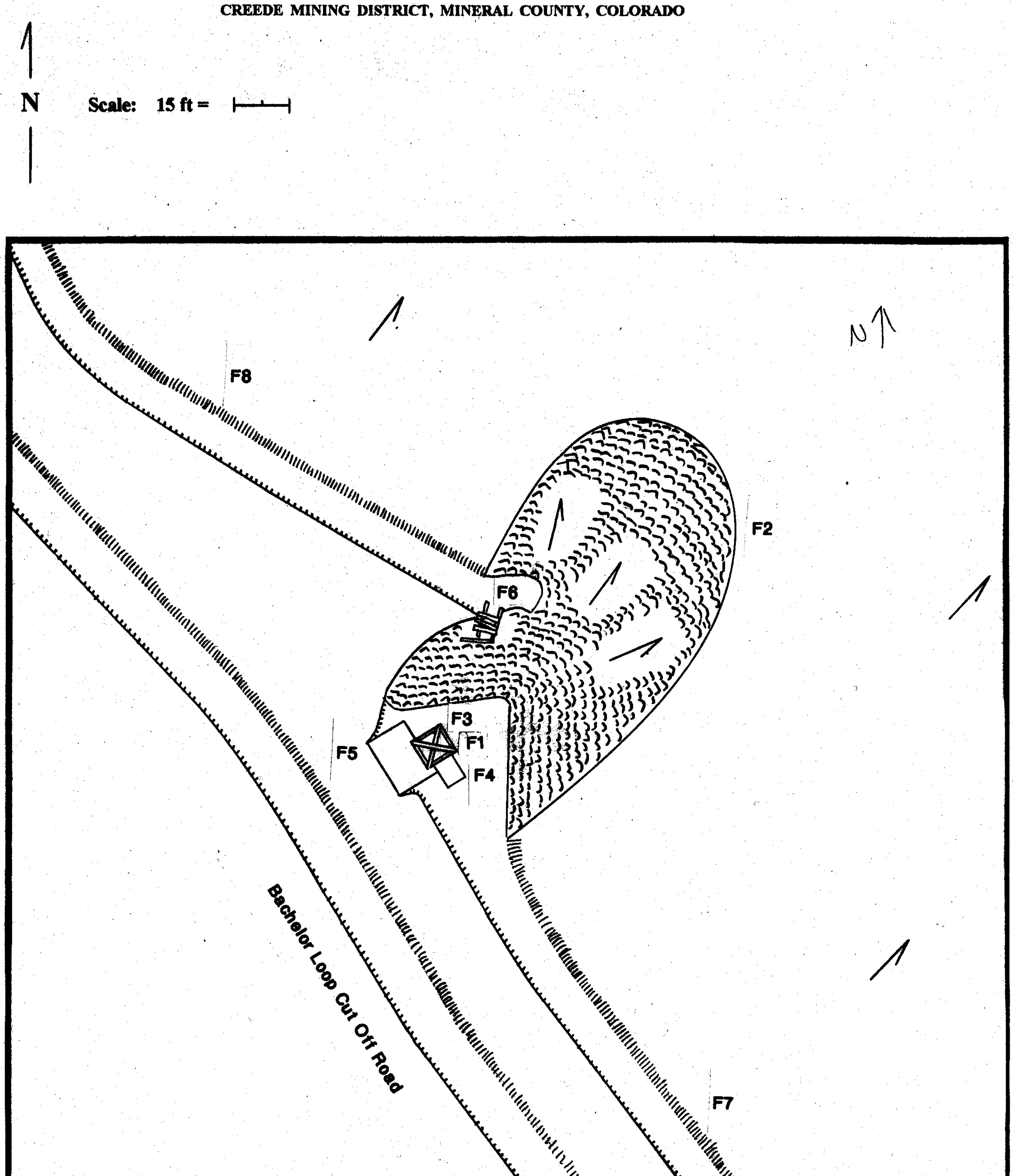
[19] Colorado Historical Society Records, MSS Box 640, v24:7.

[20] Colorado State Archives, Mine Inspectors' Reports, Box 104053: Phoenix Mine; Ratte & Steven, 1965:11.

PHOENIX SHAFT

Site 5ML200

CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



PHOENIX TUNNEL
Site 5ML200
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO

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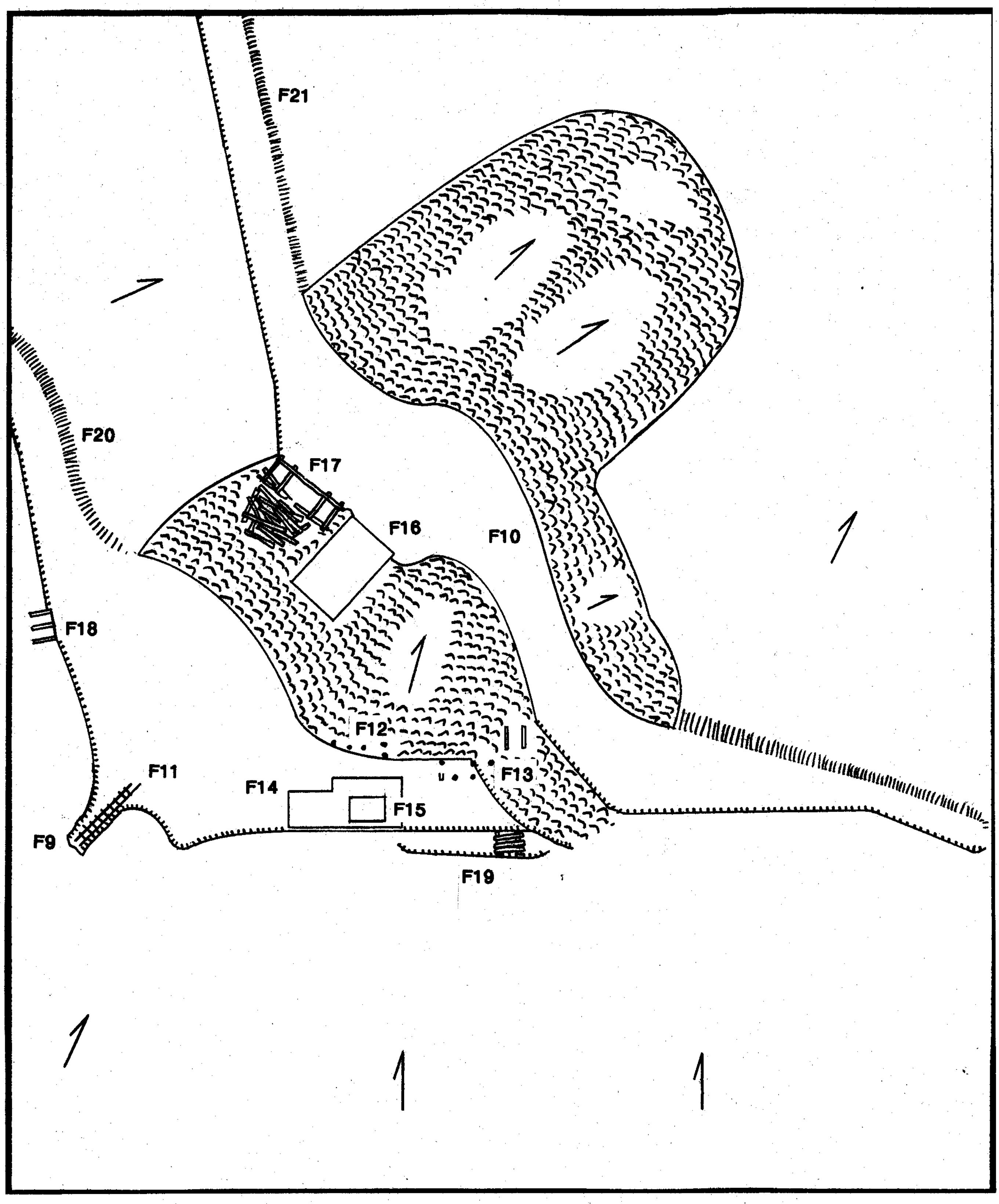


The Phoenix Shaft possesses characteristics typical of prospect shafts sunk during the Gilded Age. The shaft (Feature 1), inclined southwest, is 4 by 8 feet in-the-clear, and miners lagged it with closed cribbing to support the walls. The Outlet company added a bulkhead extending down the shaft's length, creating hoisting and utility compartments.

A small, unconventional hoisting system served the shaft. It consisted of a petroleum hoist placed at an odd angle to the dip of the shaft, and a vernacular pyramidal headframe (Feature 3). The hoist raised and lowered a skip in the shaft, and a wooden frame upset the skip at the shaft collar to transfer rock into a waiting ore car. Mine workers erected a poorly built shaft house (Feature 5) that consisted in part of a log A-frame, a frame extension around the hoist, and corrugated iron siding nailed to the headframe.

Mine workers used the traditional transportation system of ore car on a mine rail line to move rock away from the shaft. They ejected waste rock over the edge of the dump, and directed ore into a chute (Feature 6). The chute featured a gate at the bottom, which workers opened to transfer ore onto a truck parked on an adjacent road.

The Outlet company focused its activity around the Phoenix Tunnel, rather than at the small shaft, and the remnants of the associated surface plant reflect this trend. The Phoenix Tunnel is 3 by 6 feet in-the-clear, which was a size traditional for productive tunnels. The Outlet company erected a combination shop and compressor house (Feature 14) east of the tunnel. The structure, 14 by 30 feet in area, consists of frame walls standing on a timber subframe nailed to log posts. The building features two rooms. The shop, 10 by 14 feet in area, occupies the western portion, while the compressor room occupies the remainder. The shop was equipped with traditional blacksmith appliances and possibly small power tools. A V-cylinder compressor stood in the eastern room, and it was bolted to a foundation (Feature 15) consisting of a lattice of heavy timbers.

Miners used ore cars on mine rail lines to move materials about the surface plant. Mine workers constructed the lines by spiking 20 pound rails 24 inches on center to ties spaced every three feet. One rail line extended past the shop, another terminated on the waste rock dump, while a third provided access to the mine's ore bin.

The Outlet company used the same labor-intensive methods for processing ore that Creede's other mines employed in decades past. Miners pushed loaded ore cars out of the tunnel, across a rail line, and emptied them into a receiving chute descending into a sorting and storage structure (Feature 16). The ore sorting house at the Phoenix Mine, currently partially collapsed, featured a single large bin over which was located a sorting station and a rail line enclosed in a superstructure. Mine workers constructed the bin, which is 15 feet wide and 25 feet long, by nailing thick planks to the interior faces of a heavy post-and-girt frame. When the ore entered the facility, it passed over a grizzly, and the metal-bearing fines dropped into a holding bin below while waste-laden cobbles accumulated at the chute's toe. A miner transferred the cobbles into an ore car parked on a mine rail line that extended across the bin's top. When the car was full, he pushed it across the line to the end of a short trestle, where he dumped out the waste. An ore chute directed the stored payrock out of the holding bin underneath the sorting house into a truck parked on an adjacent loading area.

The Phoenix's surface plant includes several additional components that facilitated mining. The Outlet company erected a set of water tanks (Feature 18) north of the tunnel portal, and a platform (Feature 19) used for storage near the shop. The tanks probably held water for shop use, for drilling, and for compressor coolant. The Outlet company also erected a crude, small ore bin, which was superceded by the large sorting structure. The ore bin consists of three cribbed log cells. The outer two are filled with waste rock, and the center cell held ore. Mine workers assembled the structure by saddle-notching hewn logs and pinning them together with nails. A chute, which is gone, directed ore from the waste rock dump's upper tier into the structure.

Residence

The Phoenix Mine site lacks evidence indicating that the Outlet company's miners lived on-site. Rather, they commuted via truck to the mine from the town of Creede.

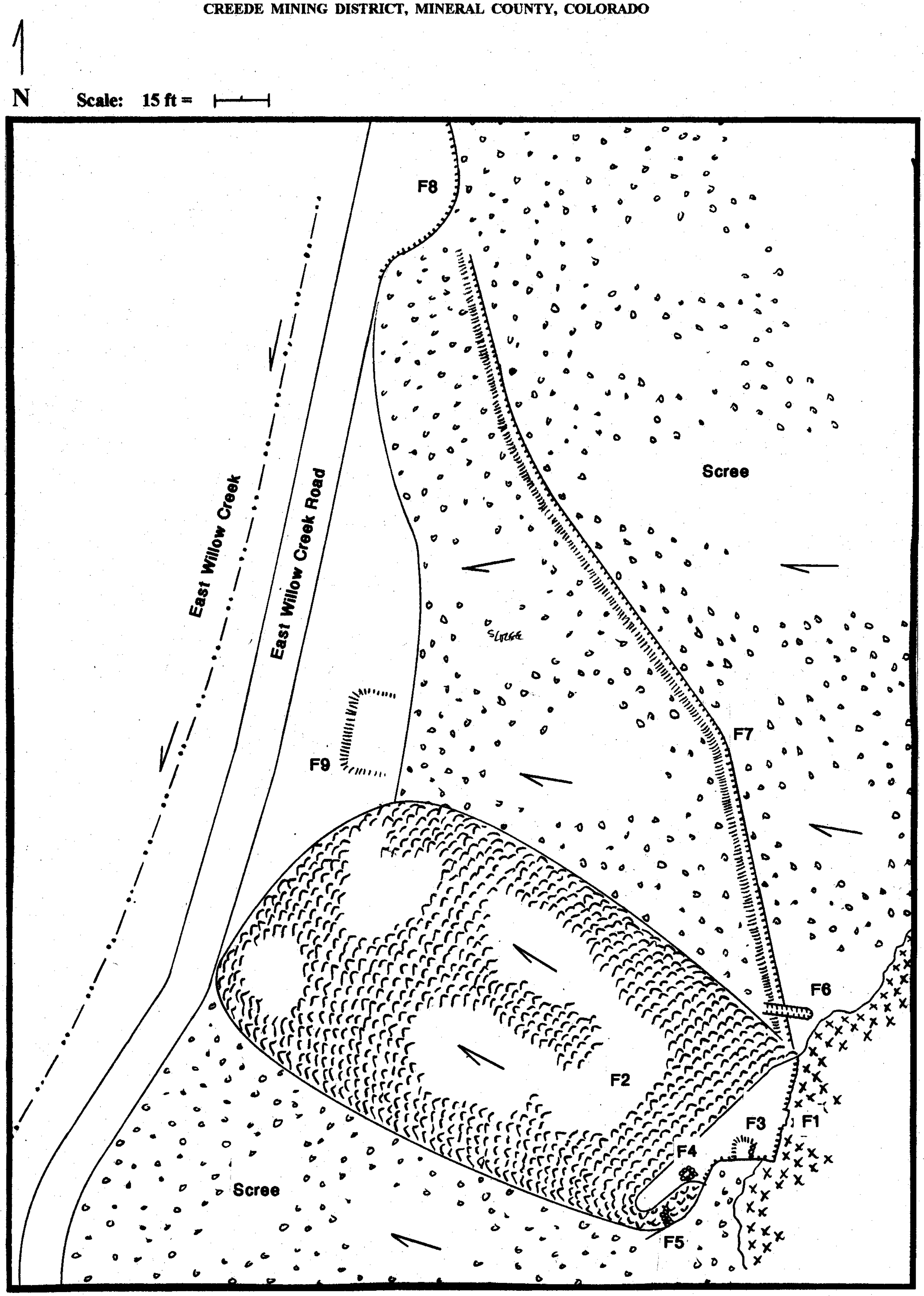
Phoenix Mine Site Analysis

The Phoenix Mine site represents a fairly profitable, well-equipped, modestly capitalized operation that adapted late twentieth century technology to traditional underground mining methods. The tunnel, the mine rail lines, the compressor, and the ore sorting facility all meet production-class criteria. The waste rock dump associated with the tunnel is modest in volume, indicating that the underground workings are fairly extensive. While the ore sorting facility was not designed to handle high volumes of payrock, its nature reflects some production. The lack of a developed surface plant associated with the shaft indicates that the Outlet company accessed most of the workings through the tunnel. Regardless, the ore chute at the shaft indicates that miners extracted minor quantities of payrock from the mine's upper levels. The lack of a shop at the shaft, and the presence of a compressed air pipe extending down the shaft's utility compartment, indicate that the miners at the shaft used the shop at the tunnel, and the Outlet company piped air for drilling up to the shaft. All of the structures, other surface plant components, and artifacts at the site were left by the Outlet company during the 1950s.

Ramey Tunnel
Site 5ML355

The Ramey Tunnel lies on the east side of East Willow Creek approximately one-quarter mile north of the townsite of North Creede. The site consists of the remnants of the tunnel's surface plant and associated residential features. Miners drove the tunnel into a bedrock cliff above the creek, and they constructed several residential buildings a short distance below on the valley floor. Evergreen trees dot the mountainside around the site, and willows line the banks of East Willow Creek, which forms the site's west edge.

RAMEY TUNNEL
Site 5ML355
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



Mining Operations

Archival information pertaining to the Ramey Tunnel could not be located, leaving the remnants comprising the site as the sole record of the past operation. In terms of mining, the site features an adit, a shop area, a privy pit, and a prospect trench. Prospectors excavated the trench first, and after identifying a promising lead, decided to drive an adit. They drilled and blasted the adit, which is 3 by 6 feet in-the-clear, into solid bedrock, and they ejected waste rock downslope. When they made preparations to drive the adit, the prospectors cut a platform into the slope at the cliff's base, where they erected a small frame blacksmith shop around 9 by 15 feet in area. The prospectors equipped the shop with hand-tools, and they erected a gravel-filled rock forge. There, they maintained tools and manufactured hardware. As the waste rock dump grew in size, the prospectors graded its top surface flat, and they used the level surface for various activities. The artifact assemblage associated with the surface plant remnant typifies those associated with short-lived prospect operations. The assemblage primarily consists of structural materials and shop refuse, and a few hole-in-cap food cans are also present. A combination of cut and wire nails, hole-in-cap food cans, and an applied bottle finish reflect activity during the early 1890s. The prospectors failed to encounter geology hinting at the possibility of economic ore, and abandoned the adit by 1893.

Residence

The Ramey Tunnel site includes two platforms where residential buildings stood, located on the canyon floor. The buildings were probably erected by the prospectors that drove the adit, and they were inhabited long after the adit was abandoned. The first platform (Feature 8) lies on the valley floor north of the adit, and prospectors commuted by foot to the adit via a pack trail. Road widening within the last 50 years obliterated nearly all remnants of the platform's residential occupation. The second platform (Feature 9) lies on the valley floor at the base of the Ramey Tunnel's waste rock dump. The platform is 12 by 20 feet in area, and it supported a frame building.

A scatter of domestic artifacts encircles the second platform, and they date between the late 1890s and 1910, long after the Ramey Tunnel was abandoned. Further, a 1912 map of the district depicts the two buildings, indicating that they still stood at this time.[21] The artifacts surrounding the platform include food cans, bottle fragments, butchered bones, and a miner's lunch pail. Additional items probably lie underneath the scree overlying portions of the platform. Despite the potential for buried artifacts, the site probably lacks the significant archaeological deposits.

Ramey Tunnel Site Analysis

Prospectors drove the Ramey Tunnel early in the Creede district's history in hopes of striking an ore body underlying Inspiration Point and Mammoth Mountain. The

[21] Emmons and Larsen, 1923.

remnants comprising the Ramey Tunnel site are typical of short-lived, unproductive prospect operations. The waste rock dump is small, indicating that the underground workings are shallow. The lack of a developed surface plant and an ore storage facility reflect a lack of ore production. The Ramey's prospectors used a mechanical blower to ventilate the underground workings as indicated by ventilation tubing on-site, and they conducted all other labor by hand.

The assemblage of artifacts associated with the intact residential platform reflects trends regarding the building's inhabitants. First, the building featured 240 square feet. During the time the building was occupied, workers required at least 60 square feet each, not including space for cooking and other domestic activities. Therefore, up to three workers lived in the building. The nature of the platform, paucity of structural debris, and absence of electrical insulators and pipes indicates that the living conditions were austere. Second, the artifact assemblage includes male-specific items such as boot remnants and alcoholic beverage containers, and lacks decorative domestic artifacts. This represents inhabitation by single miners. The lack of decorative and costly items also represents a low socio-economic status. The artifact assemblage also includes a miner's lunchpail, indicating that the workers were employed in one of the area's mines or mills. The food-related items associated with the platform consisted primarily of hole-in-cap cans, some bottle fragments, and a few butchered bones. According to the artifacts, the building's residents appear to have consumed a Victorian diet consisting primarily of preserved fruits, vegetables, and meats, and some fresh meat. They may have supplemented the above foods with grains, potatoes, beans, and baked goods, although evidence is lacking. The bottle fragments reflect occasional consumption of beer, liquor, medicine, and other liquids. The building's residents may have consumed the medicine to treat occasional illnesses.

The few dateable artifacts associated with the adit reflect activity between 1891 and 1893. The dateable artifacts associated with the intact residential platform reflect inhabitation between around 1900 and 1910, by workers employed at other operations.

Ridge Mine
Site 5ML201

The Ridge Mine site is a large complex located several hundred feet north of the Soloman Mine near the Holy Moses Vein's mid-point. The site features four adits, two tunnels, their associated surface plants, portions of a residential complex, and an area where an ore concentration mill stood. The lowest tunnel, the residential complex, and the mill area lie on the west side of East Willow Creek, while the other mine workings are situated upslope. Prospectors drove the northwestern-most and highest adit into the Ethel claim, and the operation was originally known as the Ethel Mine prior to being consolidated into the Ridge complex during the early 1890s. The southern and second highest set of adits was originally worked as the Mexican Mine, and they too were consolidated. After the consolidation, the Ridge Mining company drove two haulage tunnels at a lower elevation to strike the Holy Moses Vein at depth.

In terms of site boundaries, East Willow Creek defines the site's east edge, the Ethel and Mexican workings serve as the west boundary, and the residential complex lies along the north boundary. The south boundary extends from the Ridge Mine's main haulage tunnel up to the Mexican workings. The site occupies much of a scree-covered mountainside which is sparsely vegetated with evergreen trees. Outcrops of bedrock punctuate the scree slopes, and willows line the banks of East Willow Creek. A maintained gravel road traverses through the site along the west side of the creek, and passes by the mill area and the residential complex.

In 1990 Leanne Sander and Robert Kirkham, employed by the Colorado Division of Minerals and Geology, recorded the site as 5ML201 in conjunction with a mine closure project. Due to a lack of data, the site was rerecorded as part of the 2000 inventory of mines on the Holy Moses Vein.

Mining Operations

Charles F. Nelson arrived in the Creede area in 1890 when word of Nicholas C. Creede's Holy Moses discovery, made in the previous year, were just beginning to circulate. Nelson assumed that the area around the Holy Moses held great potential, and he began examining East Willow Creek near Creede's initial find. During 1890, Nelson made two of the district's most significant finds. Approximately a half-mile south of Creede's Holy Moses claim Nelson discovered a rich silver vein and staked the King Soloman claim. He continued his prospecting forays and found a second rich vein several hundred feet north, which he claimed as the Ridge. The word of the strikes made by Creede, Nelson, and prospectors on the nearby Amethyst Vein touched off the rush to the King Soloman Mining District, as the area became known.[22]

Imitating Nelson, other prospectors searched East Willow Creek and located several additional veins near the Ridge Mine. They staked the adjacent Ethel, Mexico, and St. Peter claims several hundred feet above the banks of East Willow Creek. The hopeful prospectors drove short adits on their claims and proved the existence of bonanza ore.

Acting on the rumors of the rich strikes in the Creede area, a few of Colorado's mining magnates took an interest in the proven claims on both the Holy Moses and Amethyst veins. In either 1890 or 1891 Nelson sold his claims, including the Ridge, to Senator Thomas Bowen, who was among the silver barons interested in the area. Bowen, who served a term in the Senate in the 1880s and had been involved in mining for decades, also purchased the adjoining claims. While the ore bodies underlying the claims were named individually, including the Ridge, Ethel, and Mexico veins, they were all actually extensions of the Holy Moses system. In 1892 Nelson, highly active in Creede's mining industry, organized the Nelson Tunnel Company, which drove the Nelson Tunnel along the fabulous Amethyst Vein on West Willow Creek.[23] Fig 7.12 Overview of Ridge
Fig 7.13 Main Haulageway

[22] Emmons & Larsen, 1923:180; Mumey, 1949:43.
[23] Mumey, 1949:43.

Figure 7.12 The photo captures the west overview of the Ridge Mine complex. The waste rock dump visible in the trees left and above center denotes the Ethel workings. The large waste rock dump immediately left of center belongs to the Mid-Level Tunnel, and the smaller dump right of center denotes the Mexico workings. The large waste rock dump near the valley floor is associated with the Main Haulageway. The mill and the residential complex were situated right and out of view. East Willow Creek flows down the valley floor. Source: Author.

Figure 7.13 The photo is an east view of the Main Haulageway's surface plant remnant. The structure at right is the shop remnant (Feature 31), built around 1891. The tunnel portal (Feature 27) is adjacent and right. The aerial tram engine (Feature 35), installed during the 1940s, is visible near the end of the waste rock dump. East Willow Creek is visible at left. Source: Author.

By 1892 a handful of wealthy men acquired the principal mines on the Holy Moses Vein. Bowen owned the Ridge group and the King Soloman, and David H. Moffat's group of investors owned the fabulous Holy Moses. In either 1891 or 1892 Moffat drew Bowen into his syndicate, and Bowen sold them an interest in his holdings, including the Ridge Mine. The joint ownership was probably organized under the title of the Creedemoor Mining Company.

By 1892 Bowen hired a crew of miners who began extracting ore through the adits on the various claims that he consolidated into the Ridge group. Bowen also financed the construction of an ore concentration mill intended to separate metalliferous material from waste. At this time Bowen's miners probably drove one of the two haulage tunnels existing on-site downslope from the claims to tap the veins at depth. Miners extracted the precious payrock through 1892 and into 1893, providing Bowen with handsome profits. In the context of the joint ownership, the Moffat syndicate came to terms with Bowen to process the Holy Moses Mine's ore at the Ridge mill. Moffat had his workers erect an aerial tramway from the Holy Moses, perched high atop a bedrock cliff, to the mill.

All the principal mines on the Holy Moses Vein turned significant profits through 1892 and into 1893. Then, in 1893, the Silver Crash caused the price of the white metal to plummet, rendering operations unprofitable and wrecking Creede's mining industry. While most of the district's other mines closed, the Ridge Mine's ore proved to be so rich that extraction of the highest grades of payrock sustained operations through the economic depression, and Bowen kept the mine active while he waited for the price of silver to rebound. Bowen and the Moffat syndicate even invested in the Ridge's operations during this time. In 1893, at the depths of the depression, they financed further development of the mine's ore bodies and the installation of a new boiler to power the mill.[24]

Unfortunately the price of silver failed to rebound before miners exhausted the Ridge Mine's richest ore. The mine continued to operate for several years through the depression, and when the costs of production began to exceed income and with no new ore in sight, Bowen and the Moffat syndicate suspended work. They shut the mill down because the Ridge Mine had become its sole supplier of ore when operations at the Holy Moses Mine stopped in 1893.

The Ridge Mine remained quiet for approximately five years until W.G. Lamb and L. Lowdermilk obtained financing for a three-year project in which they rehabilitated the property under a lease. Lamb and Lowdermilk apparently formed the East Willow Mining and Milling Company and succeeded in bringing the dilapidated mine back into production. By this time the economy recovered, capital abounded, and Creede's mining industry completely recovered. The East Willow company repaired the mill by 1901, and it had workers erect surface plant facilities at the mine's lowest tunnel, which served as the mine's main haulageway.[25]

[24] *EMJ* 10/28/93 p456.
[25] Colorado Historical Society Records, MSS Box 640, v24:20, 59.

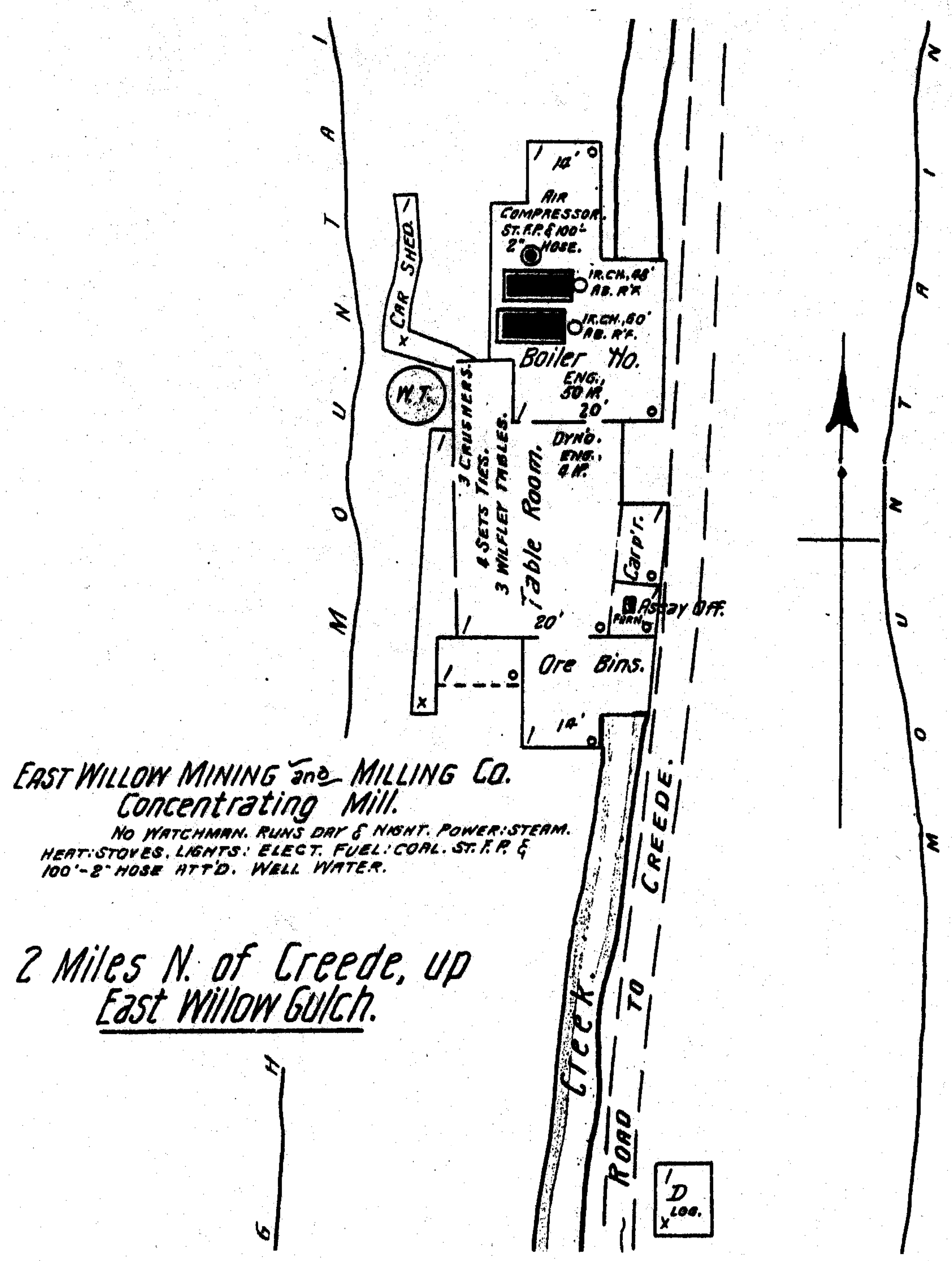


Figure 7.14 Sanborn's 1904 map of the Ridge mill. The air compressor and small electrical generator were installed by the East Willow Mining and Milling Company around 1900, while the building was erected by Thomas Bowen's operation during the early 1890s. Source: Sanborn Map Co.

The East Willow outfit continued to work the mine through the lowest haulage tunnel for at least five years until an end to profitable ore was in sight. The Ridge complex then fell idle for several years. In 1912 a group of unknown lessees found enough low-grade ore lay in the lower stopes to fund limited operations. The lessees quickly depleted the payrock, and the mine was abandoned once again. Up to that point, the Ridge Mine produced between $500,000 and $700,000 of ore.[26]

Like most of the other mines on the Holy Moses Vein, the Ridge property had little left to offer by the outbreak of World War I. Despite the demand for metals during the war, and an increase in metals prices in 1922 and 1934, the Ridge remained idle. In 1943 a small mining outfit found that low-grade ore left by previous operations as being uneconomical was then worth mining. The price of industrial metals increased during World War II, and milling technology improved, rendering low-grade ore economical. The mining outfit worked the Ridge until 1949, with production varying from $1,000 up to $20,000 per year. The last of Ridge's known economical ore gave out, and the mine was permanently closed.[27]

Today, the Ridge Mine site consists of a complex group of adits and tunnels featuring remnants left by nearly all of the operators that worked the property. The Ethel, Mexico, and original Ridge adits are distinct, as well as the haulage ways driven by Bowen's miners. The East Willow outfit left the greatest impact on the site, and most of the remnants on-site date to this operation.

The Ethel adit lies in the site's northwest corner, and it while it was driven in 1890 or 1891, it possesses little evidence of early activity. When the East Willow outfit rehabilitated the Ridge Mine, it erected a small surface plant at the adit to support work underground. The fact that the company spent capital making the improvements there indicates that its miners were working the Ridge's upper-most stopes, in addition to those accessed through the main haulageway. The Ethel's circa 1900 facilities included a shop, a mine rail line, and a platform where miners cut timbers and conducted other activities (Features 3-6). Originally, prospectors drove the adit into the base of a bedrock cliff and dumped waste rock downslope. When they prepared the ground for work, they cut a platform at the cliff's base to provide an activity area. Around 1900 the East Willow outfit erected a shop on the platform, where miners maintained equipment. The shop, heavily damaged by scree, was a 9 by 12 foot shed based on a post-and-girt frame. The east wall featured a doorway and a window, and the south wall also featured a window. A deposit of forge clinker in the shop's northwest corner currently denotes the location of the forge, and a workbench and storage shelves were fixed to the south wall. The forge was a free-standing iron pan model, and the shop was equipped with hand-tools.

The East Willow company had miners lay a traditional mine rail line within the Ethel's underground workings to transport waste rock out, and supplies and machinery in. Miners constructed the rail line by spiking 12 pound rails 18 inches on-center. The end of the line features an ore car stop made from a length of pipe bent to form a "U". The stop caught the chassis of an ore car and prevented it from rolling off the end of the track.

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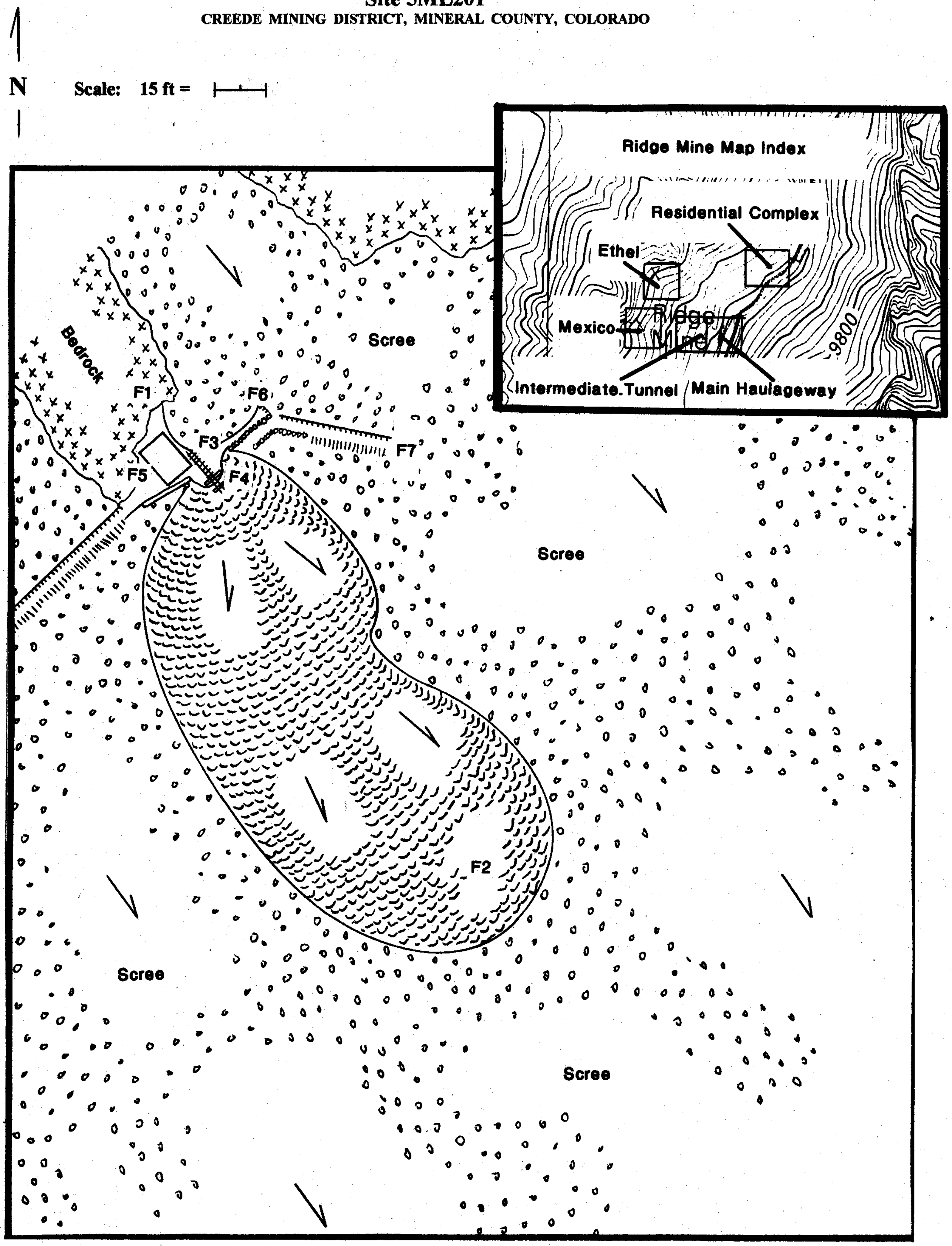
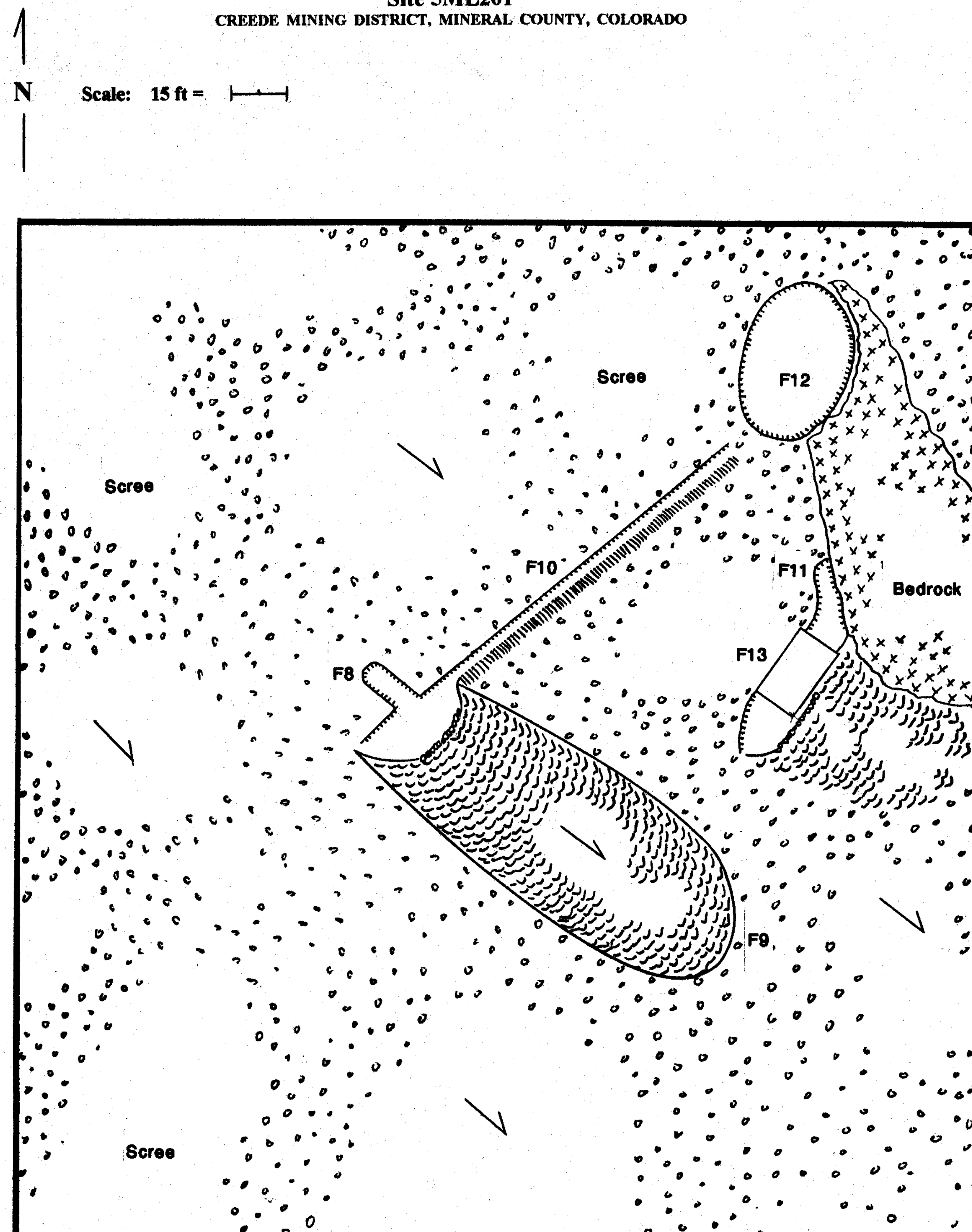
[26] Emmons & Larsen, 1923:180.
[27] Ratte & Steven, 1965:11.

RIDGE MINE COMPLEX: ETHEL MINE
Site 5ML201
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



RIDGE MINE COMPLEX: MEXICO MINE
Site 5ML201
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



Miners constructed a second platform east of the adit portal. Because the platform and associated artifacts have been buried by scree, the platform's exact function is unknown. Miners, possibly employed by Bowen's early 1890s operation, constructed the platform by erecting a dry-laid rock wall and filling the void behind with waste rock.

Artifacts associated with the Ethel's surface plant reflect several trends regarding mining operations. The shop remnant featured numerous industrial artifacts, including parts for an early Leyner drifter rockdrill and dynamite box panels. Leyner drills experienced popularity during the 1910s, and the dynamite box panels are of a type that post-dates 1905.[28] Further, more dynamite box panels lay on the scree-covered platform. These items were probably left by the circa 1912 operation that worked the Ridge Mine. The rockdrill parts, a steel spiral-wrapped air hose, and pipes indicate that the lessees used the air compressor, located in the mill, to power rockdrills in the Ethel's stopes. Air was plumbed up to the stopes through the Ridge's underground workings. Ventilation tubes in the shop reflect the use of a blower to supply miners working underground with fresh air. A lack of machine foundations indicates that the blower was a hand-powered portable unit.

The shop also contains several sanitary motor oil cans and a rubberized canvas air hose, and the scree-covered platform features a DuPont dynamite box panel with circa 1950s labeling. These items indicate that after production ceased at the Ridge in 1949, another mining outfit conducted underground exploration in the Ethel's workings during the 1950s.

The 1912 group of lessees apparently worked the stopes in the Mexico claim, as well as the Ethel. The Mexico claim lies several hundred feet southwest of the Ethel, and it features two adits. The upper-most adit (Feature 8) was shallow and abandoned during the early 1890s. Only the waste rock dump and an area of subsidence are visible today. The Mexico claim's lower adit (Feature 11) was shallow as well, however miners did not have to penetrate much ground before tapping the Mexico Vein. They drove the adit along the strike of a bedrock outcrop, and within 45 feet of the adit portal they encountered ore and stoped it close to ground-surface. With little to support the ceiling, the stope collapsed, resulting in an area of subsidence (Feature 12) visible today. Either in 1900 the East Willow outfit or the 1912 group of lessees made several, simple improvements at the portal of the lower adit in preparation to rework the stopes. They graded a platform south of the adit and erected a crude building (Feature 13) on the flat area. The building featured walls made of 2x12 planks nailed to posts, and a plank floor nailed to joists. Most of the lumber was salvaged from elsewhere. Currently, only portions of several walls and the floor remain. The building probably served as storage, and no evidence of shop work or residence is evident. Dynamite box panels around the building remnant post-date 1905, reflecting activity of the 1912 lessee operation. The paucity of artifacts at both Mexico adits indicates that activity was brief.

The Ridge's mid-level haulage tunnel and an adit lie immediately downslope from and east of the Mexico workings. The two mine openings lie approximately 200 feet apart, and the adit is located north of the tunnel. Miners drove the adit between 1890 and 1891, possibly to explore the Mexico claim at depth, prior to the consolidation of the

[28] Twitty, 2001:38; Twitty, 1999a:362.

Ethel, Mexico, and Ridge claims. The mid-level tunnel, located south, may have been the original Ridge adit driven in 1890, however it served as a haulageway for the succession of the Ridge's operators.

The northern adit (Feature 14) was driven almost due west to strike either the Mexico or Ridge veins, and the modest waste rock dump indicates that miners conducted a fair amount of underground exploration and development. Evidence in the forms of lumber and cut nails lying on the waste rock dump reflect activity around 1890 or 1891. The early operation may have erected a simple surface plant on the dump, however the artifact assemblage is insufficient to determine the nature of the facilities. It probably was the 1912 lessee outfit that effected repairs to the adit portal's timbering, and used the entry to access the stopes inside. The lessees retimbered the portal to fend off scree and they used the waste rock dump as a timber dressing station (Feature 17) where they cut and prepared mine timbers. Cut wood scraps remain.

The lessees laid a mine rail line to transport extracted ore to a sorting station they constructed on the waste rock dump associated with the mid-level tunnel, located south. The line extends out of the adit portal and immediately curves south, it traverses the adjacent hillslope for 135 feet, and terminates on a bedrock outcrop. There, miners dumped ore cars into a chute (Feature 20) that directed the payrock down to the sorting station downslope. Miners constructed the line by spiking 12 pound rails 18 inches on-center. Most of line was laid on a terrace cut out of the hillside. Scree currently blankets much of the line.

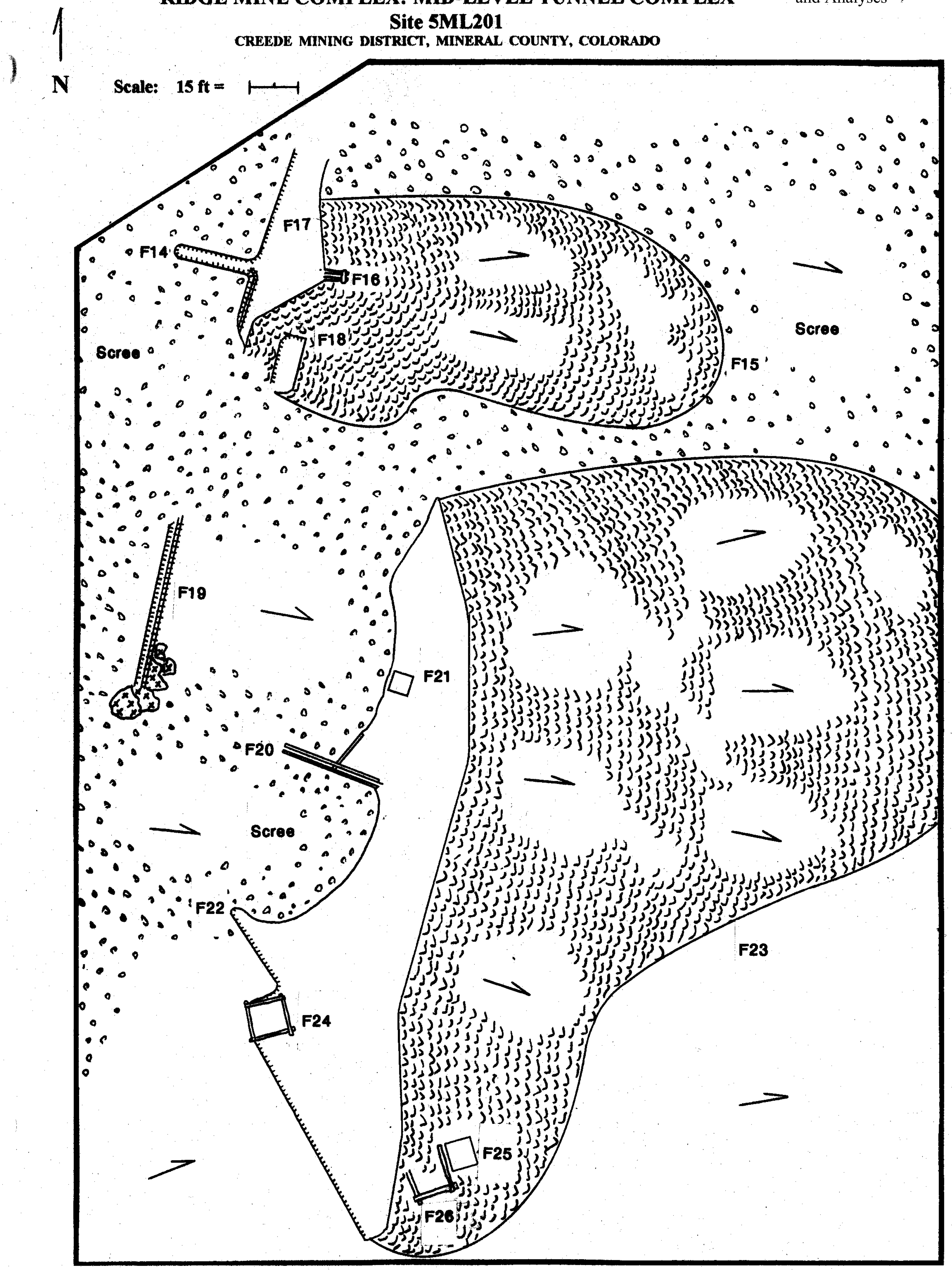
Mine workers constructed the chute by laying a series of salvaged beams across the hillslope, and they erected plank flooring and walls on the beams. The chute's bottom supports rest on a low retaining wall constructed with salvaged timbers and logs. The sorting station (Feature 21) lies north of and adjacent to the terminus of the ore chute that descends from the northern adit. The station currently manifests as a 9 by 9 foot box filled with gray rock, encompassed by plank flooring. The station appears to have been an open-air affair, and workers sorted through ore and threw waste aside. How the workers transported the recovered payrock down to the road along East Willow Creek remains unknown.

After the Ridge and other claims were consolidated in the early 1890s, mine-owner Bowen probably had a crew of miners drive the mid-level tunnel located south of the Mexico claim. The large waste rock dump indicates that miners conducted extensive underground exploration and development of the ore systems underlying the group of claims. Miners undoubtedly drove the tunnel as a principal entry to the stopes underlying the claims, and the East Willow outfit and the 1912 group of lessees used the opening as well. A shop building (Feature 24), erected by Bowen's miners in 1892, stood adjacent to and south of the tunnel portal. The building was a 10 by 12 foot log cabin equipped with a free-standing iron pan forge and hand-tools. The shop's small size and the nature of its equipment indicate that it was not geared to handle significant mechanical repairs or metalwork. It appears by a lack of evidence that the East Willow outfit erected few if any additional surface plant facilities at the tunnel. A log cribbing structure (Feature 26) stands on the flank of the waste rock dump southeast of the tunnel, and it probably supported an ore bin. Bowen's miners probably constructed the cribbing in 1892.

RIDGE MINE COMPLEX: MID-LEVEL TUNNEL COMPLEX

Site 5ML201

CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



The artifacts associated with the mid-level tunnel complex reflect peak activity between around 1900 and the 1910s. Candle box ends and a hand-made bottle finish were probably left by the East Willow Creek company between 1900 and the mid-1900s. Dynamite box panels post-dating 1905 may have been left by the 1912 group of lessees.

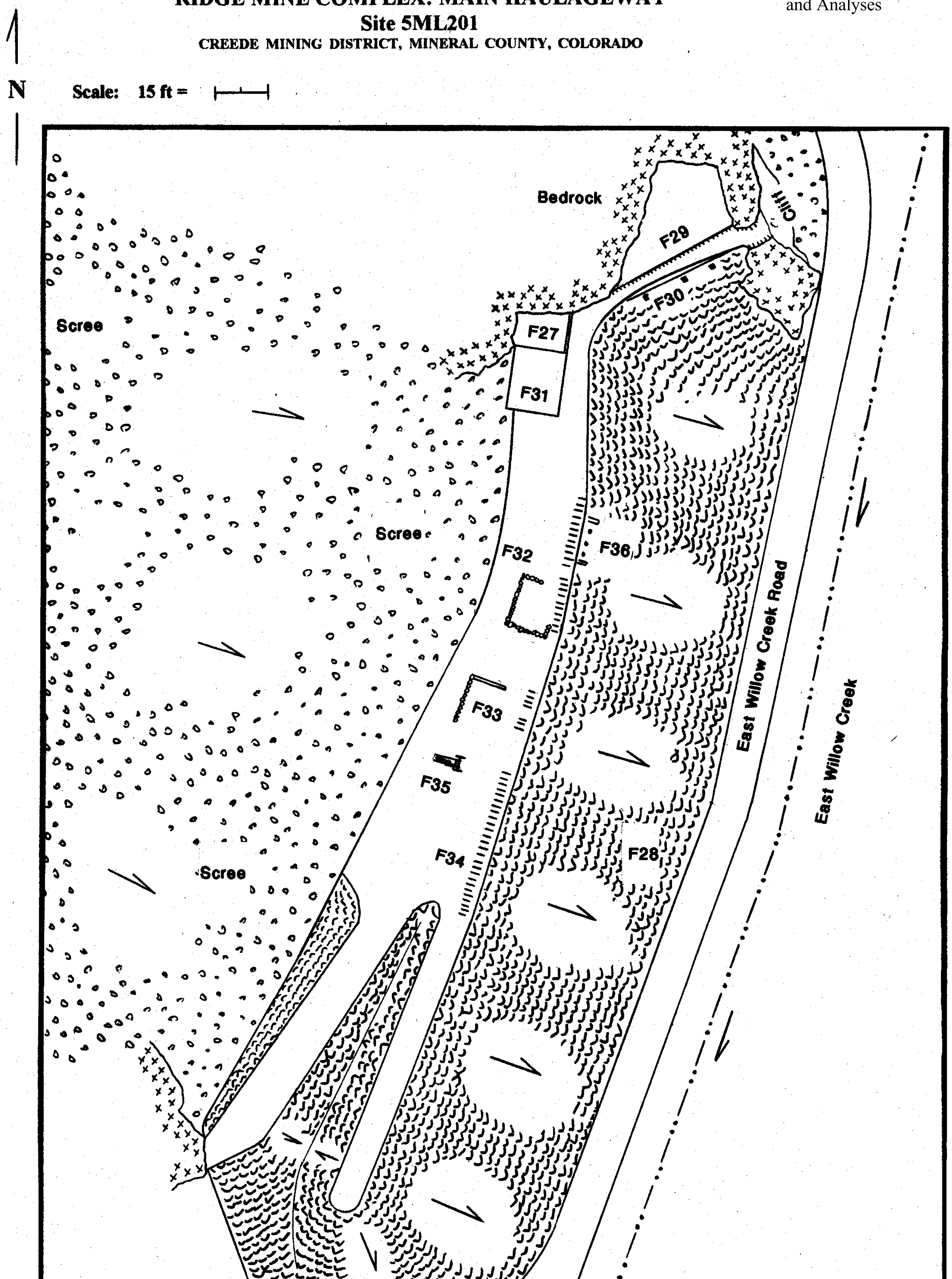
The mining operation that worked the Ridge Mine during the 1940s used the haulageway to access mid-level stopes. They constructed a short, single rope reversible aerial tramway on the waste rock dump, and it terminated at the mine's lowest tunnel complex. The structure currently standing at the upper tunnel consists of an ore bin on a timber framework 15 feet high. A cable extended down to a bin at the lower tunnel, and a tram bucket rode up and down the cable. When the bucket arrived at the top bin, a mine worker opened an ore chute and filled the bucket. An engine located at the lower tunnel lowered the bucket, where a worker emptied it. The bin's rim is concurrent in elevation with the waste rock dump's top surface, and a mine rail line, removed, extended from the bin to the tunnel portal. The support framework for the bin is a vernacular structure made with a combination of new and salvaged lumber, and hewn logs. The workmanship is average. Dry rot compromised the bin's footer timbers, and the structure currently leans east. The 1940s mining operation left a few artifacts at the tunnel, including a carbide drum.

When Senator Bowen had workers construct an ore concentration mill on the bank of East Willow Creek, miners drove a principal haulage tunnel to undercut the entire vein system and ease the logistics of feeding ore to the mill. This lower tunnel's elevation was slightly higher that the mill's head, and miners transported payrock out of the underground workings in ore cars, which they then sent to the mill. Because of its importance as both the mine's principal haulageway and primary access to the underground workings, the Ridge's lowest tunnel became a hub of activity for Bowen's, and the later, operations. Currently, the tunnel, the adjacent shop, the rail line remnant, and the waste rock dump are the only aspects of the haulageway complex that clearly date to Bowen's early 1890s operation.

The tunnel is 4 by 6½ feet in-the-clear, which mining engineers of the day considered to be production-class in size. Bowen's miners drove the tunnel into solid bedrock, and they excavated a platform in the scree slope adjacent and south for a shop building. In addition to the shop, Bowen's workers erected a roofed extension over the tunnel portal, and it spanned the area between the shop and bedrock. The structure featured double-doors that controlled the natural flow of air out of the tunnel.

Mine workers constructed the shop building with raw logs assembled with square-notch joints, and they chinked the gaps between the logs with log strips. The construction is similar in materials, style, and workmanship, to the shop located at the site's other haulageway upslope (Feature 24), and almost identical to the residential cabin standing north of the mine complex. The shop stands on log footers placed on waste rock, and the roof was arched. The east wall features a doorway and two windows, and the south and west walls also feature windows. The shop appears to have been equipped with a free-standing iron pan forge and hand-powered appliances, although the interior is currently choked with scree and boulders. A workbench erected along the southern wall is visible. Some of the woodwork was fastened with cut nails, reflecting construction during the early 1890s.

RIDGE MINE COMPLEX: MAIN HAULAGEWAY
Site 5ML201
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO



During the 1892 development of the mine, workers constructed a rail bed from the lower tunnel portal to the mill, which stood on the far north side of an abrupt bedrock ridge. Miners first constructed a trestle from the tunnel to the bedrock ridge, and subsequently filled the area around the trestle piers with waste rock, creating a bench. They blasted a notch 6 feet wide through the ridge, and constructed another trestle on the far side, that led north to the mill. The workers then laid a rail line that permitted miners to push ore-laden cars out of the tunnel, through the notch, and over to the mill. Around 1900, the East Willow Creek outfit laid a 3 inch compressed air pipe (Feature 30) from a compressor installed in the mill, along the rail bed and into the tunnel.

Around 1900, the East Willow Creek outfit focused most of its activity at the lower haulageway, and left features visible today. As part of the surface plant upgrade, workers constructed two 15 by 15 foot frame buildings south of the blacksmith shop on the waste rock dump. The northern-most building served as a carpentry shop, indicated by a scatter of wood scraps, and the other building's function remains unknown. Today, two dry-laid rock and timber foundations (Features 32 and 33) define where the buildings stood.

All of the operations that used the lower haulageway relied on the traditional transportation system of ore cars on mine rail lines. Currently, evidence of a line used to dump waste rock is visible extending south along the dump's length. The remnant (Feature 34) manifests as a series of ties with rails removed. Extant spike holes in the ties indicate that mine workers constructed the line by spiking rails 18 inches apart, and the ties are spaced every 2 feet.

The mining outfit that worked the Ridge property during the 1940s effected several additions to the lower tunnel's surface plant. It erected a bottom terminal on the southern portion of the waste rock dump for an aerial tramway that extended up to the mid-level haulageway. The terminal consisted of a small ore bin that received payrock dumped by a tram bucket, and an engine that powered the system. The bin was dismantled and removed, and the engine (Feature 35) remains today. The engine consists of a salvaged truck chassis and 6 cylinder Chevrolet engine with its drive train geared to a custom made cable spool. Workers assembled the machine by welding the framing together, reflecting construction during the 1940s.

One of the operations also constructed an ore bin on the shoulder of the waste rock dump near the shop. A mine worker transferred payrock from the bin at the tram's lower terminal into an ore car that he pushed to the bin. An ore chute directed payrock from the bin to a truck parked on the road below. Currently, foundation pilings (Feature 36) are the only evidence denoting the bin's location.

RIDGE MINE COMPLEX: RESIDENTIAL COMPLEX

Site 5ML201

CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO

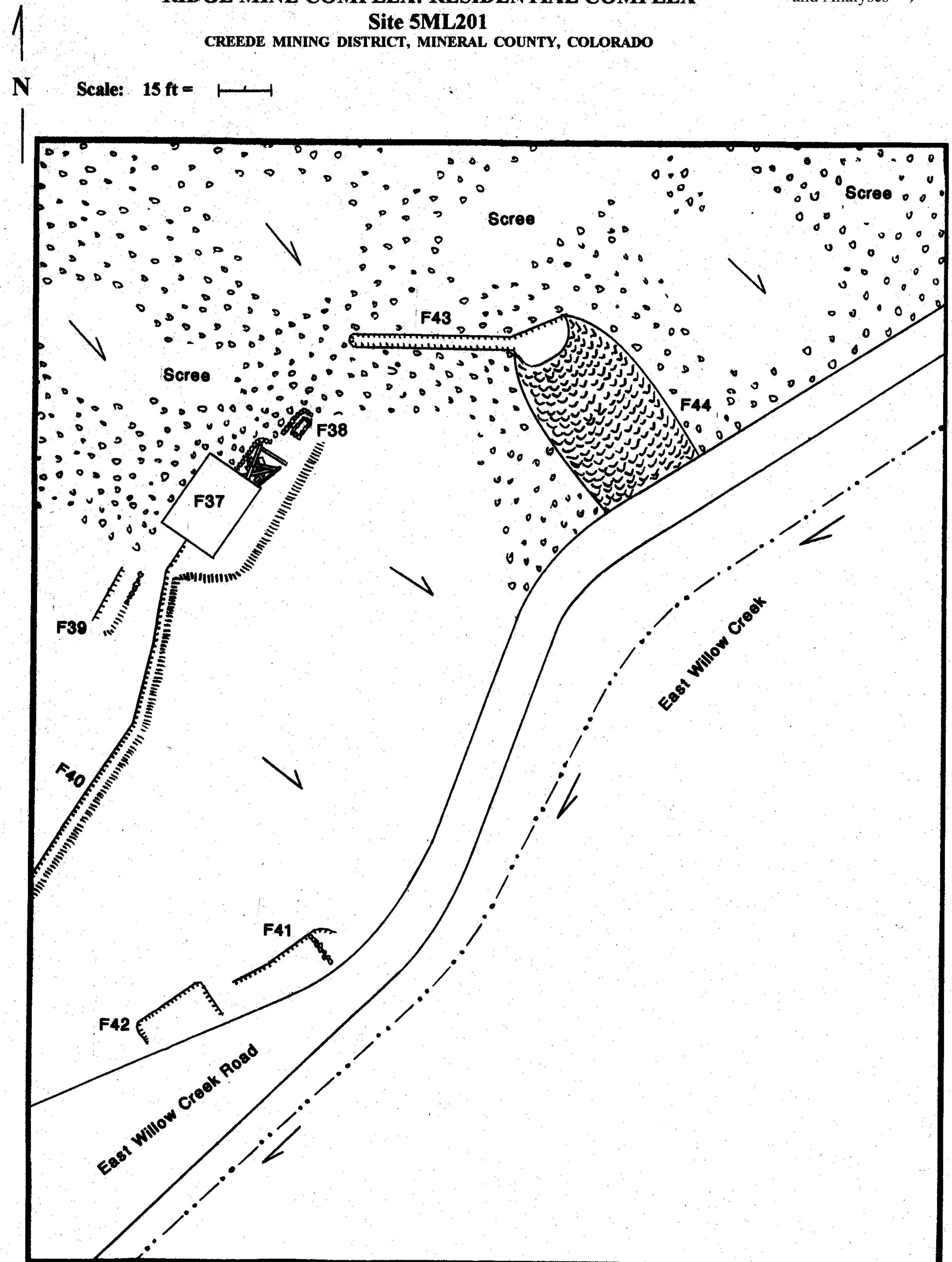


Figure 7.20 The photo depicts the west quarterview of the residential cabin (Feature 37) erected at the Ridge Mine around 1891. The cabin possesses architectural characteristics and materials similar to the shop buildings erected at the Mid-Level Tunnel and the Main Haulageway. Source: Author.

Figure 7.21 The photo portrays the area where the Ridge Mill and the residential complex stood. The mill is represented by the structural debris at left. Within recent decades the mill remnant was bulldozed and buried by rock debris. Residential buildings stood along East Willow Creek beyond. Road construction and widening erased all but two building platforms (Features 41 and 42), which are situated on the left side of the road right of photo-center. Source: Author.

Residence

Because the Ridge Mine lay more than a mile from the townsite of North Creede, a small settlement grew around the mine and mill. Three residential structures, one of which still stands, are currently represented at the Ridge Mine site by the material remains, while more certainly existed in times past. A 1912 map of the Creede district depicts two additional residential buildings not currently represented by features on-site.[29] Bulldozer disturbance and road widening within the last 50 years erased traces of the additional residential structures. It remains unknown whether the company provided the miners and mill workers with housing, and in what forms.

The residential structure currently standing on-site (Feature 37) was erected by Bowen’s mining operation during the early 1890s. The structure is a 15 by 24 foot log cabin located on a cut-and-fill platform north of and upslope from the mill area. Mine workers constructed the cabin with raw logs assembled with square-notch joints, and they chinked the gaps between the logs with mortar retained by log and dimension lumber strips. The materials, style, form, and workmanship that the workers used to construct the cabin are nearly identical to those used for the shops located by the portals of both haulage tunnels. The cabin’s walls stand on log footers placed on the platform, and the cabin’s roof, which consists of three log beams sided with boards, is arched. The north and west walls feature no windows or doorways. The south wall features the main doorway and a four-pane casement window 36 inches wide and 28 inches high. The east wall features twin window frames 28 inches wide and 60 inches high.

The cabin's interior was sided with whitewashed planks, and features a tongue-and-groove floor. Shelving units stood in the southeast corner, where the cooking area was, and more were nailed to the northwest wall. A frame addition, sided with corrugated iron, was constructed on the cabin's north side, and it stands on the cabin's earthen platform. A 6 foot high dry-laid rock wall retains the platform’s cut bank by the addition. Coal scattered in the addition suggests that the occupants used the structure for storage. The cabin is currently in deteriorated condition, while the addition collapsed. The cabin’s wall footers rotted, causing the structure to lean west, and the platform's cut bank slumped against the cabin's west wall, which also rotted and collapsed.

The site’s other two residential structures were frame buildings that stood on cut-and-fill platforms located north of the mill, on the valley floor. When the extant gravel road, extending along the creek, was widened, the earthmoving truncated the platforms’ eastern edges. Regardless of the disturbance, their historical sizes were probably close to their current sizes. The south platform (Feature 41) is 12 by 20 feet in area, and the north platform (Feature 42) is 10 by 15 feet in area.

Ridge Mine Site Analysis

The Ridge Mine serves as an example of a large, heavily capitalized, well-financed, highly productive operation. The mine featured six entries including three adits driven at a high elevation, a fourth adit driven below, and two haulage tunnels. Each adit and tunnel served a specialized function. Prospectors drove the three upper adits as

[29] Emmons and Larsen, 1923.

discovery workings intended to examine the veins on Ethel, Mexico, and Ridge claims in either 1890 or 1891, prior to consolidation by Senator Thomas Bowen. Miners drove the fourth adit into the Mexico claim, underneath the three upper adits, to examine a vein at depth and to begin ore extraction, probably in 1891. After Bowen purchased and consolidated the claims, he had his miners drive a haulage tunnel downslope from the four adits. The haulageway permitted miners to tap the vein at depth and stope the ore from the bottom up, according to conventional mining engineering. When Bowen's workers constructed the concentration mill in 1892, a crew of miners drove yet a second haulage tunnel lower down, near the valley floor. This tunnel became the principal access to the mine workings, and miners transported ore through it, across a mine rail line on ground-surface, directly to the mill. Miners used the lowest tunnel to work the vein from the bottom up, and as a platform for deep exploration via winzes underground.

The arrangement of the tunnels, their particular functions, and their surface plants reflect sound organization, fine engineering, and ore production in economies of scale. The upper adits served primarily as entries for miners and supplies into the upper stopes, and as parts of a natural ventilation system. The lower tunnels served primarily as haulageways for ore taken out of the mine's mid-level and lower stopes, and their surface plants supported work underground. Miners almost certainly drove interconnecting raises which permitted ore to be transferred via gravity from the upper and mid-level stopes to underground ore bins in the lowest tunnel.

Several of the facilities erected by Bowen's operation in the early 1890s reflect major capital investment, progressive engineering, and a reliance on mechanization. The concentration mill, which stood on the bank of East Willow Creek, separated metalliferous material from waste. While the mill required significant financing, it ultimately saved the company the costs of shipping waste-laden ore to smelters, and it saved a portion of the processing fees levied by smelters. Bowen's operation also erected shops at both haulage tunnels. Two shops were able to handle a great quantity of work. Further, the shop at the lowest haulage tunnel was large and well-equipped.

The East Willow Creek outfit also invested significant quantities of capital, it employed advanced engineering, and relied on mechanization to produce ore in economies of scale. According to archival information, the outfit spent much money rehabilitating the mine's underground workings, surface plant components, and the mill. In addition, the East Willow Creek outfit installed an air compressor in the mill to power rockdrills in the underground workings. The associated air system was complex, consisting of plumbing routed from the mill into the lower tunnel, and from there, a maze of pipes sent air to the critical areas underground. Such a system could have only been constructed with advanced engineering. The East Willow Creek outfit erected several additional surface plant facilities designed to expedite materials handling. Specifically, the outfit's workers constructed a carpentry shop and a second frame building at the lowest haulage tunnel, and it probably erected the shop at the Ethel adit.

By contrast, in the face of depleted ore bodies, the 1912 group of lessees and the 1940s mining operation invested little capital on the Ridge Mine's infrastructure. The 1912 group of lessees appears to have worked the mine as left by the East Willow Creek outfit. According to material evidence, the outfit employed rockdrills, and extracted ore from the upper adits on the Ethel and Mexico claims. The 1940s operation made only a few additions to the surface plants, consisting primarily of the tramway linking the upper and lower haulageways. Both of the above operations exhibit characteristics of restricted capital, limited production, and brief occupation.

The artifacts at the adits and tunnels lend additional information to the interpretation of the site. In general, the quantity of items that date to the 1900s is greater than items deposited before or after this period, indicating that the East Willow Creek outfit had a significant impact on the site. The quantity of artifacts at the upper adits post-dating around 1905 is much greater than those before or after, indicating that the 1912 group of lessees focused their efforts on the mine's upper stopes.

Specific sets of artifacts at the mine complex reflect the practices exercised by the mine's operators. For example, while the multiple tunnels comprising the mine offered the benefit of improved ventilation through natural circulation, ventilation tubes indicate that miners supplied fresh air to deadend workings with small mechanical blowers. Such a practice was progressive. The high number of pipes and rockdrill parts mirrors the mine's reliance on rockdrills and other machinery to expedite ore production. Last, dynamite box panels and thawer parts at the Ethel adit reflect the progressive practice of thawing frozen dynamite according to proper fashion.

Ordinarily, an artifact assemblage associated with a residential complex at an intact site can reflect trends regarding the occupants. However, because the residential features and associated artifacts located adjacent to the extant gravel road have been heavily disturbed, conclusions cannot be drawn for all of the site's residents. The standing cabin is the only residential feature retaining an intact assemblage of domestic refuse, and conclusions therefore apply only to its residents.

First, the cabin's floor space hints at the number of workers that lived in the structure. When the Ridge Mine was active, workers generally required at least 60 square feet of space each for sleeping and personal possessions.[30] Areas for cooking and other domestic activities required additional space. The cabin's floor area is 360 square feet, and probably accommodated up to four residents, including space for cooking. As a residence, the cabin was fairly primitive, and it lacked electric lighting and plumbing. Further, the remnants of a wood-frame cot indicates that at least several residents did not use full-size beds. However, an effort was made to finish the interior with plank-sided walls, a sound floor, and shelving. In addition, the broad windows afforded ample light and ventilation.

The cabin's residents disposed of their domestic refuse in the manner typical of Western mining camps. They dumped cans, bottles, and other forms of trash downslope, and relied on a privy for personal use. The artifact assemblage reflects some trends regarding the cabin's occupants.

First, the artifact assemblage consists primarily of food-related items. The presence of food cans and butchered bones reflects the preparation of some meals. However, considering the duration of mining at the Ridge, the quantity of items is low. This, and the absence of tableware fragments, indicates that the cabin's residents consumed most of their meals elsewhere, probably in a company dining hall.

The artifact assemblage includes male-specific items such as boot remnants, and lacks decorative and domestic goods. In addition, the assemblage lacks items

[30] Hardesty, 1988:13.

representative of status. In this context, the artifact assemblage indicates that the cabin's residents were male workers, probably of a low socio-economic status.

The food-related items indicate that the cabin's residents ate a hearty Victorian diet similar to that consumed in other Western mining districts. The abundance of food cans and butchered bones reflect the consumption of meals that emphasized preserved vegetables, beans, and fruits, and some fresh meat. Further, the bones consist primarily of cuts for stews and roasts. The above foods may have been supplemented with fresh beans, baked goods, grains, and potatoes, although there is no evidence. Many of the cans contained milk, which the residents may have used in coffee or tea.

The artifact assemblage includes bottle fragments that represent a moderate quantity of liquor bottles, indicating that the cabin's inhabitants openly drank liquor. The number of liquor vessels is, however, not particularly high, and there is no evidence of tobacco use. The absence of evidence of the consumption of medicines and salves indicates that the residents' health was probably sound.

The cabin's structural characteristics and associated dateable artifacts reflect the approximate periods of occupation. It appears that Bowen's miners constructed the cabin in 1891 or 1892, and they probably lived in the structure until the mine was closed in the mid-1890s. First, the cabin is almost identical in architectural style, materials, and construction to the shop adjacent to the lower haulage tunnel. Construction materials indicate that the shop was built by 1892, at the latest. The set of food cans associated with the cabin includes five times as many hole-in-cap vessels constructed with lapped side seams as those made with inner-rolled and soldered side seams. During the 1890s food packers replaced cans made with lapped side seams with those manufactured with inner-rolled and soldered side seams. The set of dateable bottle fragments consists exclusively of hand-finished vessels, and the set includes two bottle bases with makers' marks. The marks were used between 1879 and 1907, and the 1890s and 1908. Bottle makers began replacing hand-finishing technology with machine-made bottles during the 1900s, and the trend accelerated during the 1910s. Last, the artifact assemblage included a blasting cap tin made only in 1906, which workers employed by the East Willow Creek outfit certainly left. If the Ridge Mine's subsequent lessees and operators lived in the cabin, then the artifact assemblage would include sanitary cans and machine-made bottle fragments, which are absent.

Soloman Mine
Site 5ML200

Like the Holy Moses Mine, the Soloman Mine was one of the Creede district's earliest and richest metals producers. The mine lies near the south end of the Holy Moses Vein. Miners drove the Soloman Tunnel into the base of the south spur of Campbell Mountain, and they erected a surface plant, a mill, and residences on flat ground on the west bank of East Willow Creek. The mountainside around the site is blanketed by scree punctuated by bedrock outcrops. A few stands of evergreen trees grow in patches of soil above the site, and the banks of East Willow Creek are lined with willows.

Within the last 50 years the Soloman Mine experienced mining and environmental remediation, which erased nearly all evidence of historic activity. The site currently features structural remnants and water settling ponds. In 1990 Leanne Sander, representing the Colorado Division of Minerals and Geology, recorded the mine as Site 5ML200 in association with a mine closure project. The tunnel portal was gated and the project disturbed little else at the site.

Figure 7.22 The northwest view depicts the Soloman Mine in 1959. The ore bins at left manifest today as Feature 5, and the small ore bin, with the slanted roof, at right is Feature 4. All of the structures in the photo were erected either in the 1940s or 1950s, and bulldozed after the mine was abandoned. In the photo, the East Willow Creek Road parallels the creek's right bank. After the mine was abandoned, it was re-graded along the creek's left side. The waste rock dump in the right background is associated with the Ridge Mine's main haulageway (Site 5ML201).

Mining Operations

In 1889 the party led by Nicholas Creede discovered the famous Holy Moses Mine high on the side of Campbell Mountain, and word of their fabulous discovery began to spread, drawing at first a few other prospectors to the area, including Charles F. Nelson. In 1890 Nelson began examining East Willow Creek, near Creede's initial find, in hopes of locating a strike of his own. Nelson, who arrived before the rush to the district, prospected the creek's west side and made not one, but two of the district's most significant finds. Approximately a half-mile south of Creede's Holy Moses claim Nelson discovered a rich silver vein and staked the King Soloman claim. Before proving the vein's worth, he continued his prospecting forays, and found a second vein north, which he claimed as the Ridge. The word of the strikes made by Creede, Nelson, and prospectors over on the Amethyst Vein touched off the rush to the King Soloman Mining District, as the area was known, in 1890 and 1891.[31]

A few of Colorado's mining magnates recognized the potential for riches that the King Soloman district held, and they began taking an interest in the proven claims. In either 1890 or 1891 Nelson sold his claims to Senator Thomas Bowen, who was among the silver barons interested in the area. Bowen served a term in the Senate in the 1880s and had been involved in mining for decades. In 1892 Nelson, highly active in Creede's mining industry, organized the Nelson Tunnel Company, which drove the Nelson Tunnel underneath the Amethyst Vein.[32]

By 1892 Bowen hired a crew of miners to begin driving a tunnel from East Willow Creek's valley floor to tap the vein, and they erected residences and a surface plant to support work underground. Within the year miners struck the vein at depth, and it proved to be a bonanza. The ore consisted of a blend of galena and zinc in chalopyrite. Miners extracted the precious payrock through 1892 and into 1893, providing Bowen with handsome profits. Then, in 1893 the Soloman Mine shared the near-fatal blow suffered by all of the Creede district's other mines when the Silver Crash caused the price of the white metal to plummet. Mining was no longer profitable and Bowen ordered the mine closed.

Plenty of rich ore remained underground, however for five years the low price of silver and scarce capital discouraged further activity. When the economy recovered in the late 1890s, the mine's owners, which now included members of David Moffat's powerful syndicate of capitalists, made plans to bring the Soloman back into production. To offset silver's low price, they effected several changes designed to lower their operating costs. Most of the work underground continued through the miners' hand labor; little money was spent on mechanization. However, the syndicate financed the construction of a concentration mill at the Soloman Mine. The mill separated waste from metalliferous material, and the concentrates were shipped to distant smelters for refining. In so doing, the syndicate did not have to pay to ship waste-laden ore, and it saved some of the processing fees levied by the smelters. By 1898, 25 workers operated the mine, and by 1900 the mill began treating the Soloman's ore.[33]

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[31] Emmons & Larsen, 1923:175; Mumey, 1949:43.
[32] Mumey, 1949:43.
[33] *EMJ* 7/9/98 p46; *EMJ* 6/23/00 p748.

By 1910 miners exhausted economic ore and the Soloman fell idle. Convinced that the Soloman's ore bodies would no longer sustain operations on a scale of any consequence, the Moffat syndicate sold the property to the CMS Mines Company. The mine lay quiet for several more years until World War I created a demand for industrial metals. The ore considered by the Moffat syndicate to be too poor to pay became economical once again, and William Wright & Company leased the Soloman in hopes of reopening the old workings. The Wright outfit extracted ore and treated it in the mill until 1918, when the war's end caused the market for industrial metals to collapse. After a year, Wright's miners resumed work and continued to glean ore left by the previous operators. Because little capital was spent on maintaining the mine's infrastructure during the previous several decades, the mine was in a poor state. In 1919 the Colorado State Mine Inspector found conditions to be so bad that he threatened to close the Soloman until repairs could be effected. The ground was heavy and in danger of collapse, and one of the winzes showed signs of settling. However, the inspector was reluctant to force a suspension of operations in the interest of preserving the miners' jobs. The faltering demand for industrial metals forced the Wright outfit to cease operations by 1920, making the safety issue a moot point, and the Soloman remained idle for several more years.[34]

In 1922 the Pittman Act reinstituted federal price supports for silver, which stimulated a small wave of interest in silver mines throughout Colorado. At this time the Ethel Leasing Company made preparations to reopen the vacant Soloman, and it examined the workings. The Ethel outfit may have even extracted some ore before the repeal of the Pittman Act caused silver prices to crash, dashing hopes of further production.[35]

Federal price supports for silver once again stimulated an interest in the Soloman Mine. In 1934 President Franklin Delano Roosevelt signed the Silver Purchase Act into law, which revitalized mining in Creede. In hopes of mining ore remaining in the Soloman's old stopes, operator Bert Husselkus began examining the underground workings, and he hired several miners drive short exploratory drifts. However, they realized that the mine would not pay, and abandoned operations. Up to this time, the Soloman produced up to $2 million.[36]

During the following seven years the mine traded hands four times, and each owner thought that the Soloman held potential. In 1945 the Soloman Mining Company purchased the property and the New Ridge Mining Company began exploration under lease. In 1950 C.O. Withrow assumed ownership and the Mexico Mining Company conducted further exploration. In 1951 the Rio Grande Mining Company attempted to locate new ore, and in 1952 the TOC Development Company took over the lease. Where the previous lessees failed, TOC succeeded and finally found an ore body. During 1952 TOC drilled and blasted ore and realized $20,000 for its efforts before the vein pinched out. The succession of failed leases had proven that the Soloman was in fact exhausted, and no other mining interests risked capital on further exploration. The Soloman Mine was permanently abandoned.[37]

[34] Colorado State Archives, Mine Inspectors' Reports, Box 104053: Soloman.
[35] Ibid.
[36] Colorado State Archives, Mine Inspectors' Reports, Box 104053: Soloman; Colorado Engineers' Reports: Box 31301.
[37] Colorado State Archives, Mine Inspectors' Reports, Box 104053: Soloman.

SOLOMAN MINE

Site 5ML200

CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO

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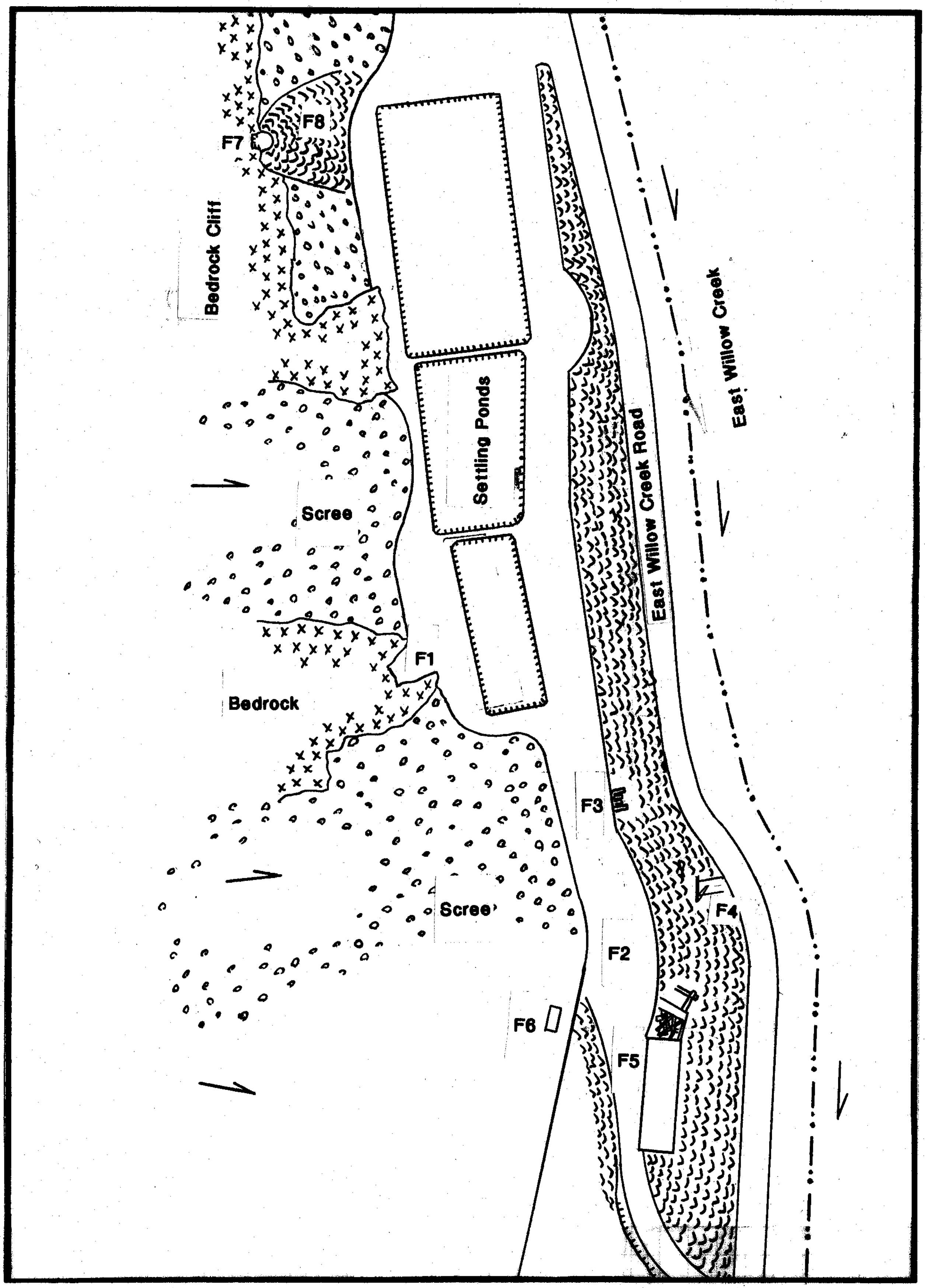

The last seven years of mining at the Soloman, and subsequent environmental remediation activities severely impacted the site, leaving few traces of earlier operations visible today. Most of the mine's waste rock dump was bulldozed, and three water settling ponds were excavated where the historical surface plant, and probably the mill and residences, stood. Few historical artifacts lie around the site, probably having been buried during bulldozing and mining activities.

The TOC Development Company erected several structures that still stand at the site. A three-cell ore bin (Feature 5) stands on the waste rock dump's shoulder south of the tunnel, and a wooden water tank (Feature 6) stands upslope. Another, small ore bin remnant (Feature 4) lies embedded in the waste rock dump along side the road that extends up East Willow Creek. An ore bin foundation (Feature 3) is located on the waste rock dump's shoulder between TOC's structures and the tunnel portal. William Wright & Company probably constructed the ore bin.

An adit is visible penetrating a bedrock cliff north of and upslope from the tunnel portal, and it may have been driven by one of the mine's earliest operations. Remnants of an ore chute extend downslope, indicating that miners working in the adit produced some payrock.

Residence

No evidence of residence on-site exists. Mine workers may have lived in a nearby boardinghouse, or they may have lived at the settlement associated with the Ridge Mine located a short distance north.

Soloman Mine Site Analysis

The Soloman Mine experienced a sporadic and highly productive life. Little evidence exists suggesting how Senator Bowen's company, the Moffat syndicate, and the Wright outfit equipped and operated the mine. The former existence of the concentration mill, and the extant, large waste rock dump reflect substantial production and extensive underground workings. The lack of heavy concrete machine foundations, which would have survived the recent bulldozing, indicates that the mine's early operators relied principally on hand-labor and simple, temporary-class machinery to drive the underground workings and to extract ore.

The mine rails, ore car parts, and the compressed air hoses left by the mine's last operators during the 1950s indicate that they used traditional methods to work the Soloman. The ore bins reflect some production during the 1950s, and probably optimism that the operators would encounter significant quantities of payrock, which they never did.

Powerhouse Remnant
Site 5ML352

The powerhouse remnant lies at the scree-covered north base of Campbell Mountain, on the west bank of East Willow Creek. Further, the site lies almost midway between the Holy Moses and Ridge mines. All of the associated structures and equipment were removed long ago, and the site retains a moderate degree of historical integrity. Archaeological remains in the forms of two building platforms, a boiler foundation, and a combination steam engine and dynamo foundation comprise the complex. Stands of pine trees dot the adjacent scree slope, and willows line the banks of East Willow Creek. A maintained gravel road passes between the powerhouse platform and East Willow Creek, and the site has been used as a vehicle pullout for decades.

<u>Operations</u>

No archival references to the powerhouse were located in conjunction with this inventory project, and as a result the existing material remnants serve as the only evidence reflecting the past electrical generation operation. The site features two building platforms, and foundations for a boiler, a steam engine, and a dynamo. According to the foundations, the boiler powered the engine, which in turn drove the adjacent dynamo. The foundation's size indicates that the boiler was a return tube unit probably 5 feet in diameter and 18 feet long enclosed in a brick setting. Such a boiler had the capacity to produce up to 90 horsepower, which was sufficient to power a large steam engine. Currently, only a dry-laid rock pad remains, and the boiler shell and most of the bricks have been removed.

The steam engine and dynamo were anchored to a common foundation consisting of two components. The engine was fixed to a pad 9 by 9 feet in area featuring four rows of 1½ inch anchor bolts. The foundation's size and shape suggests that the engine was a powerful compound duplex unit. Duplex engines had two parallel sets of drive cylinders with a large flywheel between. The dynamo was anchored to a second pad 3½ by 6 feet in area featuring two clusters of four 1½ inch anchor bolts. The two clusters of anchor bolts and the foundation's shape suggests that the dynamo had two halves with a flywheel between. The engine probably transferred motion to the dynamo via gearing or a chain drive.

Before constructing the powerhouse, workers prepared the site by clearing soil off underlying bedrock to provide a firm footing for the machine and boiler foundations. Such practices were commonly employed when constructing facilities equipped with heavy machines. The workers then built the foundations by laying a mortared rock footing over bedrock, and in the case of the combination engine and dynamo foundation, they laid brick masonry over the rock footing.

The power generation machinery was enclosed in a large frame building approximately 40 by 40 feet in area. The building stood on timber footers placed over portions of exposed bedrock and soil. The building probably featured separate rooms for the boiler and for the engine and dynamo to prevent soot from fouling the machinery.

The boiler occupied most of the boiler room, and the boiler façade faced north. The north portion of the boiler room featured a large coal bin to fuel the boiler, and a worker stood between the boiler and the bin and shoveled coal into the boiler's firebox. He also periodically shoveled clinker and ash, residue generated from burning coal, out of the boiler's ash pit into a wheelbarrow. The worker pushed the wheelbarrow out of the powerhouse and dumped it.

The powerhouse was also equipped with electrical wiring, a master switch panel, transformers, and distribution lines. Little evidence of this equipment remains today, and their historical locations are unknown.

Residence

The powerhouse site features a second building platform located south of the generation facility. Workers constructed the platform with cut-and-fill techniques, and they erected a frame building on the flat area. A few bottle and tableware fragments lie scattered on the platform, suggesting that the building may have served as residence for a brief period of time. The artifact assemblage associated with the platform is insufficient to draw conclusions regarding the building's occupants.

Powerhouse Site Analysis

The powerhouse was a well-engineered, properly constructed electrical generation facility. Dateable artifacts associated with the site suggest that the powerhouse was built between the late 1890s and 1900s, at the height of the resurgence of mining in the Creede district. Due to a lack of archival information, it remains unknown which mining company erected the powerhouse, however David Moffat's syndicate probably supplied necessary capital. Moffat's syndicate owned nearly all of Creede's major mines and mills, and these operations stood to gain the most from applying the power generated. In addition, the powerhouse's location on East Willow Creek suggests that the facility provided electricity to the Ridge and Soloman mines, which used electricity.

Because the site is located on a heavily traveled road, over the course of many decades people have scavenged building materials and other items, which severely reduced the numbers of artifacts. Regardless, the existing material evidence reflects several trends regarding the operation of the site. First, the light quantity of boiler clinker around the powerhouse platform indicates that the boiler saw little use. Second, the few domestic and other items associated with the second building platform reflect brief occupation of the structure. Last, the near-absence of general industrial items reflects brief operation of the powerhouse. In sum, these observations indicate that the facility operated for a very short time before the facility was disassembled and its components removed wholesale.

POWERHOUSE REMNANT
Site 5ML352
CREEDE MINING DISTRICT, MINERAL COUNTY, COLORADO

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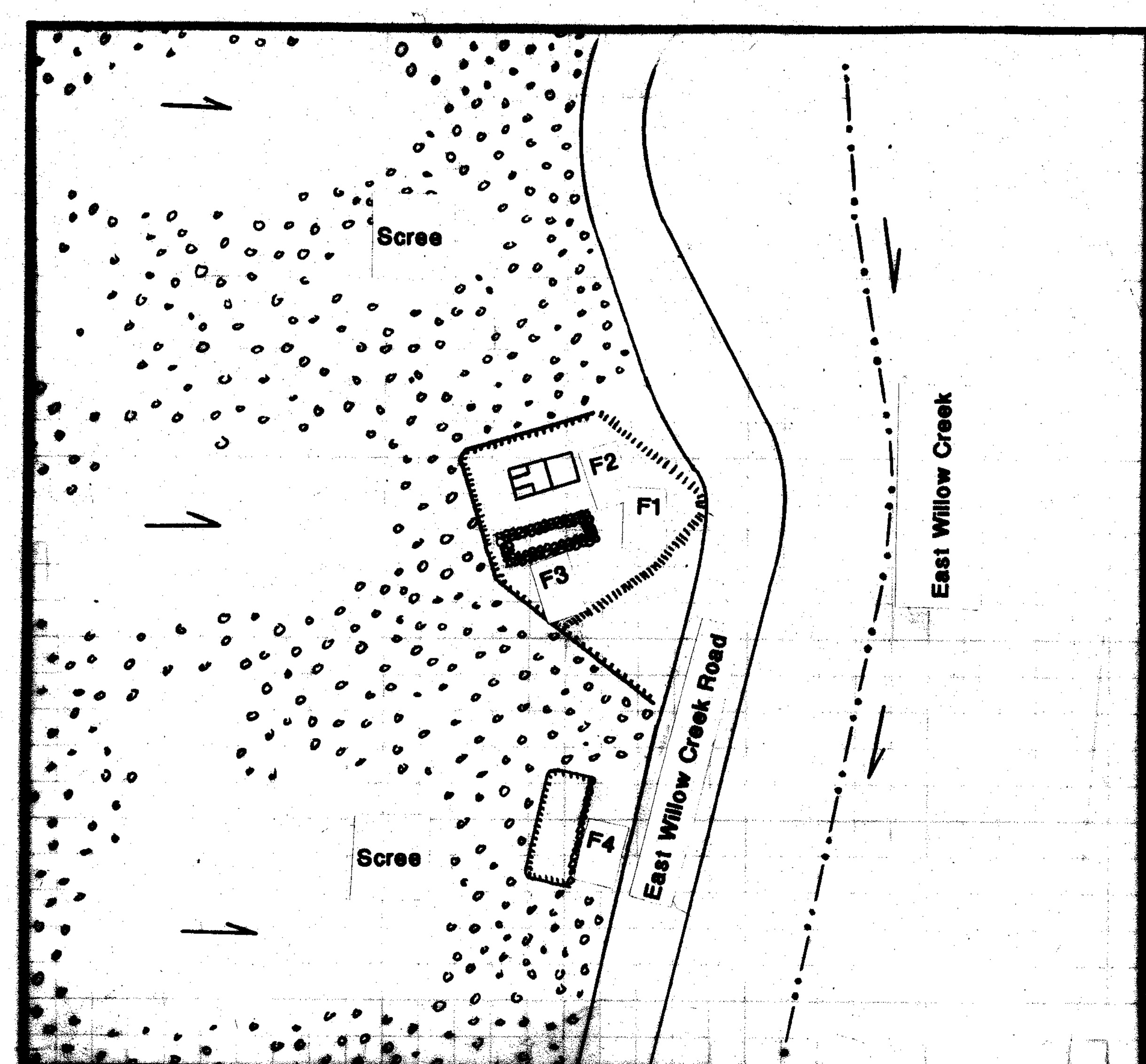

CHAPTER 8 EVALUATIONS AND RECOMMENDATIONS

Chapter 8 discusses the significance evaluations and management recommendations for the sites inventoried on the Holy Moses Vein and East Willow Creek. All of the sites were evaluated for their significance on local, state, and national levels. The sites significant on state and national levels are recommended as eligible for listing on the State and National Registers of Historic Places, and the evaluations are based on the applicability of State and National Register Criteria, and physical integrity. The National Register of Historic Places is a list of sites that hold importance to the nation's past. The National Park Service administers the National Register, and it defined a set of four basic Criteria by which a historical site could be eligible. The Colorado Office of Archaeology and Historic Preservation devised a State Register modeled after the National Register. The Criteria are as follows:

> *Criterion A*: Association with events that made a significant contribution to broad patters of history.
> *Criterion B*: Direct association with the lives of persons significant to our past.
> *Criterion C*: The embodiment of distinctive characteristics of a type, period, or method of construction, or representing the work of a master.
> *Criterion D*: A likelihood of yielding information important to history.

In addition to the above, a site must possess historical integrity relative to one or all of the applicable Criteria. For example, if a mine in the Creede district is associated with an important person, then the site must retain historical characteristics developed or in existence during the important person's activities. As another example, if a site is claimed to embody the distinctive characteristics of an early 1890s mine, then the site must not have changed a great degree afterward.

One of the underlying areas of importance shared by the sites recommended as eligible is an association with the exploration, development, and settlement of the Creede Mining District. Depending on a site's role in the district, through an association with the mining district, a site can be considered significant on local, state, or national levels. For a detailed account of the Creede district's history and associated references, see the historical context.[1]

The Creede Mining District was an important center of hardrock metals mining, and it was tied to local, state, and national events, patterns, and systems. On a local scale, the district became the economic and political hub of the region, and it drew a population, industries, and promotion to a previously little-inhabited area. Colorado state officials carved Mineral County out of Saguache, Hinsdale, and Rio Grande counties specifically to administer to the needs created by the Creede district.

On a state level, the Creede district was connected to several broad and important themes. Not only was the Creede district one of Colorado's most productive silver mining districts, but by the late 1890s its mines began producing high volumes of industrial metal ores, as well. In this light, the district contributed significantly to the

[1] Twitty, 1999b.

theme of the state's economy in several ways. First, investors from across the nation funneled capital into the district to facilitate the extraction of ore. The money directed at securing supplies, equipment, services, and property improvements, went to businesses within the state. Second, much profit realized from ore production remained in Colorado in the hands of investors, workers, and businesses. Third, Colorado, and especially Denver, was the center of one of the world's most advanced and prolific mine supply and machinery manufacturing industries. By acquiring many of their industry-specific supplies and machines from Colorado manufacturers, Creede's mining and prospecting companies helped the state's mine supply industry maintain its supremacy. Fourth, acquiring, transferring, managing, and distributing the capital and profits fostered systems of banking and commerce.

The Creede district played a part in the theme of Colorado's agricultural and ranching industries. Thousands of people populated the district, and they required food. Most of Creede's residents adhered to the traditional Victorian diet consisting of meats, vegetables, fruits, and grain products, all offered in abundance by Colorado's ranches and farms. Because of the lack of adequate refrigeration, most of Creede's foods had to be purchased from regional sources and shipped before they spoiled. In this context, the demand for foods directly supported regional farming and ranching, most of which was located in the Rio Grande River and San Luis valleys.

The Creede district played a role in the theme of Colorado's social structure. First, Creede's mines contributed to the maintenance of the social strata among mining industry participants. A few of Colorado's mining elite, including David Moffat, Sylvester T. Smith, A.E. Reynolds, and the Wolcott family, acquired all of the district's most profitable mines. During the early 1890s these owners realized personal fortunes from Creede's mines, and they rose to or maintained positions among the state's and Denver's high society. Members of the mining elite lost their fortunes during the Silver Crash of 1893, when silver was devalued and silver mines suspended operations. By infusing capital into Creede's mines during the late 1890s and resuming operations when the economy recovered, the mines' productivity permitted the established elite to maintain their social positions. Investors of lesser means and management of mining companies also profited, and they formed an upper-middle class. The need for workers in the mines and mills ensured that a working class remained.

Second, the cycles of boom and bust in the Creede district helped foster a mobile workforce, as jobs were created and terminated. Such a skilled, necessarily mobile workforce contrasted sharply with Colorado's sedentary farming and ranching societies.

Third, some workers employed at Creede's mines and dependent industries were immigrants, mostly from European countries. The development of Creede's mines drew people of different ethnicities to Mineral County, and the collapse of mining propelled them to other parts of the state.

Creede directly participated in the theme of Colorado's mining frontier. Creede was one of many metals mining districts that drew Euro-American settlement, economy, industry, transportation, and population to the Rocky Mountains. As a result of the wealth, capital, and engineering in districts like Creede, the state of Colorado attained legendary proportions worldwide for its hardrock mining industry.

The Creede district was also connected to broad themes on a national level. Some of the themes parallel those on the state level, with the addition of inter-state connections, and some are primarily on a national level.

The Creede district participated in the theme of a national economy. First, many investors and mining companies were based outside of Colorado. Communication, finance, and the acquisition and shipment of mining and domestic supplies and food occurred on an inter-state level. In this light, the Creede district was a part of complex national economic and financial systems. Second, national economics created the demand for the ores produced by Creede's mines. Federal acquisition of silver prior to 1893 created a demand for the white metal. By the late 1890s, a heavy national demand for industrial metals came to the fore. The demand peaked during World War I, faltered, skyrocketed during World War II, and remained high during the 1950s. Creede's mining companies responded by producing great volumes of such ores. Last, many of Creede's mining companies shipped their industrial metal ores outside of Colorado for treatment, to massive smelters in to Omaha, Nebraska, and Joplin, Missouri, where industrial metals were also mined. In so doing, the Creede district became part of an inter-state ore treatment system.

The Creede district participated in the theme of the nation's social structure. When the district experienced its first boom in the early 1890s, it drew optimistic people of many social strata and ethnicities from across the nation. In this context, Creede perpetuated a social group of mobile workers and businessmen. The wealth that investors and businessmen outside Colorado realized from Creede's mines helped the growing upper-middle and middle class social strata to develop.

The Creede district played an important role in the theme of national politics. During the 1890s and 1900s, powerful capitalists owned Creede's productive mines. Some of the elite, such as Thomas Bowen and members of the Wolcott family, held public offices and directly influenced policies that affected the West, especially the mining industry. The other powerful capitalists, such as David Moffat, A.E. Reynolds, and Sylvester T. Smith, supported the politicians that influenced policies. The net result was the promotion of policies in the West that impacted the public, as well as special, interests. For example, all of the capitalists that gained from mining advocated Federal price supports for silver, and when the supports ended in 1893, they fought for reinstatement.

The Creede district also participated in the resurgence of silver mining when President Franklin Delano Roosevelt signed the Silver Purchase Act into law in 1934. The Act created Federal price supports for the metal, which revitalized mining in many of the West's silver districts, including Creede. The re-opening of Creede's silver mines mobilized capital, created jobs, and contributed to the demand for supplies, food, and services, which came from sources in and outside of Colorado.

Creede directly participated in the theme of the Western mining frontier. The aspects were similar to those discussed with the theme of Colorado's mining frontier. Like Colorado, the wealth, capital, and application of technology in districts like Creede created a mining industry that, up to the 1910s, set a precedent for hardrock mining in other nations.

Last, the Creede district directly participated in the development of both mining and industrial technologies and engineering. Creede's mines served as a proving ground for innovative technologies and engineering. In 1892 an electrical plant went on-line in the district, which was one of the first in the West. Until the 1900s, the application of electricity in the West, specifically for mining, was experimental and rare. Through the 1890s the Creede district's electrical grid improved and the power source was used to an increasing degree to run mill and mine machinery. In this vein, the Creede district's electrical grid, and the use of electrical machinery, served as an example of engineering for engineers elsewhere.

In 1892 the Nelson Tunnel Company began a massive engineering project in which it drove a tunnel along the Amethyst Vein, the district's principal ore body, with the intent of linking the prominent mines at depth.[2] The tunnel's purpose was to facilitate deep drainage, to ventilation the workings of many mines, and to serve as a haulageway for the extraction of ore in economies of scale . While the use of lengthy tunnels for the above purposes dates back several decades prior to 1892, the complexity, scale and success of the Nelson Tunnel rendered the project unique. Over the course of ten years, the tunnel attained the amazing length of over two miles, and it linked all of the mines on the Amethyst Vein. The tunnel required the support of a complex infrastructure, which engineers in other mining regions recognized. Not only did the tunnel serve as a celebrated example of fine engineering, but also it demonstrated that mineral claims could be worked from the inside out. The tunnel permitted mining companies to access their claims from within, rather than from separate shafts and adits driven from ground-surface.

The Creede district also saw the application of other technologies. In the late 1890s diamond drills were used to bore long-holes with success in the Nelson Tunnel. At this time, these machines were in a developmental state, and after the 1920s, they became important to the mining industry for deep core sampling. Aerial tramways, installed to move ore in high volumes over hostile terrain, were just becoming popular in the 1890s. The Holy Moses Mine hosted the district's first tramway in 1892, and two more systems were built at the Bachelor and Amethyst mines in the late 1890s. The success of these complicated and costly transportation systems served as examples for engineers in other mining districts.

The significance evaluations for each site inventoried on the Holy Moses Vein and East Willow Creek are detailed below. Most of the sites recommended as eligible are associated with or exemplify aspects of the Creede district, and are therefore associated with the themes and patterns discussed above. To avoid repetition in the evaluations, the sites' roles in the Creede district's history are discussed, but the above associations are not.

The sites on the Holy Moses Vein and East Willow Creek have the potential for significance in another arena not discussed above. Collectively, all of the historical sites, inventoried or not, form a visual landscape within the natural setting of the East Willow Creek drainage. While individual sites can be significant, the overall entity of the visual landscape is likewise important for several reasons. First, it represents a major portion of the Creede district's important mining industry. Second, it possesses intrinsic value in of itself. Last, the legacy of the Creede district's mining industry is highly important to the

[2] The Nelson Tunnel was recorded as part of the Amethyst Vein inventory under Site 5ML346 in 1999.

region's economy, since numerous tourists, from within and outside of Colorado, visit Creede specifically for its historical resources. In this light, each site has the potential to serve as a contributing element to the visual landscape of the historic mining district.

Carbonate Tunnel
Site 5ML350

The Carbonate Tunnel site holds significance on state and local levels, and is recommended as eligible for listing on the State Register of Historic Places. The small complex possesses a high degree of physical integrity, and it meets State Register Criterion A.

In terms of *Criterion A*, the site is associated with events that made contributions to patterns of Colorado and local history through its role in the Creede district. The tunnel was a small prospect operation worked between the early and mid-1890s on the Holy Moses Vein, and it retains elements remaining from this timeframe. The site is therefore directly tied to and a manifestation of the initial exploration, development, and settlement of the Creede district.

The Carbonate Tunnel fails to meet the other Criteria. The operation was not connected to important persons, it is a sound or unique example of a prospect adit, nor is it likely to yield important data in the absence of significant features or artifact deposits. Management recommendations suggest no further work.

The Carbonate Tunnel can serve as a sound, well-preserved component of the visual landscape of the Holy Moses Vein.

Holy Moses Mine
Sites 5ML104 and 5ML351

The Holy Moses shaft complex (Site 5ML351) is recommended as eligible for listing on the National and State Registers of Historic Places. The site possesses a high degree of physical integrity, and it meets National Register Criteria A, C, and D. Because the mine is located in a unique natural setting and features intact structures, the site possesses an ambience uncommon to most Western mine sites.

In terms of *Criterion A*, the Holy Moses shaft complex is associated with events that have made a contribution to the broad patterns of our history. The mine was the first and one of the wealthiest operations in the Creede Mining District. In this context, the mine served as a cornerstone of the rush to the Creede district, as well as making significant contributions the district's economy, development, and settlement during its operating life. The importance of the Creede district is discussed above.

The site is associated with economic contributions in several ways. First, during the mine's principal period of production, between 1890 and 1893, a trio of investors including David H. Moffat, U.S. Army Captain L.E. Campbell, and Denver & Rio Grande Railroad general manager Sylvester T. Smith, owned the property. These men also acquired several of the district's other mines, and poured capital into development and operations, including the Holy Moses Mine. The Holy Moses became a conduit through which much of that capital made its way into the mining district. The capital was spent on workers' wages, the purchase of goods and food, governmental administration, and the support of businesses and services ranging from surveyors to lawyers to teamsters. Second, the mine served as an anchor which stimulated investor confidence and speculation in other properties, indirectly bringing capital to the district. Third, some of the profits realized from production remained in the mining district, as they were diverted to pay for operations.

The site is associated with the development of the district in several ways. First, the mine served as a siren drawing in hundreds of prospectors. They subsequently explored the district and discovered many profitable properties, which fueled the growing rush, resulting in the district's settlement and development of the necessary infrastructure. Second, the mine was the end-point of the first transportation system from the town of North Creede to Campbell Mountain, between East and West Willow creeks. To access the property, a road was graded from North Creede along East Willow Creek, then up the northeast flank of Campbell Mountain. A pack trail also linked the Holy Moses with other mines and residences on West Willow Creek. In 1892 an aerial tramway was built linking the Holy Moses with the Ridge Mill on East Willow Creek to the south. The transportation system ultimately linked all of the principal mining operations in the vicinity.

Last, in 1892 the Holy Moses began shipping its ore to the nearby Ridge mill for concentration, and in so doing, directly supported the development of a local milling industry. Concentrating ores within the district was of great importance, because it rendered ores of low grades to be profitably mined, whereas shipping such ores to distant mills was not economically feasible. As a result, the lives of many mines were prolonged, which had significant implications for the district. For a description and definition of ore concentration, see the historical context.[3]

The Holy Moses Mine is also associated with the application of innovative technologies and mining engineering practices, which contribute to the site's significance under Criterion A. In 1892 the mine's engineers constructed a Bleichert aerial tramway that linked the operation with the ore concentration mill at the Ridge Mine a half-mile away. During this time such tramways were relatively rare, and not until the 1900s did they become more common. In this context, the tramway at the Holy Moses served as an example to other engineers interested in applying this transportation technology.

Last, the Holy Moses Mine at first shipped its ore directly to smelters outside of the district for refining. By 1892, the mining company concentrated its ore at the Ridge Mine, and shipped the concentrates to distant smelters in Pueblo, Colorado and to Missouri for refining. The shipment of ore, and later the concentrates, reflect the mine's ties to complex mining industry-specific economic, commercial, and transportation systems in the Midwest.

[3] Twitty, 1999b.

In terms of *Criterion C*, the Holy Moses shaft complex consists of a combination of archaeological remnants and four standing structures that clearly represent both the mine's engineering and residential occupation. The archaeological remnants include several collapsed buildings, building platforms, structural remnants, mine workings, waste rock dumps, and numerous artifacts. The most valuable building materials, machinery and equipment, and other items were removed long ago. Despite this, the site retains a high degree of physical integrity and the extant archaeological and architectural remnants embody the characteristics of a remote mine active during the 1880s and early 1890s. The remnants on-site clearly represent the mine's engineering in the forms of the surface plant and transportation systems. The remnants also clearly represent the nature of residential occupation. For a detailed site description and interpretation, see Chapter 7 and Appendix 1.

The site also possesses aspects unusual for such a wealthy mining operation. The unusual characteristics lay in the remnants of the mine workings and the surface plant components. The Holy Moses Vein consisted of exceedingly rich ore, yet the Moffat syndicate invested relatively little capital to develop and equip the mine, except for the aerial tramway. The mine workings were accessed via several small shafts and open stopes, and the surface plant was simple and incapable of handling large quantities of payrock. Typically, rich mines were equipped with large surface plants that both expedited ore extraction while minimizing operating costs, and served as tacit statements of a company's power and wealth.

The Holy Moses shaft complex includes unique architectural and engineering elements, which contribute to the site's eligibility under Criterion C. Specifically, the site encompasses a standing upper tramway terminal. The structure is unique and was constructed with a combination of locally cut logs, hand-hewn beams, and imported lumber and sheet iron. Most tram terminals at other mines were large frame buildings built with milled lumber and manufactured hardware. The terminal's interior retains integrity and features the sheave system and hanging rails necessary for the function of Bleichert double rope tramways. A tram tower, which guided the system's cables, remains standing on a rock cornice a short distance south of the terminal. Together, the terminal and tower serve as a rare example of tramway engineering. Today, few tram terminals and towers remain intact. For a description and discussion of the operation of Bleichert double rope tramways, see the historical context.[4]

The site's residential complex includes three standing log cabins. The structures are missing their roofs, and one features the vernacular remnants of a bunkbed inside. The three cabins serve as sound examples of early 1890s Western mining vernacular architecture incorporating local building materials. Collectively, the group of standing cabins, and the collapsed assay house and boardinghouse, clearly represent a form of residential complex associated with early, remote mines.

Last, the Holy Moses shaft complex was active only between 1890 and 1893. Most silver and industrial metal mines were worked periodically each time the prices of metals increased and milling technology improved. This sequential activity at most mines erased evidence of early operations. The Holy Moses, left undisturbed, is now an example of a remote Western mine active prior to the Silver Crash of 1893.

[4] Twitty, 1999b.

In terms of *Criterion D*, the Holy Moses shaft complex is likely to yield information important to the interpretation and understanding of Western mining and its participants. The Holy Moses Mine's underground workings probably contain internal structures and artifacts which can contribute greatly to a currently dim understanding of mining engineering and the mine as a workplace. First, underground structures and machines can be analyzed to determine patterns that engineers used to develop and extract ore bodies. Second, the nature of the underground workings and the methods miners used to develop the ore bodies could be used to draw conclusions regarding the mine as a workplace. Were miners truly subjected to unsafe conditions? Did their work and the work environment hold the potential for health problems accrued over a lengthy period of time? Third, artifacts underground could clarify the technologies miners used to blast, transport rock through the mine, and bring it to ground-surface.[5] The site apparently holds little archaeological potential. No privy pits were identified, and the refuse dump on-site was primarily surfacial and featured little subsurface depth.

Management recommendations for the Holy Moses site suggest efforts to stabilize extant structures, to examine the underground workings in terms of Criterion D, and to define acceptable disturbance to the site in light of possible environmental remediation and mine closure projects. Specifically, the standing tram terminal and the cabins are in danger of collapsing and should be stabilized. If water run on/ run off systems are to installed on the mine's waste rock dumps, disturbance should be minimal. Open shafts and stopes should be grated closed with as little disturbance as possible.

The Holy Moses Tunnel (Site 5ML104) is not eligible for listing on the National or State Registers of Historic Places. Due to mining activity and earthmoving in the recent past, the site lost nearly all of its physical integrity. The tunnel is not associated with important persons, it is not an outstanding example of a Western mining operation, nor is it likely to yield further information.

Both the Holy Moses shaft and tunnel sites serve as contributing elements of the Holy Moses Vein's visual landscape. The shaft possesses standing and collapsed structures, and the standing tram tower. While the tunnel site lost most of its historical integrity, the waste rock dump is visually prominent and from afar, appears similar to undisturbed, historic waste rock dumps.

Mammoth Tunnel
Site 5ML353

The Mammoth Tunnel site is recommended as eligible for listing on the National and State Registers of Historic Places under Criteria A, C, and D. The site features the archaeological remnants of a prospect operation, a water system that served the town of Creede, and an electrical powerhouse. The powerhouse remnant is recommended as

[5] The *National Register Bulletin: Guidelines for Evaluating and Registering Archaeological Properties* states on page 27 that underground features and structures can be eligible under Criterion C, even if the site's surface retains little integrity.

eligible for the National Register, the water system is recommended as eligible for the State Register, and the remnants of the Mammoth Tunnel prospect operation retain little integrity and are recommended as ineligible.

In terms of National Register *Criterion A*, the powerhouse remnant on-site is associated with events that have made a contribution to the broad patterns of national, Colorado, and the Creede district's histories. The remnants consist of foundations representing a small electrical powerhouse. The facility was built during the 1890s or 1900s to provide power for use in the surrounding mines and mills, and it may have been a component of an electrical grid serving the Creede district. It remains unknown which specific mining companies consumed the powerhouse's electricity, but historical records indicate that the nearby Ridge and Solomon mines and mills were electrified. The powerhouse went on-line at a time when electric technology was in a nascent state. At this time less than 30 mining districts throughout the West were electrified, and mining and mechanical engineers kept a watchful eye on the success of the innovative power source.[6] In this context, the powerhouse remnant was associated with the broad-scale development of electrical technology, and the application of the power source for mining. The powerhouse provided mining and electrical engineers with empirical data for future improvements and applications of electricity.

On a local scale, the site was an important facility for the profitable mines on the Holy Moses Vein, and possibly elsewhere in the district. The use of electricity lowered the costs of mining, improved working and living conditions through superior lighting, and permitted the use of advanced ore concentration engineering. The application of electricity, uncommon during the 1890s and 1900s, helped the Creede district gain recognition in the mining industry.

In terms of State Register *Criterion A*, the site is associated with the development of the town of Creede's municipal water system. When miners drove the Mammoth Tunnel in the late 1890s, they struck a geological formation saturated with water under pressure. Tests run on the quality of the water revealed that it was very pure, and in the 1930s a bulkhead was built in the tunnel which diverted the drainage into a large pipe. Workers laid a pipeline from the tunnel portal to the City Tower Dam, which held Creede's drinking water.[7] Such adaptations of tunnels to municipal water systems are probably rare.

In terms of the associations discussed under Criterion A, the site retains physical integrity. The powerhouse building, boiler, and engine foundations are intact and clearly represent the facility. The pipeline constructed for Creede's water system is also intact and currently drains water.

In terms of National Register *Criterion C*, the powerhouse's archaeological remnants clearly represent the building, the engine, and steam boiler. The powerhouse foundations exemplify the technology and engineering used to generate electricity on a small, local scale prior to the 1920s. Specifically, the powerhouse relied on a return-tube boiler that powered a horizontal steam engine, which turned a dynamo. The use of steam engines to power dynamos was the earliest and most common means of generating

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[6] Twitty, 1998.

[7] Engineers' Reports, Colorado State Archives, Box 31301, File: Misc Mineral County.

electricity during the Gilded Age. The powerhouse remnant retains integrity for Criterion C.

In terms of State Register *Criterion C*, the site's archaeological remnants embody the distinctive characteristics of the conversion of a tunnel into a water collection system. The site retains physical integrity as the pipeline, which currently drains water, remains intact. It extends out of the Mammoth Tunnel and traverses the adjacent hillslope, supported by masonry pylons, for a great distance. The pipeline retains integrity for Criterion C.

In terms of *Criterion D*, the powerhouse remnant is likely to yield information important to the understanding of early electrical generating facilities. The extant remnants clearly feature the building and boiler foundations. Most of the steam engine foundation is visible, while a portion lies buried under stream gravel, as does the dynamo foundation. By excavating the foundations, the exact dynamo and engine types and their spatial arrangement can be determined. The complete makeup, operation, and generating capacity of the entire powerhouse can then be reconstructed by comparing the extant foundations to information on engines and dynamos gathered through archival research. Due to the rarity of such sites, little is currently known about the actual generation of electricity in Western mining districts, and the material evidence typically left today.

Management recommendations are limited to the powerhouse remnant. Since the features of the Mammoth prospect operation are not eligible and the pipeline remains secure and intact, these aspects of the site are recommended for no further work. The powerhouse remnant should be protected against further damage by East Willow Creek, and the foundations should be excavated in terms of Criterion D. Since workers did not live on-site, the archaeological potential in addition to the powerhouse's engine and dynamo foundations is low.

The Mammoth Tunnel and the pipeline are distinct against the surrounding natural hillside, and they lie near the maintained, heavily used gravel road paralleling East Willow Creek. Because of the site's prominence, it can serve as a component of the visual landscape of the historic mining district.

Outlet Mine
Site 5ML301

The Outlet Mine site presents a curious case in terms of significance. Because the site's features and artifacts are less than 50 years of age, the site is not eligible for the National or State Registers of Historic Places at this time. However, the site possesses a high degree of physical integrity in terms of when it was active during the 1950s, and features structural remnants and intact machinery. In addition, the site was important on local and state levels.

The mine complex, as it exists today, was developed in 1955 and produced until 1959. This time period marks the last significant era of underground metals mining at small, independent operations in the Creede district, and probably the state of Colorado. After the 1950s, underground metals mining went into decline throughout the nation as production shifted to foreign sources.[8] The Outlet Mine was a participant in this last era of underground mining, and it helped support the slumping mining industry in Creede.

The Outlet Mine produced silver and industrial metals, which is meaningful on state and local levels. The resultant profits indirectly lent credibility to and fostered speculation in both Creede and Colorado mining during the 1950s. Further, the industrial metals that the mine produced helped support the smelting industry, which declined with the final collapse of mining during the 1950s. Management recommendations suggest re-recording and re-evaluation of the site in 2006, when the site becomes more than 50 years of age.

While the Outlet Mine is not eligible at this time, is can serve as a component of the visual landscape of the historic mining district. The large waste rock dump, structural remnants, and machinery are prominent historical visual features along East Willow Creek.

Phoenix Mine
Site 5ML200

The Phoenix Mine site is recommended as eligible for the State Register of Historic Places under Criteria A, C, and D. The site possesses a high degree of physical integrity and an ambience representative of Western hardrock mines. The site currently possesses standing structures, structure remnants, machine foundations, and other features that clearly represent the past mining operation.

In terms of *Criterion A*, the Phoenix Mine complex is associated with events that contributed to the broad patterns of Colorado's and the Creede district's history. The mine complex, as it exists today, was developed in 1951 and produced until 1956. This time period marks the last significant era of underground metals mining at small, independent operations in the Creede district, and the state of Colorado. After the 1950s, underground metals mining went into decline throughout the nation as production shifted to foreign sources.[9] The Phoenix Mine was a participant in this last era of underground mining, and it helped support the slumping mining industry in Creede.

The Phoenix Mine produced silver and industrial metals, which is meaningful on state and local levels. The resultant profits indirectly lent credibility to and fostered speculation in both Creede and Colorado mining during the 1950s. Further, the industrial metals that the mine produced helped support the smelting industry, which declined with the final collapse of mining during the 1950s.

In terms of *Criterion C*, the Phoenix Mine complex embodies the distinctive characteristics of a moderately capitalized and productive circa 1950s independent Western metals mine. The site consists of archaeological remnants and standing

[8] Smith, 1977:152; Wilkins, 1972:272-276 discuss the decline of metals mining, except for uranium, after the 1950s.
[9] Ibid.

structures that clearly represent how mid-twentieth century engineering and technology were adapted to traditional Gilded Age mining methods. The mining company used Gilded Age methods for developing the mine's ore systems and it constructed the surface plant according to Gilded Age convention. However it equipped the mine with 1950s machinery.

The Phoenix Mine complex includes several standing structures, including a shop/compressor house, a shaft house, and an ore sorting house. The structures are sound examples of how mid-twentieth century Western mining vernacular architecture mimicked Gilded Age architecture in form and function.

Because the mine closed in the 1950s and saw little disturbance afterward, it retains integrity according to Criteria A and C.

In terms of *Criterion D*, the Phoenix Mine site can offer important information in the arena of mining engineering. The underground workings probably contain internal structures and artifacts which can contribute greatly to a currently dim understanding of mining engineering and the mine as a workplace during the 1950s. First, underground structures and machines can be analyzed to determine patterns that engineers used to develop and extract ore bodies during the 1950s. Second, the nature of the underground workings and the methods miners used to develop the ore bodies could be used to draw conclusions regarding the mine as a workplace. By the 1950s, the mining industry was subject to safety regulations. Were underground safety conditions at the Phoenix site different than the conditions of mines in decades past? Third, artifacts underground could clarify the technologies miners used to blast, transport rock through the mine, and bring it to ground-surface during the 1950s. How did the methods change from decades past, and how did they remain the same? The site apparently holds little archaeological potential. No privy pits were identified, and mine workers did not live on-site.

Because the Phoenix site possesses integrity, ambiance, standing structures, substantial waste rock dumps, and other features, it can serve as a contributing element of the visual landscape of a historical mining district. Management recommendations include stabilizing the standing structures, and gathering data in terms of Criterion D. If the mine is subject to environmental action, the structures and waste rock dumps should be disturbed as little as possible.

Powerhouse Remnant
Site 5ML352

The Powerhouse Remnant holds importance on national, state, and local levels, and is recommended as eligible for listing on the National and State Registers of Historic Places. The site possesses physical integrity, and it meets National Register Criteria A and C. The site suffered minor disturbance within the last 50 years because the area is used as a vehicle pullout by recreationalists. Regardless of the disturbance, the nature of the electrical generation facility is clearly represented by the archaeological remnants.

In terms of *Criterion A*, the site is associated with several important historical themes. First, the site participated in the advancement of electrical engineering. The powerhouse relied on a steam engine to run a dynamo that generated electricity for electric lighting, and to run machinery at mines. The powerhouse operated between the 1890s and the 1900s, at a time when the application of electricity to mining in specific, and industry in general, was in a nascent and experimental state. The powerhouse was a constituent of Creede's electrical grid when fewer than 30 mining districts were electrified throughout the West.[10] In this capacity, the powerhouse, and Creede's electrical grid, served as an example for mining and mechanical engineers interested in applying the power source elsewhere in the West.

Second, the site was an important facility for the profitable mines on the Holy Moses Vein, and possibly elsewhere in the district. The use of electricity lowered the costs of mining, improved working and living conditions through superior lighting, and permitted the use of advanced ore concentration engineering. The application of electricity, uncommon during the 1890s and 1900s, helped the Creede district gain recognition in the mining industry.

In terms of *Criterion C*, the site soundly represents Gilded Age electrical generation engineering. While all of the site's machinery and structures have been removed, the remnants clearly depict the system used to generate electricity. The site features foundations for a return-tube boiler, a powerful duplex steam engine, a dynamo, and the powerhouse building's platform. Because few mining districts saw electrification prior to the 1920s, this site, which was active between the 1890s and 1900s, is rare. In terms of Criterion C, the site retains historical integrity.

Management recommendations include blocking vehicle access so the site will no longer be used as a parking area. Because the site lies adjacent to a heavily used gravel road, the site can serve as an important component of the historical mining district's visual landscape. Since the site is rare, it also is a key component of the district's historical fabric.

Ramey Tunnel
Site 5ML355

The Ramey Tunnel site holds significance on state and local levels, and is eligible for listing on the State Register of Historic Places. The complex possesses a fair degree of physical integrity, and it meets State Register Criterion A. The site includes the remnants of a surface plant that served a prospect adit, and two residential platforms. The surface plant components are clearly represented by material evidence. One residential platform is currently partially buried by scree, and the other, located adjacent to a maintained gravel road, was damaged by road widening.

In terms of *Criterion A*, the site is associated with events that made contributions to patterns of Colorado and local history through its role in the Creede district. The

[10] Twitty, 1998.

Ramey Tunnel was a small prospect operation driven during the early 1890s to locate ore bodies on East Willow Creek's east side, and it retains elements remaining from this timeframe. The site is therefore directly tied to and a manifestation of the initial exploration, development, and settlement of the Creede district.

The Ramey Tunnel fails to meet the other Criteria. The operation was not connected to important persons, nor is it a sound or unique example of a prospect adit. While the site includes a residential platform partially buried by scree and a shallow privy pit on the adit's waste rock dump, the features are unlikely to possess archaeological deposits that can yield important data. Management recommendations suggest no further work.

The Ramey Tunnel lies on an undisturbed hillside punctuated by bedrock cliffs, proximal to the gravel road paralleling East Willow Creek. Because of these characteristics, the site can serve as a component of the visual landscape of the historic mining district.

Ridge Mine
5ML201

The Ridge Mine holds significance on national, state, and local levels, and is recommended as eligible for listing in the National and State Registers of Historic Places under Criteria A, C, and D. The site possesses a fair degree of physical integrity and, considering the numerous historical features interspersed amid bedrock cliffs, possesses a unique ambiance. The Ridge Mine site consists of the surface plant remnants associated with four adits and two haulage tunnels, as well as a residential complex, and the remnants of an ore concentration mill. The surface plant remnants include two standing structures and three partially intact structures. The residential complex includes a standing log cabin. The site suffered moderate disturbance within the last 50 years. Widening and grading of a road passing through the site, and bulldozing, erased many historical residential features and the mill that were located along East Willow Creek. The adits and tunnels upslope from the creek retain a fairly high degree of integrity, although erosion deposited some scree over portions of many features. The extant remains clearly represent mining operations and engineering, and aspects of the residential complex.

In terms of *Criterion A*, the mine is associated with events and patterns that made contributions on national, state, and local levels. The Ridge Mine was one of the wealthiest and oldest operations in the Creede Mining District, and its principal periods of activity occurred between 1891 and 1893, and between the late 1890s and 1900s.

The site is associated with economic contributions in several ways. First, during the mine's first principal period of production, between 1890 and 1893, it was owned by Senator Thomas Bowen. A silver mining magnate, Bowen joined David H. Moffat's investment syndicate, and together the men financed the industrialization of many of the Creede district's wealthiest mines. The Ridge Mine became a conduit through which much capital made its way into the mining district. The capital was spent on workers' wages, the purchase of goods and food, governmental administration, and the support of businesses and services ranging from surveyors to lawyers to teamsters. Second, the mine served as an anchor which stimulated investor confidence and speculation in other properties, indirectly bringing more capital to the district. Third, some of the profits realized from production remained in the mining district, as they were diverted to pay for operations.

The site is associated with the development of the district in several ways. First, the mine, one of the earliest discoveries, helped foster the rush that drew in hundreds of prospectors. They subsequently explored the district and discovered many profitable properties, resulting in the district's settlement and development of the necessary infrastructure. Second, the mine was an important node on the transportation system from the town of North Creede along East Willow Creek. Because the Holy Moses Mine's bottom aerial tramway terminal stood near the Ridge Mine, the Ridge served as an important point on the transportation system that served the Holy Moses. Last, the Ridge Mine featured the first ore concentration mill built in the Creede district, and it treated its own ore, that from the Holy Moses Mine, and possibly from other properties. Local concentration was important. It not only kept profits that would have otherwise gone to distant mills within the Creede district, but also it permitted ores of lower grades to be mined, which prolonged the lives of some of the mining operations. After treating local ore, the company shipped the concentrates to distant smelters in Pueblo, Colorado and to Missouri for refining. The treatment of ores from nearby mines and the shipment of concentrates reflect ties to complex mining industry-specific economic, commercial, and transportation systems locally and in the Midwest.

Last, the Ridge Mine's engineers employed a variety of innovative solutions to solve the problems of mining in inaccessible and remote areas, which contribute to the site's significance under Criterion A. Specifically, the company's engineers developed the ore bodies through four adits and two principal tunnels, and they erected surface plants to support work underground. The coordination of work through the adits and tunnels, and the materials-handling at the various surface plants, required advanced logistics and planning. In addition, in 1892 a principal haulageway was driven into the workings near the floor of East Willow Creek, and linked via a rail line and plumbing to the mill. Driving such a tunnel to intersect specific underground workings, its links with the mill, and the associated surface plant represent a significant engineering endeavor. In 1892 the Ridge Mine also hosted the above-mentioned ore concentration mill, which served as a proving ground for the application of technologies and engineering capable of treating Creede's complex ores. Last, the Ridge Mine is associated with the development of an electrical grid in the Creede district. During the 1900s, the owners of the Ridge and nearby properties constructed an electrical grid to serve their mines at a time when electric technology was in a nascent state. At this time less than 30 mining districts throughout the West were electrified, and mining and mechanical engineers kept a watchful eye on the success of the innovative power source. In this context, the electrical system on East Willow Creek provided engineers with empirical data for improvements in electrical engineering.

The site retains integrity from both periods of operation. All of the adits and tunnels were driven between 1891 and 1893, and surface plants erected then to support work underground. The surface plant remnants associated with the three lowest tunnels possess assemblages of features and artifacts clearly erected at this time, and the surface plant remnants associated with the upper adits possess features and artifacts clearly erected during the 1900s. Disturbance to the site impacted the site's mill and residential complex and left alone the surface plant remnants associated with the tunnels and adits.

In terms of *Criterion C*, the Ridge Mine site includes unique architectural elements. Specifically, a structure that served as an ore bin and tram terminal, built in the 1940s, stands at the site's mid-level haulage tunnel. The structure exemplifies ore storage and tramway engineering employed during the 1940s. The site also includes a partially intact log shop building built during the early 1890s at the site's lower haulage tunnel, and a standing residential log cabin located north. The shop and the cabin, built at the same time, with the same style, materials, and architectural features, are examples of circa early 1890s vernacular mine buildings constructed with local building materials.

The material remains of the Ridge Mine's surface plants also represent the serial re-occupation of the site, which was a pattern typical of many profitable silver mines. The features and artifacts associated with the lower three tunnels clearly represent the surface plants erected between 1890 and 1893. In this light, the surface plants reflect early 1890s activity and engineering. The features and artifacts associated with the upper two tunnels clearly represent the surface plants erected there in the late 1890s, when the Ridge property was re-worked. These surface plants reflect the re-occupation of the mine, and a concentration of activity in the mine's upper levels.

In terms of *Criterion D*, the Ridge Mine is likely to yield information important to the interpretation and understanding of Western mining and its participants. First, the shop building at the lower haulage tunnel is filled with structural debris and scree eroded from upslope, which obscures artifacts and features in the building's interior. Clearing the debris away and exposing the shop's interior may enhance a currently dim understanding of shop work conducted at mines similar to the Ridge. Such action could answer research questions such as the following. What sorts of appliances were shops such as that at the Ridge equipped with? What do the appliances and associated artifacts reflect about the exact type of work shop workers carried out?

Second, the mine's underground workings probably contain internal structures and artifacts which can contribute greatly to a currently dim understanding of mining engineering and the mine as a workplace. The structures and equipment underground can be studied to determine patterns of underground engineering in terms of exploration, and the development and extraction of ore. Artifacts underground could clarify the technologies miners used to blast, transport, and haul ore and waste rock to ground-surface. The structures and artifacts may also reflect aspects of the mine as a workplace. Were miners subject to inherently unsafe conditions portrayed by popular assumptions? Did tasks and the work environment hold the potential to cause health problems over a protracted period of time?

Last, the site's residential complex encompasses a privy pit associated with the residential cabin. The pit may contain meaningful buried cultural deposits which can shed light on the nature of the residents that occupied the cabin during the early 1890s and the 1900s. Privy pits have the potential to feature artifact assemblages different from items typically deposited on ground-surface, as privies offered a secluded environment for the disposal of items under secrecy. The site retains integrity in terms of Criterion D, and saw little activity following the last significant period of operations in the 1900s.

Management recommendations suggest efforts to collect further information in terms of Criterion D, to stabilize extant structures, and to define acceptable disturbance to the site in light of possible environmental remediation. Specifically, the privy pit associated with the residential complex may include buried cultural deposits, which should be first tested, then excavated provided the deposits are significant. The underground workings should be examined for their historical content, and important features and artifacts recorded and analyzed. Rubble and erosional deposits in the shop at the lower haulage tunnel should be cleared out of the structure, and the features and artifacts within recorded and analyzed. The shop, the residential cabin, and the ore bin-tram terminal standing at the mid-level haulage tunnel are in danger of collapsing and should be stabilized.

Since the Ridge Mine was one of the largest and most significant mines along East Willow Creek, it serves as prominent monument to the Creede district's mining industry. In this context, the site would be an important component of the visual landscape of the historical mining district. Due to the site's historical importance and its visual impact, potential environmental actions should be sensitive to the site's integrity.

Solomon Mine
Site 5ML200

The Solomon Mine played an important role in the Creede district. Not only was the mine one of the Creede district's earliest and richest producers, but also it featured an ore concentration mill that began treating its own payrock, and possibly that from other properties. Despite the mine's historical importance, the Solomon Mine is not eligible for listing on the National or State Registers of Historic Places because the site possesses little physical integrity. The site suffered heavy disturbance within the last several decades. In an effort control contaminated effluent draining out of the Solomon's tunnel, a series of three settling ponds were bulldozed in the area where the surface plant and mill were located. In addition, most of the waste rock dump was bulldozed.

Due to the significant disturbance, no further work is recommended, and the site would not contribute to the visual landscape of the historical mining district.

CHAPTER 9 PROJECT SUMMARIES AND CONCLUSION

The principal historic mine sites on the Holy Moses Vein and East Willow Creek are rich in material remains and archival information. This legacy lends itself well to an interpretation of each individual site, as well as shedding light on broad patterns and trends of the drainage's mining industry. In some senses, the patterns that apply to the mines on the Holy Moses Vein and East Willow Creek carry over to the rest of the Creede district, because the Holy Moses Vein's mining industry was similar to mining on the district's other ore bodies.

The following chapter addresses both the individual research questions posed in research design, as well as other important trends. In keeping with the research design, the interpretations are based on the interdisciplinary approach of wedding archival research and the analysis of archaeological and architectural remains. A significant component of the analyses involved using features and artifacts to reconstruct both the surface plants associated with the mines, and the residential complexes. Below, each research question is stated, followed by an analysis and interpretation.

Mining Operations

Question 1. Did the inventoried operations follow technological convention during the different times they operated?

To accurately determine whether the operations followed technological convention, they must be divided into the categories of productive mines and failed prospects. Further, these two categories should be viewed in the contexts of the timeframes the operations were active. The Creede district experienced four principal periods of mining. The first occurred between 1890, when the district was being developed, until 1893, when the Silver Crash forced nearly all mines to close. During this time, the hardrock mining industry incorporated some mechanization with a significant reliance on hand-labor. Technology and engineering was coming to the fore at this time, and it was costly. The second period of mining in Creede occurred between the late 1890s, when the economy recovered following the Silver Crash, and the early 1910s, when mining companies exhausted most of the viable ore. Between these dates, technology and engineering reached an advanced state, capital was abundant, and mining companies applied mechanization to produce ore in economies of scale. The Creede district remained relatively quiet until 1934, when President Franklin Delano Roosevelt signed the Silver and Gold Purchase acts into law, which boosted the prices for the metals. Mining continued sporadically into the early 1940s, and the 1950s saw the last significant period of mining in the Creede district.

The sites inventoried on East Willow Creek represent seven intact prospect operations, which lend themselves to interpretation in terms of technological convention. The Creede district's initial boom years were a time of optimism and prospecting, as wealth seekers drove numerous adits and shafts in hopes of striking ore bodies. As time progressed and the district's ore systems became common knowledge, prospecting declined. Four of the sites, including the Carbonate Tunnel, the Ramey Tunnel, the Holy Moses shaft complex, and the Ridge Mine, date to the district's initial boom-era, and their operations and surface plants can be readily reconstructed based on the sites' material remains. The Holy Moses shaft complex was in actuality a highly productive mine, however, the material remains indicate that the Holy Moses company effected little change to the surface plant initially constructed for prospecting. The Ridge Mine was also a highly productive mine, however the site possesses three unaltered prospect adits featuring the remnants of surface plants. Specifically, the adits include the highest and lowest on the Mexico claim, and an adit north of the extant residential complex.

All of the above prospect operations followed technological convention of the day. Their surface plants were simple, labor-intensive, and consisted of inexpensive temporary-class components and portable equipment. In addition, the surface plant components were arranged according to convention, and followed a similar pattern. The Ramey Tunnel serves as an example of a typical prospect operation's surface plant. Prospectors drove an adit into bedrock, and dumped waste rock in a large pad at the adit portal's mouth. They erected a small, frame blacksmith shop building adjacent to the adit portal, and it was equipped with portable equipment. The only mechanical devices the outfit employed were a hand-powered ventilation blower, probably located at the adit portal, and an ore car to move rock out of the underground workings. The Ramey operation lacked additional surface plant components. In terms of prospecting, the above sites exhibited no unusual characteristics.

Of the productive mines, only the Holy Moses shaft complex and the Ridge Mine retained integrity in terms of the Creede district's initial boom-era. The Ridge Mine features the remnants of surface plants erected during the early 1890s at the mid-level and lower haulageways. According to the material evidence, the mining company followed engineering and technological convention. First, the company hired at least one engineer who planned the systematic development of the mine's ore bodies, the erection of efficient surface plants, and the construction of an ore concentration mill. The engineer had miners drive two haulageways to tap the ore bodies at depth, which allowed miners to stope the ore bodies from the bottom up, using gravity to advantage. The engineer located the mill adjacent to East Willow Creek, which provided water, and near the lower haulageway, which facilitated the efficient transfer of payrock from mine to mill. Such a system of facilitating the flow of ore from mine to mill was conventional. Second, the engineer equipped the surface plants with conventional facilities. The plants at both tunnels featured blacksmith shops where tools and equipment were maintained and manufactured, and mine rail lines that eased the task of transporting materials into and rock out of the underground workings. The shop at the lower haulageway, which was the hub of activity, was large and well-equipped. The surface plants at both haulageways featured little mechanization, which was conventional prior to the 1890s.

The Ridge Mine featured one aspect that deviated from convention in terms of the early 1890s. Archival records indicate that the Holy Moses Mine's lower aerial tramway terminal stood near the Ridge Mill.[1] Prior to the late 1890s, aerial tramways were unconventional systems for transporting ore over hostile terrain. According to

[1] See Chapter 7, Ridge Mine.

convention, mining companies often relied on wagons to haul ore to distant concentration mills, or erected mills on-site. The other unconventional aspect of the tram terminal is that the Holy Moses and Ridge operations cooperated in terms of ore processing.

The Holy Moses shaft complex presents an interesting case in terms of technological convention and prospecting. While the mine was highly productive, the surface plant never progressed beyond its simple beginnings. Prospectors sank two shafts on the property to examine the vein at depth, and they installed simple hoisting systems, consisting of horse whims, to raise materials out of the workings. Horse whims were conventional hoisting systems for prospecting into the 1910s.[2] The whims were enclosed in hewn log shaft houses that also sheltered simple blacksmith shops.

According to convention, most mining companies that possessed rich ore bodies hired engineers that planned efficient development of the underground workings, like the Ridge Mine. Further, where the topography was steep, they did so by driving haulageways to tap the ore at depth. Instead, the Holy Moses company sank two small shafts on the vein and, in some places, worked the ore body from the top down. According to convention, when mining companies extracted ore through shafts, they erected mechanized, steam-driven hoisting systems that permitted rapid production. The Holy Moses company, on the other hand, relied on slow horse whims that had severely limited weight capacity. In addition, the Holy Moses company relied on a labor-intensive, inefficient system of ore chutes, an intermediary rail line, and transfer stations on ground-surface to move ore from the shafts to the aerial tramway's upper terminal.

While the Holy Moses company employed substandard hoisting and ore transportation systems on-site, it employed a Bleichert double rope aerial tramway to carry ore from the mine down to the Ridge Mill. During the early 1890s, aerial tramways were unconventional in the sense that they were highly advanced. Tramways did not become conventional until the late 1890s, when technology and engineering came into widespread use.

The Ridge Mine is the sole site that retains integrity in terms of the Creede district's second boom period, spanning from the late 1890s into the 1910s. According to the material evidence on-site and archival information, the East Willow Creek Mining & Milling Company, that worked the property at this time, followed technological and engineering convention. The company continued to use most of the facilities erected by Thomas Bowen's early 1890s operation. The East Willow Creek company effected several upgrades to the mill, and the surface plants that served the lower haulageway and Ethel adit. Specifically, the company erected additional shop facilities at the haulageway to increase materials-handling, and a shop at the Ethel adit to serve miners working in the upper stopes. The company also installed an air compressor in the mill, and piped the air through a complex plumbing system to points of work underground. The use of compressed air powered rockdrills in large mines became conventional by the late 1890s.[3]

The inventoried sites with integrity that date to the Creede district's last significant era of mining, during the 1950s, include the Phoenix and Outlet mines. The

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[2] Twitty, 1999a:196.

[3] Twitty, 2001:38.

Outlet company worked both properties, and it followed technological and engineering convention typical of the 1950s. Specifically, the Outlet company applied then-modern machinery to traditional underground mining methods, and it erected surface plants organized according to patterns dating back decades. The surface plants featured shop buildings near tunnel portals, mine rail lines to transport materials, and ore storage facilities on the flanks of the waste rock dumps. The Outlet company equipped the surface plants with then-modern equipment, including locomotives and air compressors to power machinery underground.

Question 2. Are the surface plants associated with the inventoried prospect and mine sites proportional to the underground workings?

The surest way to address the above question is to examine the underground workings of each operation, and compare them to the associated surface plants, as reconstructed from material remnants on-site. Since the underground workings were not accessed, the associated waste rock dumps must, therefore, serve as approximate representations. In terms of prospects, the volumes of waste rock dumps can accurately reflect the extent of underground workings, small dumps reflecting shallow workings, and large dumps reflecting extensive workings. In terms of profitable mines, the dumps reflect only those workings driven during exploration and development. Stopes, where miners removed ore, are not represented, because they sent the ore to be milled.

Of the inventoried sites, the Ridge Mine featured the most extensive underground workings, represented both by voluminous waste rock dumps and archival records documenting both a lengthy history of production, and interconnected passages. The extensive workings are also represented by the site's two haulageways and four adits. Paralleling the extensive workings, the Ridge featured a substantial surface plant at the lowest haulageway, a smaller plant at the mid-level haulageway, and simple surface plants associated with the four adits. Cumulatively, the set of surface facilities is substantial.

While the Soloman Mine retains little historical integrity, archival records indicate that the mine's surface plant featured an ore concentration mill, several buildings, and a boardinghouse.[4] Paralleling the well-equipped surface plant, the mine had extensive underground workings, reflected the voluminous waste rock dump visible today.

The Holy Moses Mine featured shallow underground workings, according to material evidence. First, the waste rock dumps are small. Second, the shafts were equipped with horse whims, which had depth capacities of only 300 feet.[5] Because miners extracted much ore, the waste rock dumps are not a complete representation of the underground workings. In keeping with the shallow workings, the Holy Moses' surface plant was simple, small, and equipped with a few closely spaced components.

The Phoenix and Outlet mines featured moderately extensive underground workings, reflected by fairly substantial waste rock dumps. The surface plants of both mines were likewise moderately sized, featuring several buildings, ore storage facilities, and machinery.

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[4] See Chapter 7, Soloman Mine.

[5] Twitty, 1999a:196.

The surface plants associated with the prospect operations are concurrent with their underground workings. The Carbonate, Ramey, and Mammoth tunnels, and the prospect adits at the Ridge, were shallow, according to the small waste rock dumps. The surface plants associated with these prospects were simple and featured only a few components, including one or no structures, no ore storage facilities, and no power-driven machinery. The Mammoth Tunnel's surface plant featured two frame buildings.

Question 3. Do the inventoried sites follow the trends of temporary-class and production-class surface plants for mines and prospects? If not, why?

All of the prospects inventoried on East Willow Creek featured surface plants equipped with temporary-class components, as represented by archaeological remnants. Such components were intended to meet the rigors of prospecting, being simple, portable, and above all, inexpensive. Prospect operations had little need for surface plant facilities intended to facilitate ore extraction, since the presence of ore was not yet confirmed. All of the prospect operations featured small blacksmith shops that facilitated only the most basic work, and the shops were equipped with portable appliances and tools, except for the Ramey Tunnel, which featured a stationary, vernacular forge built with local materials. The deeper prospect operations, such as the Ramey and Mammoth, relied on ore cars to move waste rock out of the underground workings, while the Carbonate operation employed a wheelbarrow. The deeper prospect operations also employed temporary-class ventilation systems consisting of hand-powered blowers that forced air into tubes that extended underground. The use of a ventilation system represents a significant prospecting effort.

Most of the inventoried mines featured surface plants equipped with production-class components. The purpose of production-class components was to maximize the flow of ore out of the mine while minimizing operating costs such as labor, time, and energy consumption per ton of rock removed. Production-class components and machines fell along a spectrum. Advanced, large, and costly components and machines permitted greater production with more savings per ton than those that were smaller and less costly. Mines with substantial ore bodies stood to benefit from the more efficient surface plant components.

While the Ridge Mine was not equipped with much advanced machinery, the sheer number of surface plant facilities that served the haulageways and adits fulfilled production-class criteria. The machinery that the Ridge Mine's surface plant featured consisted primarily of the mill and an air compressor. Both were production-class components. A complex ventilation system, also production-class in nature, served the Ridge Mine. The system relied on natural air circulation through the interconnected adits and haulageways.

The Soloman Mine's surface plant featured at least one production-class component. Archival information indicates that an ore concentration mill stood near the tunnel portal, and mills were certainly intended to facilitate ore production. Because recent disturbances to the site erased traces of the surface plant's material evidence, the nature of other plant components remains indeterminate.

The Phoenix and Outlet mines were both equipped with surface plants consisting of production-class components modest in scale. The surface plants featured large shops that were well-equipped, air compressors that powered rockdrills underground, ore storage facilities, and well-graded access roads.

The Holy Moses shaft complex stands in contrast to the trend of the alliance of production-class surface plants with profitable mines. The Holy Moses Mine featured rich ore and produced handsomely. The surface plant, on the other hand, featured a combination of primitive, temporary-class components with the advanced, production-class aerial tramway. Specifically, the hoisting systems that served the shafts consisted of horse whims, which were intended for shallow prospecting. Two small, log shaft houses enclosed the whims, and at least one blacksmith shop equipped with hand-tools. The structures and shops were also temporary-class in nature. By contrast, a Bleichert Double Rope Aerial Tramway delivered ore from the mine to the Ridge Mill. Such a tram system was not only a production-class facility, during the early 1890s it was considered to be advanced technology. Miners relied on a system of chutes, transfer stations, and an intermediary rail line to move ore from the shafts to the tram terminal. While the system by definition facilitated ore production, it was simple, labor-intensive, and inefficient.

Question 4. What does the spectrum of inventoried sites reflect about the expertise of engineers?

While archival information pertaining to the inventoried sites makes no mention of engineering or specific engineers, the material evidence reflects several trends regarding engineering. The inventoried prospect operations had few needs, which their surface plants reflect. The surface plants associated with the prospect operations required little engineering, and experienced prospectors were capable of installing the facilities that fulfilled immediate requirements. Since prospectors had to be somewhat self-sufficient, they understood basic blacksmithing, transportation of materials in the underground workings, and ventilation. In addition, they were versed in driving adits and sinking shafts.

The moderate-sized operations, such as the Outlet and Phoenix mines, had more stringent needs than prospects, since they were expected to profitably produce ore. Their surface plants included several structures, mine rail transportation systems, ore storage and processing facilities, and machinery. Engineering such surface plants required a knowledge of spatial arrangement, the application of specific machines, and the flow of materials into and out of the mine. In addition, underground exploration, and the development and extraction of ore bodies, required an understanding of geology, the efficient movement of materials, and the application of technology. Last, both planning a surface plant and the underground workings had to be accomplished within financial constraints. In this context, the Outlet and Phoenix mines represent organized, planned engineering on a modest scale by a specialist. The application of conventional technologies to traditional underground methods was within the scope of many engineers with a basic understanding of mining. Such engineers could have acquired their knowledge through experience, although by the 1920s, most received a technical education.[6] In another sense, the Outlet Mining Company faced limitations in terms of the engineer it could employ. Highly experienced engineers capable of advanced work

[6] Spence, 1993:18.

often commanded wages that a company with modest capital and ore reserves of unknown extent could not justify.

The Soloman and Ridge mines exhibit evidence of employing engineers with special skills. Both mines featured ore concentration mills, no longer present at both sites, that presented great engineering challenges. The engineer not only had to understand basic patterns for designing mills, but also he had to tailor technology to profitably treat a given mine's specific ore. To do so, the engineer had to determine the most efficient steps of crushing, grinding, and stages of concentration. A significant aspect of this lay in selecting effective machinery from a large pool of apparatuses offered by equipment manufactures. In addition, the engineer had to plan for an infrastructure that included ore input and concentrates output transportation systems, a powerplant and fuel, and a reliable source of water. Treating ore was such a complex endeavor that some early mills in the San Juan Mountains failed.

The Ridge Mine also features material evidence reflecting the work of an engineer with advanced skills. The mine consisted of a complex interconnected system of adits and stopes, and two haulageways driven to tap these at depth. Planning the haulageways, their intersection with underground workings, and their interaction with the rest of the mine required advanced engineering. During the late 1890s, the East Willow Creek Mining & Milling Company installed an air compressor in the mill to power rockdrills in the underground workings. This endeavor also required advanced engineering skills. The engineer had to determine the mine's total air consumption, based on the number of machines he wished to employ, and pressurizing the plumbing, and select a compressor that met such a need. The engineer also had to determine how he intended to power the compressor, and design a plumbing system that delivered air to critical areas of work underground.

The Holy Moses Mine represents a mixed application of engineering. Overall, the mine was poorly developed and equipped, in a manner that suggests a professional engineer was not involved. However, the aerial tramway was a significant engineering undertaking, so complex that it was beyond the capacity of many experienced, professionally trained mining engineers. Often, when a mining company contracted with a tramway maker for a system, the maker dispatched its own specially trained engineers either to design and install the system, or to assist the resident mining engineer.[7] The disparity between the primitive state of the Holy Moses Mine's surface plant and the advanced tramway suggests that the Holy Moses company hired an engineer specifically to design and install the tramway, and nothing more.

Question 6. To what degree did electricity impact mining on the Holy Moses Vein? How extensively was electricity applied, and what was the power source used for? When did electricity actually become popular?

The sites inventoried on East Willow Creek present an interesting and conflicted case in terms of energy consumption. Two sites feature the remnants of electrical powerplants. One small facility stood on the west bank of East Willow Creek near North Creede, and a larger facility stood on the west bank of the creek between the Outlet and Ridge mines. Archival references to the plants are scant. The material evidence at the

[7] Twitty, 1999a:161.

site between the Ridge and Outlet mines indicates that the facility was probably erected and operated between the late 1890s and 1900s. The powerplant near North Creede was documented on a 1912 map of the Creede district, while the other powerplant is absent.[8] The foundations at both powerplants indicate that the facilities followed similar engineering patterns. Each facility consisted of a steam engine powered by a return-tube boiler, and the engine turned a dynamo. The facility between the Ridge and Outlet mines was larger and featured a powerful duplex engine that probably turned a pair of dynamos. The paucity of industrial refuse and boiler clinker, which was residue generated by burning fuel coal, indicates that the powerplants operated for only a brief time before being dismantled.

The powerplants on East Willow Creek were two of a handful of other plants in the Creede district. The first powerplant in the district went on line in the town of Creede in 1892, and it powered electric lighting circuits.[9] During the late 1890s the Commodor Mining Company erected a powerhouse at its operation, and the United Mines Company built another plant at the Humphreys Mill to power lighting and machinery. Both plants were dedicated to their respective companies, and the relationship these plants shared with those on East Willow Creek remains unknown.

During the 1890s electrical generation facilities produced power in either AC or DC current. At this time, AC motors were incapable of powering most mine machinery, unlike DC motors, but AC current could be transmitted great distances. DC current, on the other hand, could not be transmitted far without a debilitating power loss, and therefore had to be used close to the point of generation. During the early 1900s, engineers developed three-phase AC motors that were able to run most machinery, while relying AC current that could be transmitted great distances.[10]

Given the state of electrical technology during the 1890s, all of the powerplants in the Creede district probably produced DC current, and could have been components of a common grid, except for one factor. Most of the powerplants were built by companies under different ownerships. Mining magnate Albert E. Reynolds owned the Commodor Mine, a group of local investors owned United Mines, and the owners of Creede's powerplant remain unknown. If the powerplants on East Willow Creek generated DC current, then they may have served local needs. The plant between the Ridge and Outlet mines probably served the Ridge and Soloman mines, and therefore may have been financed by David Moffat's syndicate, which owned the mines. The powerplant near North Creede may have fulfilled the town's municipal needs, the nearby Humphreys Mill or Commodor Mine, or the Bachelor Mine. By 1900, David Moffat's syndicate owned a controlling interest in the Commodor, and it owned the Bachelor Mine. Given the Moffat syndicate's ownership of the above mines, it may have financed the construction of the powerplant near North Creede.

Despite the presence of the two powerplants on East Willow Creek, according to archival information and the material evidence, most of the inventoried mines active between the 1890s and 1910s did not heavily employ electricity. The only mine known to be electrified on East Willow Creek was the Ridge. Further, material evidence such as electrical insulators, wires, and hardware is lacking on-site, indicating that the various

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[8] Emmons and Larsen, 1923.
[9] Twitty, 1999b:128.
[10] Twitty, 1999a:267-269.

surface plants associated with the Ridge's haulageways and adits were not electrified. A 1904 Sanborn's Insurance Map documents the use of electricity to power the mill, and at least some of this power was generated in the facility by a dynamo. During the 1900s the use of electricity to power mill machinery grew in popularity. Before that, steam engines powered mill machinery, and the Ridge Mill was no exception. The dynamo in the Ridge Mill could have merely supplemented electricity wired from one of the powerplants on East Willow Creek, and some of the mine's surface plant components could have featured electric lighting. If the Soloman Mill followed convention, it too may have been powered by electricity.

In sum, electricity apparently had marginal impact on mining in the East Willow Creek drainage during the Creede district's boom-era. The mining companies did not use electricity to power mine or mill machinery prior to the late 1890s, and afterward, they used motors to power the Ridge Mill and possibly the Soloman Mill. By contrast, the mining companies on the nearby Amethyst Vein embraced electricity and applied the power source for both mining and milling.

Question 7. To what degree were rockdrills actually employed on the Holy Moses Vein and East Willow Creek, and what types of operations used the machines?

Popular history suggests that that the mining industry universally accepted rockdrills during the 1880s because the machines permitted a significant increase in production and the driving of underground workings. Miners used the machines to bore blast-holes deeper and larger in diameter than was possible with traditional hand-drilling methods. Once the holes were bored, miners loaded them with explosives, which was the prime means of breaking and moving rock underground. In reality, the mining industry experimented with rockdrills during the 1870s, and only heavily capitalized companies employed them during the 1880s. By the 1890s improvements in drill and compressor technology and the availability of capital brought the machines within reach of smaller companies. The trend accelerated through the 1900s, and not until the 1910s did drills become common.[11]

Purchasing and installed a compressor, its power source, compressed air plumbing, and drills were beyond most prospect operations. Therefore, the prospect operations on East Willow Creek are not expected to have employed the machines. The profitable, well-capitalized mines, on the other hand, had the financial and engineering resources to use rockdrills, and they also had the need. Curiously, of the inventoried profitable operations active prior to the 1930s, only the Ridge Mine employed rockdrills. And even then, miners at the Ridge did not use drills until the East Willow Creek Mining & Milling Company installed the necessary equipment during the late 1890s. Prior to that, none of the mines on East Willow Creek employed rockdrills. Material evidence at the Ridge, in the forms of drill parts and compressed air plumbing, reflects the use of drills, and a 1904 Sanborn's Insurance Map documents an air compressor in the mill. None of the other sites feature either material evidence or archival documentation of the use of drills.

By the 1950s, rockdrills were considered to be necessary for profitable ore production, and they proliferated in the mining industry. In this context, the Phoenix and

[11] Twitty, 2001:43.

Outlet mine sites are expected to feature evidence of the use of rockdrills. The Phoenix site features evidence in the forms of air hoses, plumbing, and a compressor foundation, and the Outlet Mine site also includes air hoses, pipes, and an intact compressor.

Question 8. Did the inventoried mines and prospects feature shops concurrent with the needs of the operation? How were the shops equipped?

All prospect and mining operations required shop facilities, where tools and equipment were maintained and fabricated. Drill-steels and picks had to be sharpened, machines repaired, and materials and hardware custom-made. Prospect operations had simple needs, primarily sharpening tools, while large mines had additional needs. Mining and prospect operations therefore erected facilities that were capable of handling the anticipated work.

In keeping with the above trends, all of the inventoried prospect operations featured basic shops capable of only simple work. Further, the shops all adhere to a pattern in terms of size, location, and equipment. The Carbonate Tunnel was the smallest prospect, and it featured an open-air shop area equipped with a portable free-standing forge, an anvil, and hand-tools. The Ramey and Mammoth Tunnels both featured shops approximately 10 by 16 feet in area, enclosed in simple frame buildings. Prospectors equipped the Ramey's shop with a vernacular dry-laid rock forge and hand-tools, while the Mammoth Tunnel's shop featured a free-standing forge.

The Holy Moses shaft complex featured one small shop enclosed in the site's eastern shaft house, and the company provided a free-standing forge and hand-tools. The simple nature of the Holy Moses' shop is concurrent with the primitive surface plant. The Ridge Mine, which was a complex, highly productive mine, featured at least three separate shops, one at the lower haulageway, another at the mid-level haulageway, and the third at the Ethel adit. Since the lower haulageway was the center of activity at the Ridge, the shop is expected to be the largest and best-equipped. The shop was in fact 14 by 19 feet in area, and featured a workbench. Such floorspace permitted several workers to simultaneously accomplish tasks. To accommodate an increased workload, the East Willow Creek company erected a second shop building in the late 1890s at the lower haulageway that specialized in carpentry. The shop at the mid-level haulageway was 10 by 12 feet in area, and the shop at the Ethel adit was 9 by 12 feet in area. Because the shops at both haulageways are currently filled with scree, their equipment could not be determined. The Ethel's shop was equipped with a free-standing pan forge, a workbench, and parts bins. The bins reflect the maintenance of machinery.

The Outlet company built a combination compressor house and shop at the Phoenix Mine. The shop occupied a 10 by 14 foot room, and was equipped with traditional blacksmithing equipment. By the 1950s, rockdrill manufactures offered drill-steels with detachable, disposable bits, which negated the need for sharpening drill-steels.

In sum, the shops associated with the inventoried mines and prospects are concurrent with the needs of the operations.

Question 9. Did the mines and prospects on the Holy Moses Vein and East Willow Creek follow trends regarding fluctuations in the price of silver?

Mining on East Willow Creek was to a significant degree a function of the price of silver. However, several other factors influenced when the mines operated. Until 1893, silver commanded the relatively high price of over one-dollar per ounce. Such an economic environment provided incentive to discover and mine silver ore bodies, and most of the inventoried prospects and mines were active during this time. When the value of silver dropped by approximately half in 1893, the cost of operations exceeded profits, and most of the inventoried mines suspended operations, and prospecting ceased. The Ridge Mine continued to operate because its silver ore was rich enough to sustain profitability.

Even though the price of silver remained low, most of the inventoried mines saw activity beginning in the late 1890s, and ending when miners exhausted profitable ore by the 1910s. Mining resumed during this period for several reasons. First, improvements in mining and milling technologies lowered the costs of production, and hence increased profits. Second, the improvements in technologies permitted mining companies to produce ore in economies of scale, and the high volume produced offset silver's low price. Last, in light of an economic recovery, the mine owners had great interest in seeing their idle properties become profitable again, and invested capital to do so.

In 1922 the Pittman Act re-instituted Federal price supports for silver. The increased value of the metal stimulated interest in many of Creede's silver mines, except for most properties on East Willow Creek. At this time, the Ethel Leasing Company prepared to re-open the Soloman Mine, and when the Pittman Act was repealed the following year, the Ethel company quit work.

In 1934 President Franklin Delano Roosevelt signed the Silver Purchase Act into law, which again provided Federal price supports for silver. As with the Pittman Act, the mines on East Willow Creek saw little activity. Parties of lessees examined the Soloman and Holy Moses mines and, after finding little, abandoned operations.

The fact that the mines experienced little activity during 1922 and in the wake of the Silver Purchase Act attests to exhausted ore bodies. By the 1950s, mining technology, and inexpensive transportation in the form of trucks, significantly lowered the costs of mining. In this context, low-grade ores remaining in the Soloman, Holy Moses, and Outlet mines became profitable, and these properties finally were re-opened.

One other factor accounts for the activity during the 1950s. The ore comprising the Holy Moses Vein was, in most areas, a silver-lead-zinc blend, and in addition to the silver, the two other industrial metals also held a value.

Question 11. Did a strong alliance exist between the profitable mines and powerful capitalists? Were mines equipped with advanced surface plants associated economically and in terms of ownership with wealthy capitalists? Were the inventoried prospects allied with investors of limited means?

According to archival information, during the Creede district's boom-era, all of the large and profitable mines inventoried were associated in terms of ownership and financing with wealthy capitalists. Thomas Bowen, a silver mining magnate who served a term in the United States Senate during the 1880s, owned the Ridge and Soloman mines, and the Phoenix claim, which remained undeveloped until the 1950s. David H. Moffat, U.S. Army captain L.E. Campbell, and Sylvester T. Smith owned the Holy

Moses Mine, and acquired shares of the Ridge and Soloman mines. Moffat was a significant figure in the development of Colorado. He participated as a merchant in the Pikes Peak Gold Rush in 1860, rose to the presidency of the First National Bank of Denver in 1880, and subsequently invested heavily in mining and railroads.[12] Sylvester T. Smith acted as Denver & Rio Grande Railroad general manager, and also invested heavily in mining. Together, the trio of investors acquired several other of the Creede's district's richest mines, including the Bachelor, Amethyst, and Commodor properties on the Amethyst Vein.

The absence of archival information pertaining to the other boom-era mines and prospects strongly suggests that they were owned by little-known investors, except for the Mammoth Tunnel. Moffat cooperated with local claim holders to drive the tunnel, which proved unsuccessful.

Once the richest mines on the Holy Moses Vein exhibited signs of exhaustion, the above capitalists, or their estates, sold the properties to investors of limited means. The parties or individuals that acquired the formerly productive mines remain unknown. During the 1950s a party of investors formed the Outlet Mining Company and purchased the Phoenix claim and Outlet Tunnel. Little is known about the company and its financing, and the lack of archival information suggests that the investors were of limited means.

Question 14. Archival research revealed that many of the Creede district's mines were leased by companies from property owners. When did this practice begin and why? How does the leasing system manifest in terms of material evidence?

Operating a profitable mine on the scale of those inventoried on the Holy Moses Vein required much capital, and incurred great costs. Companies were burdened with overhead costs in the forms of labor, management, engineering, maintenance of facilities, and coordinating the acquisition of supplies and shipping of ore and mill concentrates. As long as a mine featured rich ore bodies, a company usually found it profitable to extract the payrock itself. When the rich ore became exhausted, rather than let the property remain idle, some companies scaled back operations and leased the mine, or portions of the underground workings, to independent groups of workers. Companies charged a fee per ton of ore mined, or on an annual basis, and shifted the costs of operating onto the lessees.

All of the inventoried mines active during the Creede district's boom-era were initially worked by primary companies. Then, around the late 1890s, the companies leased their properties to second-party outfits. Around 1900, the Holy Moses Company leased the Holy Moses Mine to the Second Chance Leasing Company, which worked the property for several years. The Creedemoore Mining Company leased the Ridge Mine to the East Willow Creek Mining & Milling Company during the late 1890s. Both operations invested capital developing the mines. The Second Chance company drove a tunnel into the Holy Moses Mine's workings and erected a simple surface plant at the tunnel portal. The East Willow Creek outfit extended the Ridge's underground workings, added shop facilities at the lower haulageway, and installed an air compressor in the mill. In sum, during the Creede district's boom-era, lessees invested capital and engaged in

[12] Abbott, Leonard, and McComb, 1994:376.

property improvement. Since their behavior was like that of the primary companies, the material evidence on-site differs little.

Question 17. Were the easily accessed mines and prospects on the Holy Moses Vein and East Willow Creek better-equipped and more developed than those in inaccessible, remote locations?

The mines and prospects in the East Willow Creek area can be divided into two groups in terms of geographic location. One group, including the Holy Moses Mine and the Carbonate Tunnel, were located high on Campbell Mountain. These two operations were difficult to access, and rock cliffs separated them from the valley floor. All of the other sites lay along or close to East Willow Creek, and were accessed by a road. The inventoried mines exhibit differing degrees of development.

Archival and material evidence indicate that the profitable mines on the valley floor were developed to a greater degree than those on Campbell Mountain because of the relative ease of access afforded by the road. The Soloman and Ridge mines, on the valley floor, featured substantial surface plants and ore concentration mills. The Holy Moses Mine, by contrast, featured a primitive surface plant consisting of temporary-class components and buildings constructed with local materials.

The inventoried prospects also exhibit differing degrees of development. The Ramey and Mammoth tunnels, and the prospect adits associated with the Ridge complex, featured surface plants that included mine rail line transportation systems, and shops enclosed in frame buildings. The prospectors that drove Carbonate Tunnel, on the other hand, relied on a wheelbarrow to move materials through the workings, and conducted blacksmithing in an open-air shop.

Question 18. Did the remote operations on the Holy Moses Vein and East Willow Creek rely heavily on local materials to minimize costs?

First, the degree of remoteness of the inventoried mines and prospects was a function of the Creede district's development. Between 1889, when Nicholas Creede discovered the Holy Moses Vein, and 1892, when the Denver & Rio Grande Railroad arrived, most of the Creede district was remote. Supplies had to be imported into the district by wagon from Wagon Wheel Gap, which was the nearest rail station. Further, the tortuous canyons of East and West Willow creeks exacerbated the difficulties of freighting materials to and ore from mines and prospects. The arrival of the Denver & Rio Grande Railroad lowered freighting costs to the edge of the Creede district, and mining companies cooperated on the construction of artery roads as far as they could be graded, given the impenetrable topography. The evolution of the district's transportation systems rendered formerly remote areas accessible, while some mines and prospects remained isolated.

Given the above, when the mines and prospects on the Holy Moses Vein and East Willow Creek began operations during the early 1890s, they lay in what was at that time a remote area. In response to the high costs of shipping materials, many utilized local building materials for structures and mine timbering. For example, when workers erected buildings at the Ridge Mine during 1891 and 1892, they used logs for the shops currently remaining at the mid-level and lower haulageways, and the standing residential cabin. Workers used logs for all of the structures at the Holy Moses Mine, one of the most remote sites. Specifically, the residential buildings and both shaft houses were built with logs. Complex industrial structures, such as the Holy Moses' tram terminal, had to be erected according to exacting engineering, which required dimension lumber beams for framing. Yet, in an effort to save money, the Holy Moses company used local materials in the tram terminal's framing in the forms of raw logs and hand-hewn beams.

After the transportation system along East Willow Creek became established and the cost of freighting building materials dropped, the mines and prospects used dimension lumber, which was the preferred building material. By 1892, and after, nearly all mining and prospect operations used lumber for their buildings, which manifests in the sites' material evidence.

Question 21. How did profitable companies facilitate the input of supplies and the output of ore? How did prospect operations respond?

Establishing a mine or prospect required the initial transportation of materials and equipment, the constant input of supplies during operations, and for profitable mines, the shipping of ore. Since prospects had little material needs, their means of access could be simple, but profitable mines, on the other hand, necessitated efficient systems. Further, since mine owners expected their properties to operate throughout the year, the transportation systems had to function during adverse conditions.

The inventoried sites follow several trends regarding transportation access in light of the above. According to material evidence, the prospect operations, including the Ramey and Mammoth tunnels, and the prospect adits at the Ridge complex, were accessed by purposefully graded pack trails. The operations only required the delivery of some building materials and portable equipment, and the occasional input of supplies, which could have been transported by pack animals. Such transportation systems were commonly used to haul materials to remote prospects. The traffic to the Carbonate Tunnel was sporadic enough such that prospectors did not take the trouble to construct a formal trail.

In most cases pack trails became impassable during heavy snows, rendering remote prospects, such as the Carbonate Tunnel, seasonal operations. The Ramey and Mammoth tunnels were located close enough to the settlement of North Creede such that they could have been worked all year.

Because the Ridge and Soloman mines required substantial quantities of building materials, machinery, and supplies, and the shipment of ore, mining interests graded a road from North Creede, the nearest point of commerce, to the mines. Workers built the road alongside East Willow Creek, which offered an unobstructed, gently sloped pathway. Wagons could negotiate such a road in all weather except for deep snows, and under these conditions, teamsters used sleighs.

Grading a road to the Holy Moses Mine, located atop rock cliffs, presented significant obstacles. Workers in fact graded a crude, circuitous road to the mine, but it would have prevented the shipment of materials in all but dry conditions. To resolve the transportation problem, the Holy Moses company erected an aerial tramway that terminated at the Ridge Mine, on the valley floor. The tramway, impervious to winter, not only shuttled ore down to the Ridge Mine, but also workers loaded the tram buckets with supplies to be shipped up to the Holy Moses.

During the 1950s, by the time the Phoenix and Outlet mines were active, mining companies relied on trucks to ship ore and deliver supplies. Trucks were usually necessary for such moderate-sized operations to remain profitable, because they offered inexpensive transportation. Fortunately for mining companies, by the 1950s, bulldozers became common, which eased the tasks of grading and maintaining necessary roads. Like most mines active at this time, the Outlet and Phoenix mines reflect the use of bulldozers to grade roads for the delivery of machinery and supplies, and the shipment of ore.

Question 23. Did the large mines on the Holy Moses Vein erect mills capable of refining ore into silver bullion? If not, what was the nature of the mills?

The facilities that refined ore into silver bullion were known as *smelters*, and they incorporated a complex series of steps. The process began with crushing, followed by roasting the ore, separating waste from metalliferous material, and smelting the material into metal. Building a smelter required enormous capital, engineering, flat ground, and an infrastructure that provided water, fuel, and transportation. In many cases, large mining companies attempted to carry out some of these ore treatment steps in-house to avoid seeing potential profits go to independent smelting companies. The facilities that provided partial treatment were known as *ore concentration mills*, and they crushed the ore and separated out waste mostly with mechanical processes. The resultant *concentrates* were shipped to smelters for final refining.[13] In many mining districts, independent milling companies offered concentration services to local mines incapable of building their own facilities.

Silver ores, especially those with a high industrial metals content, were difficult to concentrate. Between the 1870s and 1890s, milling companies in the San Juan Mountains experienced great difficulty finding processes that were effective. By the 1890s, engineering and technology advanced to the point where several processes proved universally applicable, which had to be adapted to the specific ores of a mining district.

In an effort to maximize profits, the group of investors that owned the profitable mines on the Holy Moses Vein built a mill at the Ridge Mine to treat ores in 1892. The same group of owners built another mill at the Soloman Mine around 1900 with the same intent. The material remains at both sites and archival information indicate that the mills strictly concentrated the ores, and were not smelters.

The physical evidence left by smelters should include evidence of furnaces, roasters, and machine foundations. The heavy consumption of fuel resulted in large residue dumps, and smelting generated slag. All of these characteristics are absent from the Ridge and Soloman sites. While the areas where the mills stood were bulldozed, some of the above evidence would remain. Archival information confirms that the Ridge and Soloman mills were concentration facilities.[14]

The archival information documents some of the mills' concentration processes and machinery. According to a 1904 Sanborn Insurance Map, the Ridge Mill was well-

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[13] For a detailed description of concentration, see Meyerriecks, 2001, and Twitty, 1999b.

[14] See Chapter 7.

equipped and enclosed in a frame building approximately 60 by 110 feet in area. Mine workers dumped raw payrock into a receiving bin at the mill's head. The ore first passed through three crushers, and when pulverized, went to a set of three Wilfley tables. These types of tables featured slanted tops that vibrated rapidly, sending light waste to the bottom where it was shunted away. The heavy metalliferous fines remained trapped by cleats on the tabletop's upper portion, where workers collected them. If the mill followed engineering convention, then the three tables were probably arranged in series, so each successive unit could further the separation process. When workers removed the final concentrates from the last table, they transferred the material into bins for storage. According to archival information, a steam engine, powered by a boiler, ran the mill.[15] By 1904, the East Willow Creek company, which operated the mine, adapted the engine to drive a dynamo. The electricity then powered motors that ran the mill.

According to archival information, the Soloman Mill relied on a similar process to concentrate ore. A set of crushers pulverized the ore, and Cornish rolls reduced the resultant material into sand. After crushing, the sand proceeded through stages of concentration. Jigs separated heavy particles from light waste, and the heavy material went on to Wilfley tables for greater concentration.[16] Jigs were troughs with a current of water that washed away light material, allowing the heavy metalliferous fines to drop through. The mill's power system remains unknown.

Both mills relied on variations of concentration processes that were used throughout the silver mining industry. By the 1890s, mill engineers found that Cornish rolls effectively provided necessary secondary and tertiary crushing, and jigs and vibrating tables were best for separating metalliferous material from waste. These crushing and concentration processes proved universally adaptable to the ores in the Creede district, as well as other mining districts in the San Juan Mountains. The mills at the Amethyst and Happy Thought mines, on the Amethyst Vein, relied on the same machines and stages of crushing and concentration. Further, mills around Silverton and Lake City also used the same machinery and stages of crushing and concentration.[17]

Residential Occupation

Question 1. Can the numbers of workers at the large mines be determined by the material evidence? If so, did all workers live on-site?

The numbers of workers only at one of the large, inventoried mines can be determined by material evidence. Many of the residential features at the Ridge Mine, and all such features at the Soloman Mine, were damaged or destroyed by bulldozing. The Holy Moses shaft complex, on the other hand, retains all of its historical residential features.

When the Holy Moses company hired a crew of miners to develop the property in 1891, it erected a series of four log cabins and a boardinghouse for the crew. The cabins

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[15] See Chapter 7: Ridge Mine.

[16] *EMJ* 9/21/01 p368.

[17] Twitty, 2000a; Twitty, 2000b; Twitty, 2001. In addition, six mill sites were recorded as part of an ongoing inventory of the Silverton Mining District, south of the town of Silverton.

were built in a single north-south row, and the southern two were for workers, the center one was for the superintendent, and the northern cabin was an assay office. Each residential cabin featured 270 square feet. Given that a worker required 60 square feet for bedding and personal possessions, the eastern two structures accommodated up to five workers each.[18] Up to two residents may have lived in the superintendent's cabin, and some of the extra space could have been dedicated for administrative purposes. The boardinghouse featured 600 square feet, not including the storage cellar. The structure may have featured a loft, as was common, contributing to the building's total square footage. It remains unknown how much space the cooking and dining areas occupied in the structure. Given the above, it seems likely that the boardinghouse accommodated at least eight residents. In total, the residential complex could have housed approximately 20 residents, while archival information indicates that in 1890 or 1891, the Holy Moses company employed up to 30 workers at one time.[19] Where the excess workers lived remains unknown.

Question 2. Did women live at the mines on the Holy Moses Vein and East Willow Creek, and if so, did they hold a greater presence at the large operations where jobs accepted by society were available? Were families present?

In general, women traditionally commanded a strong presence in the household, and managed domestic activities either as members of families, or employed as hostlers in hotels and boardinghouses. In an effort to maintain an acceptable household, women tended to consume domestic items of luxury and décor that men, especially single workers, did not prioritize. The identification of women can be determined primarily by the presence of artifacts reflecting these goods. Some types of items, such as decorative tableware, cut-glass fragments, and other decorative artifacts, suggest the presence of women, while other items, such as women's boot remnants and corset parts, directly represent their presence. In a few cases, archival information documented the presence of women. Domestic artifact assemblages lacking decorative items while including many male-specific items strongly suggest an all-male population.

According to the material evidence, the residents at the Holy Moses Mine were men. The artifact assemblages lack decorative items, and include numerous male-specific artifacts such as boot remnants, miners' lunchpails, clothing buttons and rivets, and other personal items. However, according to archival information, Christina Matsen, a Swedish immigrant, served as the hostler in the Holy Moses boardinghouse. Matsen spoke little English, and eventually married the mine foreman. In addition, archival information indicates that women tended boardinghouses at the Ridge and Soloman mines.[20] Their presence is not clearly represented in the surface artifact assemblages at any of the sites. Excavation of buried deposits could reveal artifacts suggesting the presence of the women hostlers.

[18] Hardesty, 1988:13.
[19] See Chapter 7: Holy Moses Mine.
[20] Van Horn, 2000: "Women had Tough Jobs Running Boarding Houses in Old Mining Days".

Question 3. Do the inventoried mine and prospect sites reflect the presence of ethnicities, and if so, what occupations did they hold?[21]

Determining the presence of ethnicities is a difficult proposition, and may be accomplished through the analysis of structural remnants, artifact analysis, and archival research. Ethnic groups different from the Euro-American culture that dominated hardrock mining, such as Chinese, Hispanics, and Native Americans, had the potential to leave distinct artifacts and material use patterns. However, European and American ethnic groups shared similar cultural aspects in terms of household, diet, consumer goods, and dress. In this light, the material evidence left by European ethnic groups often appears similar to that left by American groups, however, some differences can be ciphered out of artifact assemblages. European ethnic groups may have preferred familiar European consumer goods and foods, which may by represented by bottles, types of meat, tablewares, and other items. In addition, some groups may also have employed traditional construction practices, such as the propensity of Italians to erect rockwork foundations, walls, and structures.

While archival information indicates that Northern European immigrants worked in the Creede district, the artifact assemblages at the inventoried mine and prospect sites lack clear evidence of their presence.[22] The artifact assemblages were fairly uniform in terms of the consumer goods, and food and beverage types represented. If ethnicities made up the workforces of the inventoried mines and prospects, they consumed few disposable items readily identified today.

Question 5. To ensure the presence of a workforce, capitalized mining companies attempted to strike a balance between providing a tolerable living environment while investing minimal capital on housing. Do the residential buildings among the inventoried sites reflect this trend? Did the capitalized companies provide housing superior to that at small mines? Did the housing of the above differ from the accommodations at prospect operations?

The natures of residential buildings at the inventoried sites can be reconstructed based on material evidence, in the event sites lack standing architecture. Material evidence includes structural debris, artifacts, and building platforms. The structural remnants and associated artifacts can be analyzed to determine whether housing featured amenities such as electric lighting, plumbing, abundant space, and adequate heat.

The Holy Moses Mine features three standing log cabins and a collapsed boardinghouse, which convey the living conditions provided by the company. The cabins were relatively small and were 270 square feet in area. Workers built all of the structures with logs, and the eastern two cabins featured two doorways each and no windows. The western cabin, which probably housed the superintendent, featured one door and two windows. The boardinghouse, also made with logs, was 600 square feet in area, and it featured several doors and windows.

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[21] Carrillo, 2001 discusses a possible link between ethnicity and socio-economic status, and how both manifest in the archaeological record.

[22] Van Horn, 2000 features vignettes noting the presence of many Swedes in the Creede district.

The two windowless cabins were equipped with vernacular bunkbeds made with logs and lumber. All of the cabins served as bunkhouses, and the crew consumed meals in the boardinghouse. In general, the structural remnants at the Holy Moses indicate that the company invested minimal capital in accommodations for the crew, and that living conditions were primitive. The cabins' small floor areas and the bunkbeds reflect crowded conditions, and the sleeping arrangements were poor in quality. The rough nature of the cabins and the lack of windows in the eastern units suggest that the structures were dark, poorly ventilated, and dank. The boardinghouse, which also featured few windows, was not much better. The lack of artifacts such as electrical insulators, window screens, and pipes indicates that the residential buildings lacked amenities of comfort and sanitation. The Holy Moses company's unwillingness to invest in the crew's housing, in the context of the substantial profits won from the mine, is perhaps a testament to the company's lack of concern for the welfare of its workers.

Because the residential complex associated with the Ridge Mine suffered heavy damage due to bulldozing, only several buildings can be characterized. A 1912 map of the district documented the existence of a cluster of buildings around the Ridge Mill, and archival information indicates that the Creedemoore Mining Company, which operated the mine, provided housing that included a boardinghouse.[23] Currently, a standing log cabin, and two building platforms, remain on-site. The cabin is 15 by 24 feet in area and featured one door, one fixed-pane window, and two double-hung units. The cabin was spacious, had adequate height, a plank floor, interior siding painted white, and one stove. Based on the above qualities, the cabin provided living conditions that were conventional, somewhat primitive, but comfortable. The windows admitted plenty of light and ventilation. The white paint, plank floor, ventilation, and light permitted the residents to maintain sanitary conditions. The lack of pipes and electrical artifacts indicates that the cabin featured no amenities of comfort.

Based on associated artifacts, the Ridge Mine's two existing building platforms supported simple frame buildings 12 by 20 feet in area and 10 by 15 feet in area. The lack of pipes and electrical artifacts suggests that the buildings also lacked amenities.

The Ramey and Carbonate tunnels were the only prospect operations that featured associated residences. The Ramey Tunnel's crew apparently lived in two buildings, currently represented by platforms. One platform suffered heavy bulldozing attributed to widening of the adjacent road, and is therefore uninterpretable. The other platform is 12 by 20 feet in area, and associated artifacts indicate that it supported a frame building lacking amenities.

The Carbonate Tunnel site featured the most primitive accommodation. Prospectors graded an 8 by 12 foot platform for a wall tent, reflected by a total lack of structural artifacts. Such a residential structure was strictly temporary and seasonal.

In sum, the housing provided by the profitable companies on the Holy Moses Vein ranged from primitive to tolerably comfortable. The Holy Moses Mine provided its crew with accommodations and a living environment poor in quality. The company supplied housing that was probably barely tolerable, and the mine crew were tantamount to captives as they had no alternative residences. By contrast, the Creedemoore company, which operated the Ridge Mine, provided at least one cabin that was tolerably

[23] Emmons and Larsen, 1923; Van Horn, 2000: "Women had Tough Jobs Running Boarding Houses in Old Mining Days".

comfortable, without a significant capital investment. The cabin may serve as an example of the quality of the other residential structures that once stood on-site.

Based on material evidence, the accommodations at the Ramey Tunnel, which was one of the inventoried prospects, apparently differed little from those at the Ridge Mine. Both operations provided basic frame buildings for their crews, and the remaining platforms are similar in sizes and artifact assemblages. The residential accommodations at the Carbonate Tunnel, on the other hand, differed from those at the Ramey Tunnel and the profitable mines. The prospectors at the Carbonate Tunnel erected a primitive, temporary wall tent. Such a residence is concurrent with the nature of the prospect operation. The Carbonate Tunnel was the smallest inventoried prospect, and it was worked for only a brief period of time before it was abandoned.

Question 7. The popularization of the automobile in the 1930s offered workers the potential to commute from distant residences. During this time and afterward, did workers on the Holy Moses Vein and East Willow Creek in fact rely on automobiles to commute from distant residences?

Based on material evidence and archival information, all of the productive mines on the Holy Moses Vein experienced some activity during the Great Depression, and afterward. In 1934 an unknown party spent some time examining the workings of the Holy Moses Mine, and between 1953 and 1958 the Sublet Mining Company mined ore through the Holy Moses Tunnel. Beginning in 1943, an unknown party mined ore from the Ridge Mine's workings, and abandoned operations in 1949. Between 1951 and 1956 the Outlet Mining Company worked the Phoenix Mine, and the Outlet Mine shortly after. None of the above mines exhibit material evidence suggesting that work crews lived on-site, or nearby. Therefore, they probably relied on automobiles to commute from distant residences. During the Depression, when income was scarce, some workers may have commuted on horseback.

Question 8. Does the material evidence at the mines on the Holy Moses Vein and East Willow Creek reflect a difference between the socio-economic status of laborers and management? Did management live separately from the workers?

Different socio-economic groups can be identified by analyzing artifact assemblages, and architectural and structural remnants. Artifact assemblages representing a relatively high status can include high quantity decorative items, butchered bones left over from costly cuts of meat, evidence of expensive, fine goods, and items consumed as benchmarks of status. The reverse would be true of artifact assemblages attributed to a low status. The artifact assemblages attributed to workers should include slightly different items than those attributed to management. Mine workers generated refuse in the forms of heavy boots, lunchpails, candlesticks, miners' felt hats, and other durable articles. The artifact assemblages of each feature representing a residence can then be compared for socio-economic indicators. In the event a site offers standing architecture, the residences of management may feature amenities, greater space, and a location away from the mine surface plant.

Only the Holy Moses Mine features evidence suggesting a difference in socio-economic status, and a separation of management and crew. Because many of the Ridge Mine's, and all of the Soloman Mine's, residential features were bulldozed, such differences at these sites remain indeterminate. While the artifact assemblage at the Holy Moses Mine reflects no differences, the group of residential cabins suggests that management lived separately. The site features three log cabins identical in size. The southern two featured two doorways, no windows, and bunkbeds, while the northern cabin featured one doorway, two windows, and no evidence of bunkbeds. The relatively superior architectural characteristics of the western cabin suggest it was built for one or several individuals higher in status than the other workers. The cabin, therefore, probably housed the mine superintendent.

In contrast to the cabins, the artifact assemblage at the Holy Moses Mine lacks items clearly characteristic of high status. The assemblage featured no high quality or decorative items, and included basic workers' artifacts. Some of the butchered bones, however, suggest the preparation of special meals for one or several individuals of note. Specifically, most of the bones were for beef stews and roasts, typically consumed by the workers. A few of the bones represent the preparation of beef ribs, which were more desirable than common stews and roasts. The small quantity of ribs indicates that they were not prepared en masse for the crew, and that they were served on a limited basis.

The Ridge Mine and the prospect sites lack evidence suggesting individuals of a higher socio-economic status. The assemblages lacked decorative and high quality items, and the personal items, such as boot remnants, miners' lunchpails, and clothing items, reflect a common status. The food-related artifacts likewise represent common status, and the butchered bones were cuts for basic beef roasts and stews. Evidence at the Ramey and Carbonate tunnels suggest that the workers lived together with no divisions according to labor.

Question 11. Popular history suggests that miners ate a poor diet based on canned food. Does this assumption hold true for prospect operations? Does it hold true for the crews of productive mines? If not, why? What did the typical diet at each type of operation consist of?

The material evidence at the inventoried mine and prospect sites provides sound information permitting a reconstruction of workers' diets. The information can be gleaned from food-related items associated with the sites. When activity peaked on East Willow Creek, the dominant Euro-American work culture favored certain types of foods which can be termed the *Victorian diet*, which evolved from traditional Northern European cuisine. Meals emphasized foods high in fat, protein, carbohydrates, and starches, and consisted of meat dishes, egg dishes, baked goods, grains, beans, vegetables, and fruit.[24] Beef was favored over other meats, pork was least desirable, and fresh meats and vegetables were preferred over preserved foods.[25] The nature of kitchen facilities such as preparation areas, stove size, and cookware, influenced the types of meat and vegetable dishes prepared. Meat dishes often took form as roasts, stews, and fried cuts, while vegetables tended to be boiled, and potatoes roasted.

[24] Conlin, 1986:12-16; Mehls et al, 1995:52.
[25] Conlin, 1986:11, 15-16.

Even if the workers on East Willow Creek followed the convention of a preference for fresh foods, they could not consume such foods if they were unavailable. In this context, the nature of the transportation system that served the district, and the seasons, had a direct impact on the diets of the workers on East Willow Creek.

During the Creede district's first several years, the region's population consisted primarily of prospectors, and they had little need for a formal transportation system. Between 1890 and 1892, the development of mines and the establishment of settlements required avenues for the movement of materials and people, and freighting supplies on the scale necessary for the Creede district's growth could only be accomplished with wagons. Local rancher Martin Van Buren Wason graded a toll road into the district, and mining companies and local government drove additional roads into the district's remote areas. In 1892, the mining industry held such potential that the Denver & Rio Grande Railroad built a line to the district's gateway.

Each successive improvement to the district's transportation network offered the district's population benefits in several ways. First, the cost of goods fell both through reduced shipping prices, and an increase in volume. Second, the relatively rapid shipment of goods permitted animals for slaughter and fresh foods to be imported with little spoilage. Therefore, the early, primitive transportation system meant that high costs, slow shipment, and unavailability of some foods limited the diet of miners and prospectors mostly to preserved foods. The reduced costs of food and the greater availability of fresh meats and produce in the wake of improved transportation systems offered the population an opportunity to consume improved diets.

An accurate portrayal of the diets of East Willow Creek's prospectors is difficult to ascertain, since the Carbonate Tunnel serves as the sole unaltered site. The residential building associated with the Ramey Tunnel was re-occupied during the late 1890s, and the associated artifact assemblage, therefore, does not represent the original residents. According to the material evidence, the prospectors that drove the Carbonate Tunnel consumed a diet almost exclusively of canned food. Preserved foods commonly included stews, meats, beans, vegetables, and fruits. Baking powder cans on-site also reflect the preparation of baked goods. In sum, the canned foods probably represent the consumption of an abbreviated Victorian diet.

The material evidence at the Holy Moses and Ridge mines reflects trends regarding the diets of workers at the large operations. The artifact assemblage at the Holy Moses Mine included more than 1,500 food cans that could have contained stews, vegetables, fruits, or other foods, 440 milk cans, 40 meat cans, and a lard pail. The assemblage also included over 50 butchered beef bones, a baking pan, and a butter knife. The plethora of cans reflects an emphasis on preserved foods, while the butchered bones indicate that the company provided some fresh meat. The baking pan and knife represent the consumption of baked goods. If the company provided fresh meat, then it probably served some fresh vegetables, as well. The above foods may have been supplemented with grains and beans. While the number of items at the Ridge Mine is only a fraction of those at the Holy Moses Mine, the assemblage's constitution is similar.

In sum, the artifact assemblages suggests that the crews at both mines consumed a typical Victorian diet, and that, at least during the district's early years, canned food proliferated. The butchered bones all represent cuts of beef, which confirms the preference for such meat. The mining companies on the Holy Moses Vein often obtained fresh foods from regional sources in the Rio Grande and San Luis valleys, where the growing season was short. Therefore, fresh foods were unavailable for a significant portion of the year, and preserved food became a mainstay during these times.

Question 12. Does the material evidence at the inventoried prospect operations and mines reflect the presence of ethnicities identified by certain foods?

Archival evidence indicates that at least a few European-based ethnicities worked in the Creede district, and that Swedes apparently held the strongest presence.[26] In many cases, immigrant laborers retained some cultural traditions, including a preference for certain foods and consumer goods, and construction practices. Some of the ethnic foods involved imported bottled goods and types of meat, which may be represented in artifact assemblages.

The material evidence at the inventoried sites, however, exhibits little evidence of the presence of ethnicities. The artifact assemblage associated with the Carbonate Tunnel included a sea-green bottle finish manufactured with applied techniques. Most American bottles made prior to 1920 turned shades of amethyst and aqua with exposure to ultraviolet radiation, while European, and especially British, bottles often turned sea-green. The bottle finish at the Carbonate site suggests that one of the prospectors may have been of British or Irish ancestry, and chose a familiar product. The Holy Moses Mine's artifact assemblage lacks evidence of the presence of ethnicities, however, archival information indicates that the boardinghouse hostler, Christina Matsen, was a Swedish immigrant.[27]

In general, the lack of material evidence of ethnic groups at the mining and prospect operations on East Willow Creek suggests they adopted, or already possessed, the dominant Euro-American cultural ways.

Question 13. Popular history portrays mine workers as living in the clutches of vices such as a heavy consumption of alcoholic beverages and tobacco. Does the material evidence support this assumption?[28] Did workers at prospect operations consume more or less liquor than those employed by organized mining companies? What factors possibly account for the trend?

The material evidence at the mine and prospect sites featuring residential complexes certainly reflects trends regarding the consumption of alcohol and tobacco. Certain types of fragmented bottles and earthenware jugs represent alcoholic beverages, and cans and tins represent tobacco. Liquor and beer bottles can be identified by makers' marks, proprietary labeling, shape, and finish types. Likewise, tobacco companies packed their products into cans with specific shapes, sizes, and closures.

All of the sites exhibit fragmented bottles indicating that prospectors and miners consumed alcoholic beverages. However, contrary to popular myth, the paucity of

[26] Van Horn, 2000: "The Swedes on Sunday", and other vignettes make references to Swedes.

[27] Van Horn, 2000: "Women had Tough Jobs Running Boarding Houses in Old Mining Days".

[28] Mehls, et al:1995 discusses the "mythic portrayal" of mine workers and heavy alcohol and tobacco consumption, and the use of material evidence to represent actual trends.

bottles represented indicate the residents imbibed only limited quantities of alcohol. In terms of prospect operations, the artifact assemblage associated with the Carbonate Tunnel includes one identifiable liquor or beer bottle, and the assemblage at the Ramey Tunnel represents several liquor and beer bottles. The number of vessels at both operations must be viewed in the context of a small number of residents and brief occupation.

The artifact assemblage associated with the residential cabin at the Ridge Mine features a greater number of alcohol vessels. Six bottle bases, one finish, and glass fragments represent at least seven liquor bottles. Still, given the cabin's lengthy occupation between 1891 and 1893, and again between the late 1890s and mid-1900s, the vessels are few. The artifact assemblage associated with the Holy Moses Mine indicates that the consumption of alcoholic beverages was surprisingly very limited. Only two liquor bottles were clearly represented, and additional bottle fragments suggest a few more bottles. The artifact assemblage included a small quantity of earthenware fragments. Distillers used earthenware jugs for liquor, however, makers of food products also used jugs for flavoring extracts, molasses, and other liquids.

The residential building platform at the powerhouse remnant site also featured evidence of the consumption of alcohol. Like the mine and prospect sites, the bottle fragments represent only a few vessels. Specifically, a bottle base and a finish remain from two beer bottles.

Only the large mine sites possess evidence indicating that workers used tobacco. The artifact assemblage associated with the Holy Moses shaft complex included eight tobacco cans, each of which contained significant quantities of pipe tobacco. The residential cabin at the Ridge Mine featured two small tobacco tins. In addition to cans and tins, tobacco companies also used perishable cloth pouches for cigarette tobacco, which were not represented in the artifact assemblages.

Since the crews at the Ramey and Carbonate tunnels consisted of only a few members who lived on-site briefly, the number of alcohol vessels can be viewed as proportionately higher per individual than at the Ridge Mine. The Holy Moses shaft complex featured only a handful of alcohol vessels, which stands in contrast to the high numbers of cans and other forms of domestic refuse on-site. In this light, it appears that workers at the prospect operations consumed more alcohol than the workers at the large mines. The reason for the disparity between prospect and mining operations probably lies with company policy. In seeking to exert control over the work and living environments, the Creedemoore Mining Company, and the Holy Moses Mining Company, probably prohibited the regular consumption of alcohol in company housing. Since the workers at the prospect operations had greater autonomy, they were free to consume as they wished. Yet, they too consumed little alcohol, possibly due to limited disposable income.

Question 14. How does the material evidence reflect the health of workers? What diseases were present? Water-born pathogens were poorly understood, and food preservation was difficult and also poorly understood, fostering an environment for gastro-intestinal diseases. Are these represented by the material evidence?

The artifact assemblages at the mine and prospect sites featuring residential complexes reflects some aspects regarding the health of workers. Some of the sites exhibit evidence, in the form of fragmented bottles, that workers consumed medicines on occasion. Only the Carbonate and Ramey tunnels featured a few fragmented medicine bottles, which contained proprietary products. While the specific contents of such bottles are difficult to determine, they were generally sold as cures to internal ailments of various types.[29] Therefore, the bottles probably represent an attempt to treat temporary illnesses. The other sites lacked evidence of the use of internal or topical medicines. Therefore, the material evidence strongly suggests that the health of the workers on East Willow Creek was sound.

Conclusion

In sum, the historic mines on East Willow Creek reflect the influence of six basic patterns endemic to the historical Western hardrock mining industry. The patterns are:

1. Equipping and operating a mine was a function of money. Mining properties with great promise were able to inspire the caliber of investors capable of providing ample capital for development. The wealthiest investors equipped their mines with the biggest and best surface plants.
2. Large and complex surface plants reflect large ore reserves. Investors financed the erection of large surface plants at mines with large ore reserves in hopes of maximizing production while minimizing operating costs. Small surface plants reflect limited production.
3. The time period during which a mine operated influenced how and to what degree it was equipped. Mines that were active late in a district's life tended to be better equipped than those active early in the district's life.
4. Structural geology influenced how miners and engineers set up and operated a mine. Steeply dipping veins were more conducive to being developed through shafts. The topography overlying an ore vein, determined by structural geology, influenced the type of surface plant that engineers built. Flat terrain was conducive to sinking shafts, while steep terrain was suited for driving tunnels.
5. The geographic locations of mining operations influenced the degree to which they were developed and equipped. Mining operations located near commercial centers and close to the richest portions of the vein were more apt to attract wealthy investors, and hence a greater degree of capital.
6. The physical climate influenced how miners and engineers set up a mine. Operating throughout the year required substantial buildings to shelter a mine's critical surface plant facilities, while prospect operations that were active only during warm months could afford simple and small structures.

The Influence of Financiers, Capital, and Ore Production

[29] Fike, 1987:3.

In terms of the first and second influential factors discussed above, the historic mine sites on East Willow Creek reflect the relationship between investors' financial status, capital investment, and the composition of the mines' surface plants. Wealthy and powerful investors acquired the Holy Moses Vein's richest operations, and they supplied ample capital to fund the development of substantial underground workings supported by well-appointed surface plants. Specifically, Senator Thomas Bowen acquired the Ridge and the Soloman mines from Charles Nelson in 1891, and David H. Moffat and his syndicate purchased the Holy Moses Mine also in 1891. The Moffat syndicate purchased significant shares in Bowen's properties in either 1891 or 1892, essentially drawing Bowen into the syndicate. According to both archaeological remains and archival information, shortly after Bowen purchased the Ridge and Soloman, and when the Moffat syndicate acquired the Holy Moses, they financed the erection of substantial, well-equipped production-class surface plants to boost ore production.

The other historic sites on the Holy Moses Vein, including the Carbonate and Mammoth tunnels, and the Outlet Mine, were not owned by prominent investors. The Carbonate Tunnel was a minor prospect operation, and it featured a surface plant equipped with the most rudimentary components. Further, the site lacks physical evidence of ore production. The Ramey Tunnel was also unproductive, and its surface plant was only slightly better equipped. The Phoenix Mine, located at the north end of the Holy Moses Vein, and the Mammoth Tunnel, driven into Mammoth Mountain, were exceptions. Bowen purchased the Phoenix from Nelson in 1891 and dispatched a crew of miners to drive exploratory workings. They found little ore, and Bowen allowed the claim to remain idle for almost 10 years before leasing it, despite his access to abundant capital. Moffat consolidated a claim he owned on Mammoth Mountain with other claim holders, and had a crew of miners drive what became an unproductive tunnel.

The Influence of Operating Timeframe

The Holy Moses Vein's principal historic mines reflect patterns regarding the influence of operating timeframes. According to archaeological remains and archival information, all of the mines began as modest operations in the early 1890s, and within several years the profitable operations expanded in size, paralleling the Creede district's initial boom. At this time, capitalists felt secure about investing money in the district's mines, and one of the net results was that the infrastructure necessary to transport equipment and supplies in, and feed a growing workforce, came into being. During the early 1890s, the prospects that proved unsuccessful were abandoned.

The original Ridge, Ethel, and Mexico adits on the Ridge site, the Holy Moses Mine, and the Carbonate and Ramey tunnels, exemplify the simple beginnings experienced by the Holy Moses Vein's mines. The remains existing at these sites indicate that the operations' surface plants consisted of relatively inexpensive, temporary-class components, and the small waste rock dumps reflect shallow exploratory workings. While the Holy Moses, the Ridge, and the Soloman mines began simple, their owners injected capital and upgraded the surface plants with a combination of sinking-class and production-class components.

In the late 1890s, when the Creede district experienced its second boom, the productive mines throughout the district were reworked while the failed prospect operations remained idle. By the late 1890s the economy recovered from the Silver Crash of 1893 and capitalists were again willing to furnish money to equip the mines and support a workforce. At this time the costs of purchasing and shipping equipment fell, and milling technology improved. These two trends had the effect of lowering the costs of mining and rendering previously uneconomical ores profitable to treat.

Curiously, collectively the principal mines on the Holy Moses Vein rail against the trend of significant upgrades in their infrastructures. By contrast, the mines on the Amethyst Vein the Alpha-Corsair ore systems saw extensive upgrades. The owners of the Amethyst Vein's largest mine sites invested capital to expand the surface plants as part of an effort to produce ore in economies of scale. Production in large volumes offset the decrease in silver's value in the wake of the Silver Crash of 1893, permitting profitable operations. The owners of the principal mines on the Holy Moses Vein, who also owned the mines on the Amethyst Vein, left the Holy Moses operations primarily as they were. Further, to avoid investing capital, the owners leased the properties, leaving the costs of equipping and maintaining the mines to the lessees. The properties' owners were undoubtedly aware that the ore bodies within the Holy Moses, Ridge, and Soloman mines were nearly exhausted and would not provide returns for investment and improvement.

Like many other mines in the Creede district, those on the Holy Moses Vein became silent by the 1910s. The Ridge Mine saw brief activity in 1912, and lessees worked the Soloman sporadically through World War I. The principal reason for the slump of mining on the Holy Moses Vein was that miners gutted the Holy Moses Vein during the 1890s and early 1900s. Several other reasons contributed to the drop off in activity. While the demand for industrial metals held strong during the 1910s, other regions in the nation were producing large quantities of ore, glutting the market. The demand for metals spiked during World War I; however when the war ended, metals prices tumbled and the market collapsed, spelling a cessation to mining in Creede.

In 1934, at the depths of the Great Depression, President Franklin Delano Roosevelt signed the Silver Purchase Act into law, which provided artificial price supports for the white metal. The Act stimulated silver mining in the West, and miners reopened many of the Creede district's mines. However, the mines on the Holy Moses Vein remained quiet during this time. It was probably common knowledge that previous operations exhausted the ore bodies, and capital spent on equipping and rehabilitating the decayed mines would be wasted.

After almost 30 years of neglect and decay, during the late 1940s and early 1950s mining companies reopened all of the Holy Moses Vein's principal mines, and they developed afresh the Phoenix claim. In 1943 a mining outfit reopened the Ridge, and during the 1950s various lessees conducted underground exploration and ore extraction in the Soloman, Holy Moses, and Outlet mines. In 1951 the Outlet Mining Company developed and successfully mined the Phoenix claim, and several years later the Outlet Mine. The mining companies hoped to profit from low-grade ores left by past operations under the umbrella of improved milling technology and decreased operating costs. The operations active during the 1950s, with the exception of the Outlet company, suffered from a lack of capital, and the remains they left at the sites today reflect this.

Improved mining technology decreased the costs of ore extraction, improved milling technologies rendered low-grade ores profitable, and the demand for industrial metals remained strong in the 1940s and the 1950s. During this time, however, several factors were conspiring against mining in Creede. Mining shifted to foreign nations where operating costs were low and increased regulations increased the costs within the domestic industry, rendering mining in many Western districts no longer profitable. But the main reason for the final failure of the mines on the Holy Moses Vein was that the ore was truly exhausted after 60 years of mining.

The Influence of Structural Geology

The mine sites on the Holy Moses Vein show the influences that structural geology had on how engineers set up the mines. First, the structural geology impacted the area's topography. Campbell and Mammoth mountains are parts of a volcanic formation, and they possess typical characteristics. The mountains feature flat tops bordered by steep, rocky slopes. The Holy Moses' mining engineers working near the vein's center, where the terrain was relatively flat, found that sinking shafts to tap the vein was best. Engineers at the vein's south and north ends, where they passed close to Campbell Mountain's steep flanks, found that tunnels were best for development. All of the mines north and south of the Holy Moses were tunnel operations, while the Holy Moses was initially a shaft operation, and worked through a tunnel later.

The Influence of Geographic Location

The Holy Moses Vein's historic mine sites illustrate the influence of geographic location on the constitution of their surface plants. The two best-equipped and heaviest producing properties on the vein, the Soloman and the Ridge, lie on the floor of East Willow Creek's valley. The Holy Moses Mine, also a significant producer, was perched high atop bedrock cliffs on Campbell Mountain. A road graded along East Willow Creek afforded easy access to the Soloman and the Ridge mines from the railhead at North Creede. Hauling supplies and machinery to the Holy Moses Mine, on the other hand, was a major undertaking.

The surface plants associated with the Soloman and Ridge mines stood in stark contrast against that of the remote Holy Moses Mine. Both the Soloman and Ridge mines featured concentration mills and extensive surface facilities, while the Holy Moses Mine remained fairly primitive. The Ridge Mine in particular was developed through two principal haulageways and several adits, and each featured support facilities. Further, the mine had an air compressor, ventilation blowers, and multiple buildings dedicated to different activities. The Holy Moses Mine, on the other hand was developed through two constricted shafts enclosed in small shaft houses. The mine apparently had one blacksmith shop, which was crammed into one of the shaft houses. The Holy Moses Mine featured little mechanization beyond an aerial tramway. The hoists at the two shafts were apparently horse whims, which was one of the most temporary and simple systems available during the early 1890s. Convention for productive mines usually dictated the employment of steam hoists.

The ore handling systems at the Soloman and Ridge Mines differ from that at the Holy Moses Mine. Miners trammed loaded ore cars directly out of the Soloman and Ridge mines, across stout trestles, to concentration mills. The system at the Holy Moses Mine, on the other hand, relied on a series of small chutes and transfer stations descending from the shafts to the aerial tramway terminal. Because the Holy Moses Mine lay at an inaccessible location, the tramway proved to be a wise investment to ship ore to the Ridge Mill.

The architecture at the Ridge Mine contrasts against that at the remote Holy Moses Mine. All of the buildings at the Holy Moses were constructed with local building materials in the form of logs, supplemented with easily transported corrugated iron. While the tram terminal incorporated some dimension lumber, mine workers hewed the principal beams from local logs. The Ridge Mine featured some log buildings, and some structures constructed with dimension lumber, which was more easily transported up the short road from North Creede.

The Influence of Physical Climate

The Holy Moses Vein's historic mine and prospect sites reflect the mining companies' responses to the influence of weather on operations. The Soloman and Ridge mines operated throughout the year, which required both sheltering vital surface plant components in heated structures, and maintaining transportation arteries for the input of supplies and the output of ore. Archaeological remains and archival data indicate that these operations featured surface plants equipped for work during winter.

The surface plants at the Ridge and Soloman mines featured substantial buildings enclosing the tunnel portals, shops, and concentration mills. Further, the surface plants at both mines were laid out to facilitate the flow of ore from the tunnels directly to the mills. Specifically, the mining companies constructed the mills close to the tunnel portals to minimize the distance that workers had to push ore-laden cars, and to minimize the degree to which the ore had to handled.

The Holy Moses Mine, in contrast, may not have produced ore during the winter. To ship ore from the mine, workers loaded it into chutes located near the shaft collars, which directed the payrock to transfer stations. Workers at the open-air stations transferred the ore into cars, pushed them a short distance, and unloaded the cars into another chute that shunted the payrock into a receiving bin in the mine's aerial tramway terminal. Inside the terminal another worker loaded tram buckets from the bin, and the buckets descended to a mill at the Ridge Mine on the valley floor. The system of chutes and transfer stations appears to have been completely exposed to the elements, and possibly unworkable during the winter. If miners stayed on at the Holy Moses Mine during the winter, they probably labored underground developing the vein in preparation for extraction during warm months.

All of the principal mining operations, including the Holy Moses, the Ridge, and the Soloman mines, maintained wagon roads for the delivery of supplies. In addition, the Ridge and Soloman mines relied on the roads for the drayage of concentrates produced by their mills. The Holy Moses Mine also featured an aerial tramway that carried ore down, and supplies up. The road to the Ridge and Soloman mines was easily maintained during the winter, but the road to the Holy Moses became impassable. The Holy Moses' tramway, however, was impervious to the elements. Yet, carrying cases of food, sacks of grains and beans, and other items from the tram terminal up to the residential complex on the steep, snow-covered pack trails was a Herculean task.

All of the principal mines on the Holy Moses Vein provided residential facilities for their mine crews. In so doing, the companies ensured that they had a workforce on hand through all seasons. By living in company housing, the mine crews did not have to commute far on foot or horseback during the winter.

The small prospect operations included in the survey, on the other hand, reflect activity only during the warm months. The Carbonate, Ramey, and Mammoth tunnels all featured small structures which offered little protection against the weather. The prospectors working the Carbonate Tunnel installed an open-air blacksmith shop that was exposed to the weather. In addition, all of the above operations lacked transportation links that were reliable in all seasons.

Application of Technology

The mine sites recorded on the Holy Moses Vein fit broad patterns regarding the application of mining technology. The outfits engaged in prospecting and deep exploration relied on conventional Gilded Age equipment and facilities to support work underground. They followed convention and equipped their surface plants with relatively inexpensive, small, and portable temporary-class facilities, and workers carried out most labor by hand. The sites that reflect such practices include the Carbonate, Ramey, and Mammoth tunnels.

The surface plants associated with these prospects typically consisted of a small blacksmith shop equipped with hand tools, and a simple transportation system. Prospectors at the Ramey and Mammoth tunnels probably used ore cars on rail lines, while the prospectors at the Carbonate Tunnel relied on wheelbarrows. The surface plants associated with the Ramey and Mammoth tunnels also included hand-powered ventilation blowers, which the prospectors used to force fresh air into the underground workings.

The mining companies that worked the productive properties on the Holy Moses Vein also applied conventional Gilded Age technology. They equipped their surface plants with some production-class components capable of supporting deep, intensive underground work. The largest operations, including the Soloman and Ridge mines, included plant facilities designed to maximize production and minimize operating costs over protracted periods of time. These mines, by no coincidence, were also the biggest producers backed by the wealthiest investors. By contrast, the Holy Moses Mine was equipped with temporary-class machinery and simple facilities, despite the mine's richness and ownership by David Moffat, who had access to abundant capital.

The Ridge Mine best illustrates the application of production-class Gilded Age surface plant components. The mine featured at least three blacksmith shops at different tunnel portals. The shops were dedicated toward serving the needs of miners working in different levels of the mine, and collectively they facilitated a high volume of work. Further, the shop at the main haulageway was large and well-equipped, possibly featuring power appliances. The main haulageway's plant also featured a separate carpentry shop, which facilitated the rapid completion of woodwork. Miners working underground drilled blast-holes with rockdrills supplied air from a compressor located in the Ridge Mill, which expedited the blasting cycle.

The owners of the Ridge Mine erected an ore concentration mill around 1892, and in 1900 at the Soloman Mine, to separate metalliferous materials from waste. Engineers appear to have equipped the mills with conventional machinery, however they applied calculation and metallurgy to select processes and machines capable of treating the Holy Moses Vein's complex ore. The Ridge Mill was the first concentration facility built in the Creede district, and in this context it represents innovative and progressive applications of technology. The mill served as a proving ground for ore concentration that later engineers in the district would emulate to a degree.

Several of the Holy Moses Vein's principal mining companies strayed from Gilded Age convention and applied innovative and highly progressive technologies. In either the 1890s or around 1900 the Moffat syndicate financed the construction of an electrical generation facility to power mill machinery, probably at the Ridge and Soloman mines. The remnants of powerhouses lie on the bank of East Willow Creek between the Holy Moses and the Ridge mines, and between North Creede and the Ridge Mine. During the 1890s and 1900s, few Western mining districts were electrified and the technology was new and in an experimental state. The Creede district's electrical grid became empirical evidence for mining engineers and machinists keeping a watchful eye on the success of the technology.

The Holy Moses Mine represents the application of conventional Gilded Age technology in the context of its inaccessible location. Because the mine lay high on the flank of Campbell Mountain, transporting the equipment ordinarily employed by such a productive operation proved difficult. As a result, the mine's engineer employed hoisting and ore-handling systems, described above, that were easy to transport to remote locations.

Architecture

The buildings that the mining and prospect operations erected at the sites on East Willow Creek reflect the influences of time frame, geographic location, and the availability of construction materials.

When the mines were initially developed during the early 1890s, the transportation infrastructures to the district, and local sawmills, were under development. Lumber commanded premium prices, and prospectors and miners on East Willow Creek turned to local building materials for the structures they had to erect. Then, with the coming of the railroad, the establishment of a network of passable roads, and the development of a local logging industry, the cost of lumber fell. The buildings existing at the historic sites today, and the evidence left by the buildings that have been removed, reflect the transition from local building materials to lumber. Specifically, many of the structures erected at the Holy Moses and the Ridge Mines in the early 1890s were of logs, and buildings constructed during the latter portion of the 1890s and the 1900s were of lumber.

The large industrial structures that involved fine engineering, such as the Soloman and Ridge mills, and the Holy Moses' tramway, required the regularity and uniformity offered by lumber, and logs could not be substituted. To avoid the costs of purchasing costly lumber and transporting it up to the inaccessible Holy Moses, the company employed construction workers to hand-hew beams for the tram terminal on-site out of logs in 1892. The Holy Moses company also attempted to avoid lumber by substituting corrugated sheet iron, which had been introduced to the construction market only a short while earlier.[30]

When mining in the Creede district slowed significantly around 1910, the defunct mining operations left behind much of the building materials they used for their surface plants. The few groups of lessees, often in want of capital, that reworked the formerly productive properties turned to these materials for their own uses. They constructed buildings with lumber scavenged from abandoned structures, and in some cases simply relocated entire frame buildings. In subsequent decades other lessees continued the practice of using salvaged materials. Some of the structures and structure remnants at the sites on East Willow Creek that post-date the 1900s exhibit this trend, which is reflected by the incorporation of salvaged materials.

[30] Twitty, Eric *Reading the Ruins* p304, 362.

Residence

Nearly all of the historic mine and prospect sites on East Willow Creek feature the remains of associated residential complexes. While most of the structures were removed long ago, the complexes are represented by cut-and-fill building platforms, highly intact artifact assemblages, and unexcavated privy pits. This material evidence is important, because it appears to be the sole source of data that speaks about the mine workers who called the East Willow Creek mines their workplace. The information gathered during the survey revealed trends regarding the natures and durations of occupations by the mine crews.

Residential Buildings at Mines

During the initial development of some of the Holy Moses Vein's mines, the mine crews that worked the properties erected small cabins which were sufficient to house the limited number of workers then employed. When the properties changed ownership and the mining companies geared up for significant development, they hired larger crews. To house the greater numbers of workers, the mining companies had to erect bunkhouses and additional residential buildings.

All of the residential buildings associated with the prospect operations were small and temporary. Prospectors working the Ramey Tunnel lived in either a log or frame cabin, and the men working the Carbonate Tunnel lived in a wall tent. Each residence accommodated only several occupants, and in them workers attended to general domestic duties such as preparing food and general hygiene. The residences at the prospect operations were austere and simple for several reasons. First, the prospectors financed and constructed the residences themselves and invested minimal time and effort. Second, by nature prospecting was speculative, and erecting anything but impermanent facilities was imprudent.

Once the profitable mining companies commenced operations in earnest, they erected bunkhouses and fed the work crews in dining halls. Usually, one large building served these two functions. The sizes of the bunkhouses were relative to the extent of the mining operation. The large mines kept big crews employed, and they erected substantial structures to accommodate the workers.

The residential complex at the Holy Moses Mine consisted of three bunkhouses and a boardinghouse. Mine workers slept, exercised hygiene, and probably spent some leisure time in the bunkhouses, and they consumed communal meals in the boardinghouse. In addition to a kitchen, the boardinghouse probably featured living quarters in a loft. The residential buildings at the Holy Moses were crude, dark, and unfinished, creating austere living conditions.

Some mining operations, such as the Ridge, built detached frame buildings in addition to bunkhouses to provide ample living space. However, little can be surmised regarding the living quarters at the Ridge and Soloman mines because most of the residential features at the sites were destroyed within the last 50 years.

Diet

During the early 1890s the typical mine worker's diet was slightly different than that consumed in the late 1890s. The Holy Moses Mine and the Carbonate Tunnel were abandoned early in the district's history, and they include early domestic dumps slightly different in composition from those that at the mines active during the late 1890s. Specifically, the abundance of food cans reflects the consumption of preserved vegetables, fruits, and meat, which was supplemented with grain products. Relatively few butchered bones suggest that the mine crews ate little fresh food. The reliance on preserved foods was necessary during the early 1890s because transportation and commercial infrastructures were in a nascent stage, and fresh food was not yet widely available.

By the late 1890s the Holy Moses Vein's mining companies fed their crews a hearty Victorian diet similar to that consumed in other Western mining districts. A combination of food cans and butchered bones reflects the consumption of meals that emphasized vegetables, fruits, and fresh meats. Further, the bones consisted primarily of cuts for beef-based stews and roasts. At that time, miners preferred beef to other types of meat. The mining companies undoubtedly supplied the cooks with fresh fruits and vegetables, such as apples, peaches, potatoes, and corn, when available. Cooks probably prepared meals which also required flour, corn meal, other grains, and beans. However, the packaging for fruits, vegetables, beans, and grains was perishable, and is therefore absent from the artifact assemblages at the Holy Moses Vein's mine sites.

Contrary to popular stereotypes, the miners that worked at the Holy Moses Vein's principal operations openly consumed little alcohol. The domestic artifact assemblages associated with the mines included only a paucity of liquor bottle fragments. At these operations, mine workers consumed beer, wine, champagne, and liquor in very modest quantities.

The artifact assemblages associated with the residential complexes at the large mines on the Holy Moses Vein reflect the preparation of large quantities of food, and the consumption of meals in a dining hall setting. The boardinghouse remnant at the Holy Moses Mine features an associated refuse dump, and it includes numerous institutional-sized food cans (6 inches in diameter and 6¾ inches high), and large butchered bones such as beef femurs and pelvises generated by preparing voluminous servings of stews and roasts. The artifact assemblage also includes numerous heavy tableware fragments, known as *hotelware*, which was typically used in dining halls.

Gender and Population

The artifact assemblages associated with the residential complexes reflect the gender of the mines' residents. The relative paucity of miscellaneous and decorative domestic items represents groups of single miners working at remote locations. Because many residential features at the Ridge and Soloman mines were destroyed, determination of whether women lived at these operations is difficult. Archival information indicates, however, that women served as hostlers at least at the Holy Moses Mine. At the prospect operations the workers were responsible for completing all domestic duties including housekeeping and cooking. The large mining companies, on the other hand, hired workers to carry out the domestic tasks while the miners labored. They employed hostlers and cooks that cleaned the living quarters and prepared meals.

Settlement Patterns

The historic mine sites on East Willow Creek reflect settlement patterns typical of those in many Western mining districts. During the Gilded Age, miners and workers lived on-site at all of the prospects and mines, with the exception of the Mammoth Tunnel, where they lived in nearby North Creede.

Because small prospect crews, probably consisting of several men, worked the various prospect operations, only one to several residential buildings were needed, and they were usually erected near the points of work. The large mining companies housed crews consisting of up to several dozen workers, which required large buildings. The companies tended to cluster the buildings together on the flattest ground possible near the mine workings. The locations of the residential complexes at the Holy Moses and the Ridge mines reflect this trend.

A small settlement grew along East Willow Creek around the Ridge Mine, most of which was probably supplied by the company. Workers employed in the mine, at the mine's surface plant, at the mill, and for other capacities, lived in the settlement. Workers employed at the nearby Soloman Mine and at the powerhouse that stood to the north on East Willow Creek may have also lived at the settlement.

Because most of the residential features at the Ridge Mine and all of the residential features at the Soloman Mine were destroyed, general conclusions regarding living quarters and dining facilities there remain indeterminate. However, the Ridge Mine includes a log cabin that served as a self-contained residence. The cabin's interior was finished with whitewashed ribbed paneling, suggesting that the Ridge Mine provided better housing for its crew than the Holy Moses Mine.

The collapsed of mining during the 1910s and the rise of the automobile during the 1930s changed the settlement patterns at the mines. The automobile allowed mine workers to live in Creede and North Creede and commute to their places of employment. All of the historical sites examined by this inventory lack evidence of residence post-dating the 1910s.

Site Eligibility

Most of the historic sites on East Willow Creek are eligible for listing either on the National or State Registers of Historic Places (NRHP and SRHP). Of these sites, many participated in broad patterns of history, they serve as sound archaeological examples of prospect, mining, or early electrical generating operations, and some have the potential to yield further information. The Ridge Mine's residential complex features a privy pit that may contain buried domestic deposits capable of contributing to the current understanding of lifestyles, populations, and foodways in mountain mining communities. The Mammoth Tunnel site features a powerhouse remnant with partially buried machine foundations capable of contributing to the currently dim understanding of early electrical generation. Several of the large mines probably feature historical features and artifacts in their underground workings, which can contribute to the currently dim understanding of mining methods, engineering, and technology used underground, and of the mine as a workplace. Many of the mine sites active during the 1950s and later possess little historical integrity due to the use of heavy equipment for earthmoving, and the construction of new surface plants. Such sites are not eligible for listing on either the NRHP or SRHP.

Table 9.1 Site Identification and Eligibility Summary

Site Number	Site Name	Integrity		Eligibility		NRHP Criteria	SRHP Criteria
		Yes	No	Yes	No		
5ML350	Carbonate Tunnel	X		X		None	A
5ML351	Holy Moses Mine	X		X		A,C, and D	
5ML104	Holy Moses Tunnel		X		X	None	None
5ML353	Mammoth Tunnel	X		X		A, C, and D	
5ML301	Outlet Mine		X		X	None	None
5ML200*	Phoenix Mine	X		X		None	A, C, and D
5ML352	Powerhouse Remnant	X		X		A and C	
5ML355	Ramey Tunnel	X		X		None	A
5ML201	Ridge Mine	X		X		A, C, and D	
5ML200*	Soloman Mine		X		X	None	None

* Recorded under the same number by the Division of Minerals and Geology in 1990, prior to the Holy Moses inventory.

The historic mine and residential sites on East Willow Creek offer a rich legacy of 90 years of mineral exploration, mining, and electrical generation. The material evidence and archival information gathered for this inventory compliment each other, and they illustrate the application of mining technology, the industrialization of the region, and the collapse of mining in the late twentieth century. While the archival data gathered in association with this publication revealed much regarding the history of East Willow Creek, the sites contain more information in the form of archaeological remnants. The analysis of these remnants by this inventory greatly enhanced the current understanding of mining in the area, as well as life in the deep Rocky Mountains during the Gilded Age.

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Holy Moses Mine Box 104053
Kentucky Belle Box 104053
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Last Chance Mine Box 104053
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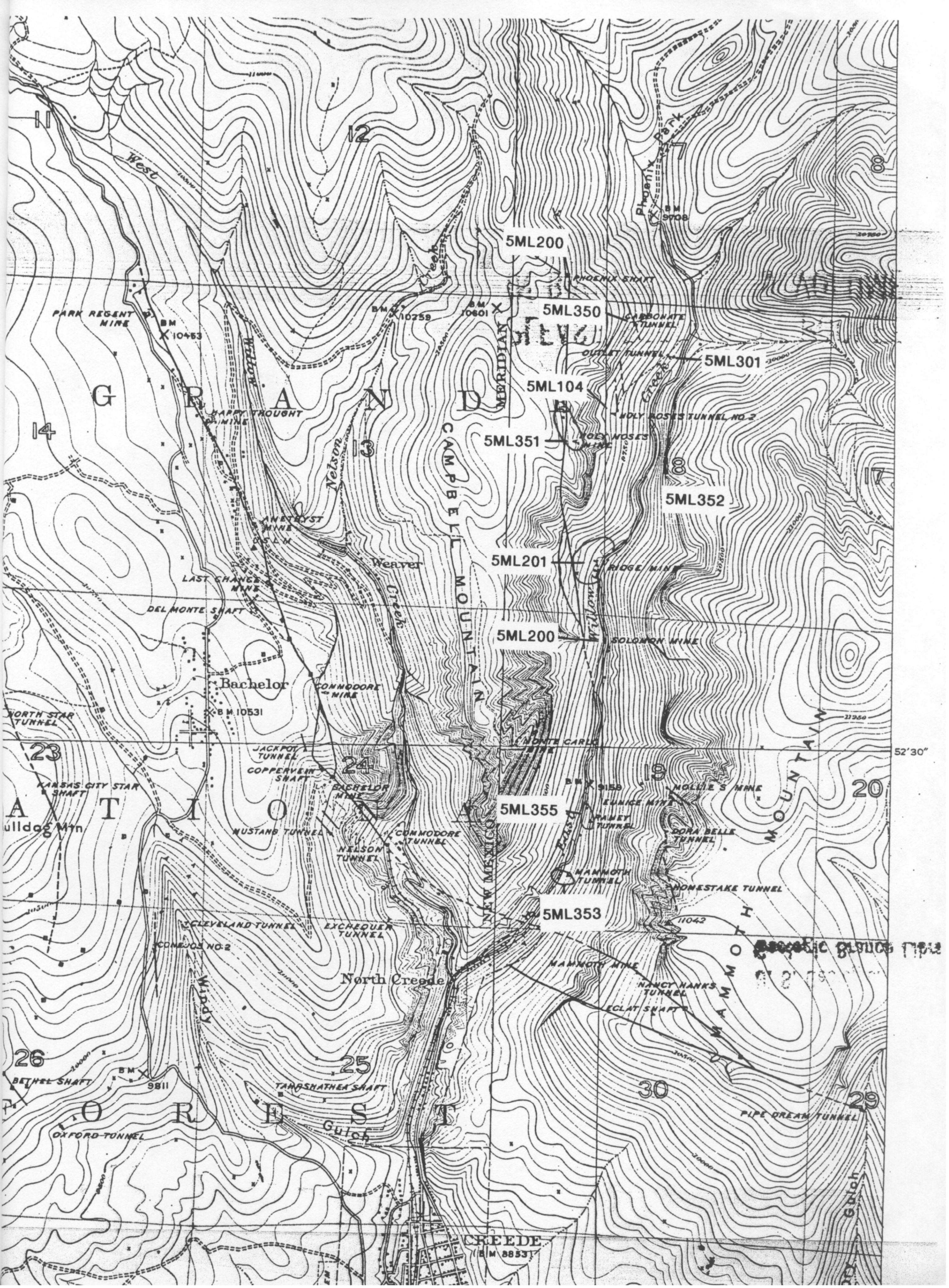
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MAMMOTH TUNNEL
HOMESTAKE TUNNEL
MAMMOTH MINE
NANCY HANKS TUNNEL
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MUSTANG TUNNEL
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NELSON TUNNEL
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EXCHEQUER TUNNEL
CONEJOS NO. 2
BETHEL SHAFT
TAM O'SHANTER SHAFT
OXFORD TUNNEL
Bachelor
North Creede
CREEDE
(BM 8853)
Bulldog Mtn
Weaver
West Willow Creek
Nelson Creek
Weaver Creek
East Willow Creek
Windy Gulch
Phoenix Park
CAMPBELL MOUNTAIN
MAMMOTH MOUNTAIN
NEW MEXICO MERIDIAN
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