CONTEXT FOR HISTORIC MINING RESOURCES

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BLACK HILLS AND SOUTH DAKOTA

A GUIDE FOR IDENTIFICATION, INTERPRETATION
AND
EVALUATING ELIGIBILITY
TO THE
NATIONAL REGISTER OF HISTORIC PLACES

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CHAPTER 2

BACKGROUND FOR ASSESSING ELIGIBILITY TO THE NATIONAL REGISTER OF HISTORIC PLACES

Review of the National Register of Historic Places Designation Program

The National Register of Historic Places is a program that recognizes historically significant cultural resources on both an individual basis and collectively in the form of districts and landscapes. These resources may be important on local, statewide, or national levels, and they include objects, buildings, structures, and archaeological sites. Although the National Park Service oversees the National Register of Historic Places (NRHP), the agency charged the South Dakota State Historical Society (SDSHS) with applying the program in South Dakota. The SDSHS can be contacted regarding the benefits and limitations of listing a property on the NRHP.

Official listing on the NRHP is a status that historic properties achieve after a formal nomination and review process. Being *eligible* for the NRHP is a different status than being officially listed. An eligible resource meets the requirements for being listed, but has not yet been formally nominated and accepted. A determination of eligible affords the resource some protection against invasive Federal projects such as the cleanup of abandoned mines, and is a platform for officially nominating resources to the NRHP. Being officially listed not only provides the resource with the same level of protection, but also opens the gateway for grant programs, other forms of assistance, and recognition.

A process of evaluation is required to recommend a historic resource eligible for the NRHP. To structure the process, the National Park Service defined requirements that a historic resource must meet. In overview, the requirements include: assessing the resource's physical integrity, identifying the resource's timeframe, determining how or why the resource is important, and then producing a statement of significance.

It should be noted that in its *National Register Bulletin: How to Complete the National Register Registration Form* publication, the National Park Service explains the requirements in reverse order. The mining context, in contrast, has been formatted primarily for field use by a diverse readership, and therefore presents the requirements in the order below.

Physical Integrity

Physical integrity is a fundamental quality that a mining-related resource must possess to qualify for the NRHP. Simply put, the resource must be intact enough to clearly convey its type of entity, and the timeframe during which it was important. Physical integrity is the first requirement presented in this chapter because without integrity, a resource will be ineligible and the process of evaluation need go no farther.

NRHP Seven Aspects of Integrity

To support the official nomination process, the National Park Service quantifies integrity as seven specific aspects. A resource must possess some, but not all, of the aspects to be nominated. Although the aspects were broadly designed for all historic and prehistoric resources, the seven aspects as applied to mining resources are:

> *Location*: Location usually refers to buildings, structures, and objects, often machinery in the case of mining resources. To retain integrity of location, the building, structure, or object must be in its original location of use. If the construct has been moved from the site, it no longer retains integrity of location and does not contribute to a site.
>
> *Design*: To retain integrity of design, the resource must reflect its organization, layout, and planning. This requires physical intactness and minimal disturbance. If the site has been reduced to archaeological remnants (defined below), and the features and artifacts clearly represent the site's constitution, then the site retains integrity of design. The aspect of design is especially relevant to mine and mill sites, which consisted of multiple components usually arranged according to a plan. Integrity of design also applies to buildings and structures, which must exhibit characteristics of their planning.
>
> *Setting*: The aspect of setting refers to the physical environment around a historic resource. To retain integrity of setting, that environment must retain characteristics evocative of the timeframe when the site was historically significant. In mining districts, the characteristics typically include natural landscapes, mine dumps, placer workings, industrial features, and period buildings. Modern buildings, highways and other automobile development, and utility infrastructure tend to compromise setting.
>
> *Materials*: Integrity of materials primarily refers to buildings, structures, and objects. The construct must consist primarily of original materials, and any alterations or repairs conducted within the last 50 years must be done with materials identical or very similar to the original.
>
> *Workmanship*: Most of the elements of a building, structure, or object must be of original workmanship. Any repairs or alterations within the last 50 years should be accomplished with methods like the original. For example, recent additions or repairs made to period buildings or structures may be incompatible with original workmanship. Period machinery repaired with a predominance of modern parts may not possess integrity of workmanship.
>
> *Feeling*: The aspect of feeling refers to the ability of a resource to represent its type, operation, and timeframe. Integrity of feeling requires that the resource be physically intact, reflect its design, and consist of original materials and workmanship. An intact setting contributes heavily to feeling. A site need not possess all its buildings and structures to convey feeling. For example, a mine may lack its buildings, but the waste rock dumps and debris can convey the sense of mining operations.
>
> *Association*: The aspect of association is broadly applicable to mining sites, and it requires the resource to convey its role in history to today's observers. The site and its surrounding setting should be physically intact, and integrity on an archaeological level is acceptable. For example, the ruins of a concentration mill may impart a sense of ore treatment and its importance to the success of mining in the Black Hills.

Physical Integrity and Mining Resources

Mining historians with the National Park Service surmised that applying the seven aspects of integrity to mining resources can be difficult, in part because the seven aspects weigh heavily toward intact architecture and structures.[1] The historians acknowledged that most

[1] Noble and Spude, 1998:13.

mining resources have been reduced to archaeological features and artifacts whose integrity is not easily defined by the seven aspects. Given this, it is highly useful to perceive physical integrity according to three general levels: archaeological, engineering, and architectural. Differences can be understood through a brief explanation of the typical composition of mines.

Nearly every mining operation erected facilities to support activity on the property. Hardrock operations, for example, featured a *surface plant* around the mine opening. Surface plants consisted of a variety of *components* such as buildings, structures, machinery, small pieces of equipment, activity areas, and topographical alterations.[2]

When a mine closed, companies or other parties usually removed most of the structures, other materials, and equipment because these still held some value. They almost always left distinct material evidence clearly representing the structures or other aspects that were removed. The remnants of buildings, structures, other facilities, and their associated artifacts constitute *archaeological evidence* as found on ground-surface. Archaeological features and artifacts on the surface are a different form of evidence than buried materials, which have erroneously become synonymous with the term archaeology. When the surface archaeological evidence clearly represents the former mining or milling operation, and permits its virtual reconstruction, a site retains *integrity on an archaeological level*. If the site possesses its machinery or engineered structures, then it retains *integrity on an engineering level*. If the site also has its buildings, then it retains *integrity on an architectural level*. It should be noted that these terms help define a resource's integrity but are not official language of the NRHP program

> *Integrity on an Architectural Level:* Refers to the presence of standing buildings. Resources that possess only some of the original buildings retain partial architectural integrity. Sites with all their original buildings retain full architectural integrity. Any level of architectural integrity is uncommon.
>
> *Integrity on an Engineering Level:* Refers to designed structures and machinery. Resources that possess some structures and machinery retain partial engineering integrity. Sites with all their original structures and machines retain full engineering integrity. Any level of engineering integrity is uncommon.
>
> *Integrity on an Archaeological Level:* An assemblage of archaeological features and artifacts clearly representing historic operations or occupations, and related timeframes. Most mining resources in South Dakota retain only archaeological integrity but can still be important.

We can expect most mining resources in South Dakota to have been reduced to archaeological features and artifacts. Such resources should in no way be perceived as ineligible for the NRHP because they lack buildings, or as less important than resources with buildings. Resources that retain integrity on an archaeological level can be eligible provided that the features and artifacts clearly represent the design, function, and physical content of the operation. In essence, the features and artifacts should permit the researcher to reconstruct the site and its history in a virtual sense. If the resource was heavily altered or damaged after abandonment, it may have lost its baseline archaeological integrity.

[2] Twitty, 2002:24-25.

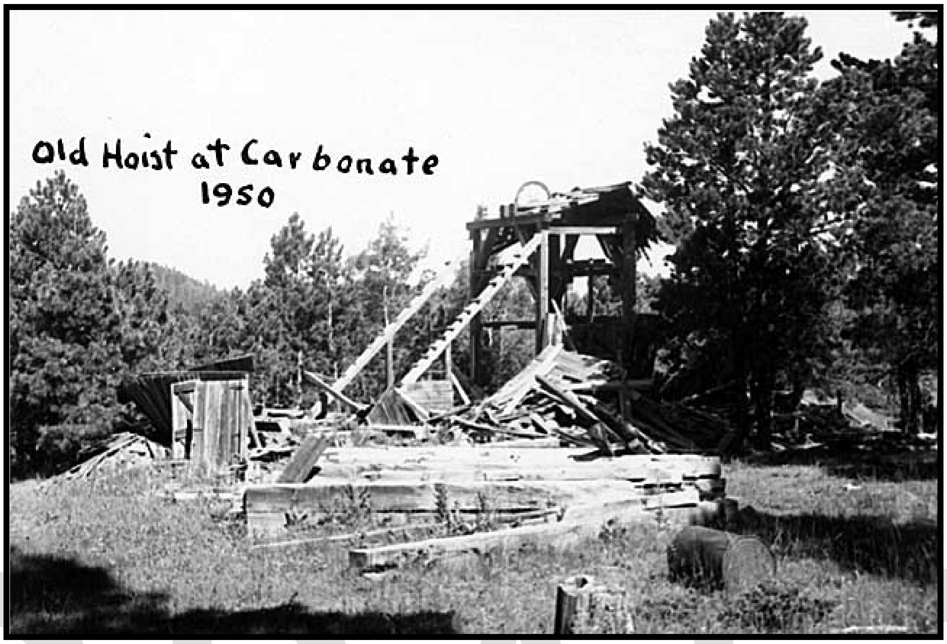

Figure 2.1: The Carbonate Mine, reduced to ruins in this 1950 photo, is an example of a mine site with integrity on archaeological and engineering levels. The headframe is an intact engineered structure, and such resources are rare and important. The collapsed shaft house and other aspects are archaeological features, and they contribute integrity on an archaeological level. Courtesy of the State Archives of South Dakota Historical Society.

Figure 2.2: Mines that suffered catastrophic collapse often lack integrity. Massive collapse often impacts the assemblage of archaeological features necessary for site interpretation. Source: Eric Twitty.

Period of Significance

The timeframe to which a resource's physical remains date is an important consideration for eligibility. Different types of mining resources (discussed in Chapter 3) were important during specific timeframes in South Dakota's history. During other timeframes, they played minor roles in history. Gulch placers are one example. This type of placer mine was an important institution between 1874 and 1880, when the Black Hills were in a frontier state. Gulch placers decreased in importance after 1880 because they were mostly exhausted and other forms of mining took their place. The timeframe when gulch placers were important is that resource type's Period of Significance. To be eligible, a resource should date to the Period of Significance defined for its Property Type in Chapter 3. A resource often can be associated with events, trends, and contributions that were important during its Period of Significance. These are discussed below and with the Property Types.

The concept of physical integrity is relevant to Period of Significance. The physical remains that constitute a resource should date to the Period of Significance. For example, the features representing an existing gulch placer site need to be those created between 1874 and 1880, and not afterward. If the site was worked again at a later time, it no longer dates to the Period of Significance for gulch placers. In essence, the resource's physical remnants must reflect the specific period of time during which the resource was important. In general, sites can be dated by archival research, and an examination of archaeological features and artifacts. It should be noted that if a site falls outside of the Period of Significance for its type, the site may still be eligible. The researcher must explain why.

Applying the NRHP Significance Criteria

For a mining-related resource to be eligible, it must meet one of the Criteria for significance defined by the NRHP. The National Park Service specified four Criteria to recognize the different ways that historic resources are significant in history. To qualify under the Criteria, the resource must be at least 50 years old, which the NRHP officially defines as historic. Criterion Consideration G, explained below, provides an exception for resources less than 50 years of age. The Criteria, as commonly applied to mining resources, are:

> *Criterion A*: The resource must be directly associated with events and trends that made significant contributions to broad patterns of history; or, the resource must be associated with specific events of importance.
>
> *Criterion B*: The resource must be directly associated with the lives of persons significant to our past.
>
> *Criterion C*: The resource must embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or represent a significant and distinguishable entity whose components may lack individual distinction.
>
> *Criterion D*: The resource must possess a likelihood of yielding information important to history.
>
> *Criterion Consideration G:* The resource must have achieved significance within the last 50 years and be exceptionally important.

Physical integrity must be considered when assessing the relevance of the Criteria to a given resource. If the resource is recommended eligible because it is associated with an event or trend in history, then the resource must not have changed substantially from the timeframe when the event or trend occurred. For example, a mill that played an important role in a mining district during the late 1890s must not have been heavily altered afterward (Criterion A). If a resource was associated with an important person, then that resource must be recognizable to that person were they alive today (Criterion B). If a resource is argued to embody the distinctive characteristics of an late 1890s mine, then the resource must retain a majority of features and artifacts that date to the late 1890s (Criterion C). In essence, the resource's physical remnants must reflect the specific period of time during which the resource was important. Integrity on an archaeological level is usually acceptable for the Criteria.

Applying NRHP Criterion A

> *Criterion A*: The resource must be directly associated with events and trends that made significant contributions to broad patterns of history; or the resource must be associated with specific events of importance.

The mining industry in South Dakota was a sum of the people, companies, organizations and places involved with the production of gold, other metals, and coal. As such, the industry can be credited with significant contributions to history on local, statewide, and national levels. A specific resource may be eligible under Criterion A if it directly participated in the events and trends for which the mining industry was important. Some of these trends already have been mentioned in the chapter on mining history. Additional trends that apply broadly are categorized under the Areas of Significance presented below. The resource's role in the industry, and its operating timeframe, must be considered. Some types of resources were more significant than others at different times.

Resources also may be associated with single, pinpoint events in history that were important on county, state, or national levels. Examples include mineral discoveries, technological developments, and labor strikes. A potential for important events should not be overlooked. The cultural resource specialist must conduct archival research beyond the material presented in this context to identify them, as well as other historical associations.

Applying NRHP Criterion B

> *Criterion B*: The resource must be directly associated with the lives of persons significant to our past.

To apply Criterion B, a person of importance must have spent an appreciable amount of time on the site. Further, the resource must retain integrity from when the person was involved with the property. If the resource changed a great degree afterward, then integrity relative to the individual is lost and the resource is no longer eligible under Criterion B. The resource should be recognizable to that person today, were they still living. If the resource was architectural in nature, integrity requires standing buildings. If the resource was a large-scale complex or set of mine workings, then archaeological integrity is sufficient, provided that the resource's design, organization, and setting are clearly discernable.

Examples of direct presence on a site are many. The site may have served as a place of employment or residence for an important person. In some cases, prominent engineers or contractors personally supervised the construction of mills or mine complexes, remaining on site until the work was finished. Hands-on mine managers often kept offices in principal settlements, but lived part-time at their mines and spent enough time there for resources to qualify.

Criterion B excludes absentee involvement with a resource. If an engineer or contractor designed the resource but was not on-site for a sustained amount of time, then their involvement may qualify under Criterion C, below. People of prominence, especially influential capitalists, backed a number of mining companies or owned properties in South Dakota. Financial involvement with or the ownership of a resource, however, is too indirect for Criterion B. The important person must have personally spent time on the site, and many investors were unwilling to endure the austere conditions of the mining industry.

Overall, few resources are expected to be eligible under Criterion B because most either saw changes through subsequent activities or lost their physical integrity due to natural decay. To ensure an objective assessment, thorough research of a resource's history is absolutely necessary. The researcher must provide a brief biography of the important individual and explain how the individual was directly connected with the resource.

Applying NRHP Criterion C

> *Criterion C*: The resource must embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or represent a significant and distinguishable entity whose components lack individual distinction.

Although Criterion C appears to be complex and multifaceted, it emphasizes historic resources as physical entities. For this reason, a resource must retain either archaeological, engineering, or architectural integrity to qualify. Criterion C features three clauses, and they are interpreted below for mining resources.

The first clause refers to the importance of specific types of resources. This clause will probably be the most common application of Criterion C. For a resource to be recommended eligible under Criterion C, it must be a sound physical representation of a specific *type*, or category, of entity. A resource's general function or the nature of activity that occurred on the site usually defines the type, and identification of the type should be as specific as possible. Once the specific type of resource is defined, the resource should be assessed to determine how well it represents that type.

The Property Types outlined in Chapter 3 define the common types of resources associated with the mining industry. Resource types range from individual buildings, to engineered structures, to mine or mill complexes, to mining landscapes. Buildings must embody a time period, a method of construction, or use of indigenous materials. The most common types in settlements include residences, workers' housing, commercial, administrative, and community buildings. The types of buildings at mine and mill complexes are categorized primarily by function. Although the buildings did not possess architectural style, they featured an appearance, materials, construction, and workmanship that was common to mining throughout the American West. To recommend a building under Criterion C, the researcher must define what the dominant architectural form and style is, if any, and how the building conforms. Aspects that the researcher should take into account are: design, large architectural features, rooflines, windows, siding, trim and ornamentation, and overall appearance.

Criterion C can be applied to mine and mill complexes differently from individual buildings. The site is perceived on the scale of the entire complex, and how well that complex represents design, layout, content, and operations. Traditionally, mine and mill sites have been perceived as examples of their resource types only when buildings and engineered structures are present. However, sites consisting only of archaeological features, and no buildings or structures, can also be sound representations of specific resource types. When structures, machinery, and other materials of value were removed from a mine or mill, they often left direct archaeological evidence. In terms of mining resources, all surface manifestations other than buildings, structures, and equipment qualify as archaeological evidence. If this evidence permits the clear reconstruction of the operation and its physical makeup, then the site may represent a specific resource type.

The representation of a resource type alone is, however, insufficient for eligibility under Criterion C. The concept of importance must be considered, as well. When considering a resource's eligibility, the researcher must address several questions: In what ways and areas was the type of resource important? Do the physical remains represent important aspects of engineering, architecture, processes, or materials use? Defining importance can be subjective and includes areas in addition to those just mentioned, and the definition may require creativity on the part of the researcher. The NRHP provides Areas of Significance relevant under Criterion C, and these are outlined in the section below.

In addition to explaining the importance of type, the researcher must acknowledge how the resource relates to its Period of Significance. Specific types of resources were more important during definitive timeframes in South Dakota history than others. The Property Types in Chapter 3 provide the Period of Significance, and the researcher may identify additional timeframes. If a resource's physical remains clearly date to a Period of Significance, the resource is more likely to be eligible because it represents the type at a peak of significance.

Rarity can lend weight to the importance of mining resources. If few physical examples of an important resource type, technology, or practice currently survive, then intact resources may be eligible.

According to Criterion C's second clause, resources may be eligible if they were the works of masters. In the mining industry, engineers, metallurgists, architects, and experienced industry experts qualify as masters. These types of individuals planned, designed, and supervised mining and milling facilities. The Criterion is not restricted to individual buildings and instead applies to all aspects of mine and mill design. Broad-scale design includes planned facilities, the arrangement of mine surface plants and mill complexes, infrastructures, and organized property use. Underground mine workings are another form of structural entity that may be eligible under the Criterion. In general, underground workings usually had infrastructures that coordinated ore production, the movement of workers and materials, ventilation, and drilling. The workings themselves also required planning and surveying relative to the local geological conditions. In large mines, formal designs were necessary to achieve the above, and they were usually carried out by trained mining engineers who may fit the Criterion. Small-scale designs include engineered structures, in-situ machinery, and buildings. To qualify, the engineer, architect, or builder must be identified and biographical information provided.

Criterion C's third clause states that a resource may be eligible if it is a component of an important greater whole whose parts may otherwise lack distinction. The researcher must identify exactly what the greater whole is and justify its importance. A number of possibilities exist in terms of mining resources. One entity is the historic landscape. Some areas possess groups of prospects and mines that, individually, appear unimportant and common. Collectively, however, they form a greater whole that conveys the feeling and perception of the mining that made South Dakota important. Historic districts, and collections of resources with the potential to be designated as such, are another form of an important greater whole. Multiple properties owned or worked by single companies is a third form of a greater whole.

Applying NRHP Criterion D

> *NRHP Criterion D*: The resource must possess a likelihood of yielding information important to history.

Intensive site recordation, such as the Class III standard defined by the Department of the Interior, is intended not only to document the remains of a resource, but also to evaluate whether the resource may address important research questions upon in-depth study. Resources that hold such potential may be eligible for the NRHP under Criterion D. The information may enhance the current understanding of an individual site or may contribute to broader areas of inquiry. To recommend a resource eligible, the potential information source must be discussed in terms of specific areas of study and how it can contribute.

Buried Deposits

Buried deposits hold a high potential to provide information for a variety of studies. Traditionally, areas of inquiry have focused on residential deposits such as privy pits, refuse dumps, cellar pits, and building platforms. Recovered artifacts can answer questions regarding culture, social structure, gender, family, ethnicity, consumerism, diet, health, substance abuse, and other aspects of life in South Dakota's history. Privy pits are valuable because they may offer artifact assemblages not found elsewhere. They provided secluded environments where residents disposed of items under secrecy, and were repositories for organic wastes. Cellar pits have the potential to contain articles kept in storage and not intended to be refuse.

Buried archaeological deposits associated with the mine or mill as a workplace have escaped intensive examination. A variety of buried deposits can be found at mine and mill sites, and they hold the potential to reveal workplace behaviors, materials-use patterns, and aspects of mining or milling operations. Buried deposits often accumulated in crooks in waste rock dumps and in boiler clinker dumps, where workers threw industrial refuse. Workplace privy pits are especially valuable because they can possess personal items representing workers in their environment. As with domestic privy pits, laborers may have disposed of articles under secrecy or accidentally dropped items of value. Buried industrial deposits may also enhance the understanding of sites lacking a definitive assemblage of surface artifacts.

Buried Features

Like buried artifact deposits, buried features also hold the potential to address areas of inquiry. Exhuming foundations, structures, machinery, and components of feature systems may provide information regarding engineering, function, construction methods, and timeframe.

Analysis of Buildings and Engineering Features

Class III recordation and lesser forms of resource inventory are not intended to study complex buildings, structures, and feature systems in detail. Engineering in the mining industry can be better understood by closely documenting such attributes. The information should then be used for interpretation, comparison, and explanation. For example, a detailed plan-view of a hydraulic mine's water system, and an explanation of how the water was used, can enlighten the current understanding of hydraulic mining.

Underground Workings

Underground mine workings are as important a component of a mine or prospect as are the surface features and artifacts. Underground workings are perhaps one of the least understood aspects of mine sites, and few if any formal studies of them have been carried out to date. Hazards, lack of time and funds, and unconventionality conspire to prevent documentation and interpretation. The current familiarity with mine workings came about through historic photographs and texts, and anecdotal information.

In general, miners and engineers followed a few general patterns for driving exploratory passages, developing and extracting ore bodies, and constructing necessary infrastructures. In some cases, mine sites can offer a great potential to provide information for a variety of studies. A mine's underground workings can contain internal structures, features, machinery, and artifacts found nowhere else. As a whole, these resources can contribute greatly to a currently dim understanding of mine engineering, the operations of mines, and the mine as a workplace.

The potential to contribute information is relative to the size of the mine. Because of their simplicity, most shallow prospect shafts and adits would contribute little beyond existing historical descriptions. Deeper mines and prospects, however, may hold some potential, and substantial operations are likely. Deep mines often featured interconnected passages and were active long enough for an accumulation of artifacts. Significant operations also required infrastructures and engineering features to facilitate operations.

Several conditions render studies of underground workings highly impractical and contribute to the demise of features and artifacts. First, flooded workings pose an impediment to access, and the water may have damaged workings, features, and artifacts. Second, iron and wood decays when left in humid environments for long periods of time. When a tunnel or shaft collapses, the workings become sealed and the atmosphere becomes a poor preservation environment. In contrast, if the mine is well-ventilated, the geology porous, and the climate dry, the potential for intact features and artifacts is high. Third, some mines are inherently unsafe to enter. Underground passages often penetrated areas of weakness that miners supported with timbering, which often decayed when a mine was abandoned. Internal shafts and other openings constitute another hazard. Not all underground workings are unstable, but they should be assumed so unless demonstrated otherwise.

Figure 2.3: Underground mine workings, such as this shaft station in the Homestake Mine in 1908, hold a high potential to yield important information. Few if any formal historical studies of underground workings have been completed, and much can be learned in the fields of mining engineering, practices of drilling and blasting, and the underground work environment. Because of this, underground workings may qualify for the NRHP under Criterion D, when preserved and safely accessible. Courtesy of the State Archives of South Dakota Historical Society.

Applying NRHP Criteria Consideration G

> *Criteria Consideration G:* The resource must have achieved significance within the last 50 years and be exceptionally important.

To qualify for Criteria A through D, the NRHP requires a resource to be at least 50 years of age, which is the official definition of the term historic. National Park Service historians, however, acknowledged that some types of resources younger than the 50 year threshold are worthy of listing on the NRHP. They drafted Criteria Consideration G, which provides an exception for those resources that are less than 50 years of age and are of exceptional importance.

The principal stipulation for recommending a mining resource eligible under Criteria Consideration G requires the researcher to clearly demonstrate the site's importance. The researcher should explain the site's history, the significance of the resource type, and why the resource was of exceptional importance. The Homestake Mine at Lead is an example for a number of reasons. In terms of historic associations, the mine was one of the nation's greatest gold producers. The mine was also the nation's deepest, largest, and most complex underground operation.

National Register Areas of Significance

Areas of Significance are categories of broad trends and themes through which resources may relate to history. The National Park Service developed the Areas to help structure formal nominations of all resource types to the NRHP. The Areas can be highly useful for developing statements regarding eligibility in advance of formal nomination. The National Park Service designed the Areas to work with, and clarify how, researchers apply the NRHP Criteria. Although the park service defined thirty Areas, some are more relevant for mining resources than others. Table 2.1 lists the Areas and their compatible NRHP Criteria, and the most applicable Areas are discussed below.

Table 2.1: Areas of Significance and Compatible NRHP Criteria

Area of Significance	Compatible Criteria	Definition
Architecture	Criterion A Criterion C	The practical art of designing and constructing buildings to serve human needs.
Archaeology	Criterion D	The study of historic cultures through excavation and the analysis of physical remains.
Commerce	Criterion A	The business of trading goods, services, and commodities.
Communications	Criterion A	The technology and process of transmitting information.
Community Planning and Development	Criterion A Criterion C	The design or development of the physical structure of communities.
Economics	Criterion A	The study of the production, distribution, and consumption of wealth; the management of monetary and other assets.
Engineering	Criterion A Criterion C	The practical application of scientific principals to design, construct, and operate equipment, machinery, and structures to serve human needs.
Ethnic Heritage	Criterion A	The history of persons having a common ethnic or racial identity.
Exploration/Settlement	Criterion A	The investigation of unknown or little known regions; the establishment and earliest development of new settlements or communities.
Industry	Criterion A Criterion C	The technology and processes of managing materials, labor, and equipment to produce goods and services.
Politics/Government	Criterion A	The enactment and administration of laws by which a nation, State, or other political jurisdiction is governed; activities related to political process.
Social History	Criterion A	The history of society and the lifeways of its social groups.

Area of Significance: Architecture

The *Architecture* Area of Significance is relevant when working with two NRHP Criteria. Criterion A applies to individual and groups of buildings that participated in, or contributed to, the architectural history of South Dakota's mining industry. Criterion C is reserved for resources that physically embody an architectural type, method of construction, or use of materials relevant to timeframe.

Buildings were a cornerstone of the mining industry during its entire history. They served as residences, housed businesses and institutions, made up communities, expressed social status, and allowed mining companies to function. South Dakota's mining districts had their own regional architectural histories, influenced heavily by timeframe, needs, remoteness, and the success of the local industry.

Log cabins and wall tents were usually the first buildings erected in a community, followed by frame construction. Although a few buildings may have featured basic ornamentation, most were vernacular in form and followed no recognized architectural style. As defined here, vernacular refers to buildings erected without professional architects, and according to traditional methods adapted to local conditions and available materials. Mining industry participants typically employed construction principals learned elsewhere and completed functional buildings that met immediate needs within financial constraints. This trend was universal in the Black Hills between 1874 and around 1885, but continued for decades afterward in localized areas.

If a community offered the promise of permanence, residents and business interests erected superior frame and masonry buildings. The newer buildings reflected to some degree national trends in form, architectural style, construction methods, and materials. Although the movement began during the early 1880s, the exact timeframe and rapidity of the transition was community-specific.

Industrial buildings followed an evolution, as well. At first, mining companies used logs and canvas, but employed lumber as soon as available because it allowed larger, formally designed buildings. Although the designs were custom and an industrial version of vernacular, they mirrored mining industry conventions of their era. In a broad sense, companies and engineers adapted practices and general concepts universal in the American West to the conditions of the Black Hills.

Areas of Significance: Commerce and Economics

NRHP Criterion A is compatible with the Areas of *Commerce and Economics*. In terms of Criterion A, mining in South Dakota participated in economic trends ranging in significance from local to national levels. Investment was one trend important on local, statewide, and national levels. Most of the capitalists who invested in the mining industry were of regional importance, many were important on a statewide scale, and some were based outside of South Dakota. The implementation of their investments fostered growth in and around the Black Hills, as well as communication, banking, and the acquisition of supplies and food. As a result, mining investments became part of and contributed to complex regional, statewide, and national commercial and financial systems. Most types of mining resources large enough to require substantial investment can be allied with the trend.

The mining industry contributed to regional, statewide, and national markets. Mining companies diverted money into local economies by paying wages to workers and consultants, and by purchasing small items from sources mostly in the major towns. Substantial companies also acquired large machinery and other industrial goods from manufacturers in Denver and the Midwest. On a cumulative basis, the companies supported local economies and tied them into a larger external system.

The people who made up the mining industry had similar relationships with local and external economic systems. By purchasing food and domestic goods from a variety of sources, they not only supported a complex national food transportation network, but also farming and ranching in South Dakota. Preserved food was shipped from packing companies in the Midwest and on the West Coast, while fresh foods came from South Dakota farms and ranches. Although each individual had a limited impact, the population as a whole contributed to consumer-based commerce.

Some types of historical resources tend to be associated with the above economic and commercial trends more than others. In particular, the companies that ran the substantial mines and mills, and the populations of settlements, had enough buying power for meaningful contributions.

The production of both crude ore and mill concentrates was an important trend within the theme of economics. Those mines and mills that actually yielded ore and concentrates provided direct contributions in two arenas. The profits realized from the productive operations became a direct contribution to the local and statewide economies. The income went to capitalists, workers, and for goods and services. One of those services was ore treatment local to the principal centers of hardrock mining. By paying independent mills for ore concentration, the productive companies fostered a milling industry.

The other arena related to production involves the materials that the mining companies generated. The exact recipients of the gold, silver, lead, and tin sold by the productive companies are difficult to trace. However, these commodities became direct contributions to American manufacturing firms, the United States Mint, and European governments.

The mines and mills that actually produced ore and concentrates are the only resources that can be associated with the above economic contributions. The contributions of those mines and mills that had substantial outputs are stronger than the small operations.

Placer mines, hardrock operations, and mills that produced between 1929 and 1942 contributed to local and statewide economies at a time when it was needed. During this period, South Dakota suffered due to the Great Depression, which was the nation's worst economic disaster. When the Great Depression began in 1929, most mining districts in South Dakota had already declined significantly, but many possessed a few operations that continued to support commerce on reduced levels. The depression temporarily brought mining and its dependent industries to a halt and ruined the local economies. The mining districts and their communities suffered severe poverty through lack of investment, high unemployment, and few sources of income outside of industry. Many people left, but those who remained returned to the old mines, previously thought exhausted, in hopes of finding enough gold for a subsistence-level income. The movement began slowly at first, increased in momentum in 1933 when President Franklin Delano Roosevelt increased the value of gold, and became a substantial revival in 1934 when Roosevelt formalized the increase as the Gold Reserve Act. The mines ranged in scale from small, family placers to deep hardrock operations run by organized companies. Although a shadow of previous decades, the resuscitated mining industry provided jobs and income, stabilized the existing communities, and contributed to local economies at an important time of need.

Area of Significance: Communications

Communications was an important Area of Significance throughout most of the mining industry's history. The initial gold rush fostered the first communication system, which was little more than newspapers, mail, express service, and word-of-mouth. Industry required something better, and as a result, entrepreneurs and the Postal Service established post offices, telegraphs, and later, telephones. These forms of communication contributed to the growth of the mining industry, connected it with the outside world, and improved the quality of life.

Only those resources with communications facilities directly participated in the Area of Significance. NRHP Criterion A is relevant under Communications because the Area of Significance refers primarily to historical patterns and trends. Criterion C may apply to post offices and telegraph or telephone stations.

Area of Significance: Community Planning and Development

Community Planning and Development was an important Area of Significance throughout the Black Hills between 1874 and 1885. During the first five years, the region's general settlement pattern materialized, and because it was mostly a function of exploration and prospecting, the pattern was in flux. The development of a formal mining industry during the latter five years cemented the pattern, which then changed little for around twenty-five years.

Those resources with residences, and especially the settlements, directly participated in community development. The Area of Significance is used with NRHP Criterion A when the trends and historical associations of community development are discussed. Examples include relationships between communities, industry, and ethnic or cultural groups. The regional role of a community is another example. The Area of Significance is used with Criterion C when individual or groups of communities are evaluated for significance as physical entities.

Area of Significance: Engineering

In the field of the mining industry, the *Engineering* Area of Significance refers primarily to designed constructs and systems, and the roles that they played in history. Most mining operations larger in scale than the individual miner with gold pan employed engineering to some degree. The sluices, water systems, and methods typical of company placer mines required engineering. At underground operations, miners employed engineering to organize workings and arrange surface plants. Throughout the history of mining in South Dakota, the engineering was primitive and vernacular at the small operations, but advanced and formal at some of the large mines.

Vernacular engineering refers to structures and systems built by individuals who were not formally trained in design. The individuals adapted familiar design and construction principals to the specific conditions of their mines, available materials or equipment, and the immediate environment. Although functional, vernacular engineered structures and systems tended to be impermanent, inefficient, and small in scale. They were important, however, for several reasons. First, the structures and systems allowed many mining operations to function. Second, the small mines, and their informally engineered surface plants and workings, made up the bulk of South Dakota's mining industry.

At large mines, trained engineers designed structures, systems, and underground workings according to principals established in the greater mining industry. Through planning, efficient workings and surface plants allowed the companies to produce higher tonnages of lower grade ore from deeper workings than was otherwise possible. In so doing, formal engineering prolonged the lives of many mines and their dependent communities.

Mills followed a similar pattern. Vernacular metallurgical engineering adapted known methods for recovering metals to the character of a region's payrock. Such engineering combined available machinery, conventional appliance arrangements, and a custom building. Vernacular engineering was sufficient for simple ore, and important during the first years of the mining industry, but often inadequate for complex payrock. Formally trained metallurgists employed current practices when engineering advanced mills and smelters. Such engineering prolonged the viability of mining in many regions.

The area of engineering is not limited to mines and mills. It also is relevant to the infrastructures that supported the mining industry and its communities. Examples include electrical and water systems, transportation networks, and communication.

The Engineering Area of Significance is relevant with two NRHP Criteria. Criterion A applies to structures and systems that participated in, or contributed to, the development and application of engineering in the mining industry. Criterion A is also relevant for the role a system or structure played in a mining or milling operation, a community, or a region. Criterion C is reserved for resources that physically embody a structure or system type, method of construction, or use of materials relevant to function and timeframe.

Area of Significance: Exploration and Settlement

NRHP Criterion A is relevant to *Exploration and Settlement* because the Area of Significance primarily considers the trends and patterns of the frontier movement. When the Black Hills gold rush began in 1874, the northern plains were a wild region inhabited primarily by homesteaders and Native Americans. When prospectors and miners arrived in significant numbers, they brought the mining frontier to the Black Hills, and to the Rocky Mountains in the west. The region was in a frontier state for approximately ten years, and during this time, the prospectors and miners first established a baseline body of knowledge regarding the geography and natural resources. Through examination, sampling, and claim development, they defined the areas with the highest concentrations of placer deposits and hardrock ore bodies. This information gave guidance to investors willing to risk in capital in the proven areas.

Localized mining industries and its settlement pattern quickly followed. Each industry fostered the growth of settlements, dependent industries, commerce, and infrastructure. The Black Hills were not the only region in the northern plains to feature a mining frontier, and instead it was part of a larger frontier that included Wyoming, Montana, and Colorado. During the late 1870s and early 1880s, the overall frontier movement resulted in the exploration, settlement, and industrialization of the Rocky Mountains and northern plains.

Those mining resources that date between 1874 and 1885 are associated with the frontier and settlement era. This phase was important on local, statewide, and national levels. On a local level, the Black Hills were explored, seized by the United States Government, and settled permanently. Mining fostered the development of the economy, infrastructure, political organization, and agricultural industry. On a statewide level, the frontier movement was important because it contributed to South Dakota's permanent settlement, social geography, the spread of ranching and farming, and possession by the Federal Government. On a broad scale, the Black Hills rush was a national sensation that opened the northern plains.

Area of Significance: Industry

Industry is a complex and multifaceted Area of Significance, and it is among the most relevant for mine and mill sites because of their industrial nature. Although some historical trends and patterns of the mining industry changed over time, a few were in effect as long as the industry was a viable entity. Two NRHP Criteria are relevant when considering mining resources in terms of the area of Industry. Criterion A applies when a resource can be allied with historical trends and patterns of the mining industry. Criterion C is reserved for resources that physically represent specific types of industrial entities.

The initial growth and development of the mining industry was a movement between 1874 and 1880. During this time, prospectors and miners established the basic elements required for mining to assume industrial proportions. At first, prospectors located and then began developing placer deposits and hardrock gold veins. Within a short time, outside investors began to take an interest and organized companies that purchased and then improved the primitive operations. Although most failed, the profitable ventures in turn inspired confidence among other investors, who felt encouraged to do likewise. Their capital, combined with the increasing numbers of people who journeyed to the Black Hills, became a mining industry. Cumulatively, individuals and the companies, regardless of size or productivity, improved the transportation networks, reinforced the extant settlement patterns, contributed to local economies, and established commercial and communications systems.

A true mining industry finally took hold in the Black Hills by 1881. From this point in time until around 1920, the mining industry was a foundation of the Black Hills, as well as one of the most important forces in South Dakota. Mining provided enormous economic contributions, diversified culture and business beyond agriculture, drew subsidiary industries, and helped shape the political landscape. South Dakota also became widely known as a major gold producer. During the period, mining companies contributed to mining engineering and the metallurgy of treating gold ore.

Mining declined significantly after 1920, but revived when President Franklin Delano Roosevelt raised the price of gold in 1933, followed by silver the next year. At the time, South Dakota and especially the Black Hills suffered due to the Great Depression. Unemployment was high, jobs were few, income was irregular at best, and many people faced the threat of having to leave. The mining revival played a crucial role by providing jobs, contributing to the economy, and offering individuals and families a means for subsistence when most needed. The revival lasted until 1942. At this time, the Federal government banned gold mining and World War II siphoned off labor and supplies.

Area of Significance: Social History

The people and companies that constituted the mining industry participated in the development and evolution of regional, statewide, and national social structures. As places of employment and residence, today's mining resources may be associated with this important area. Because trends and patterns make up Social History, NRHP Criterion A is relevant.

One social structure was the development of class. When miners worked the drainages for placer gold during the 1870s, their profits contributed to the initial development of social classes at first in the Black Hills settlements, and later in the surrounding towns. Through profits won from the gravel, some prospectors and placer mine owners began their ascent to upper classes while the laborers, of whom there were many, formed a working class dependent on wages. The development of hardrock mining during the late 1870s and its continuation during the 1880s reinforced the same pattern. As mining perpetuated, two general categories of capitalists acquired the productive properties and profited from the ore. The first and by far largest category consisted of local investors of limited means primarily in Black Hills commercial centers. The second category consisted of wealthy elite based in Rapid City, Sioux Falls, and Midwestern cities. The profits realized from the mines reinforced the fortunes of the elite while contributing heavily to the formation of a middle-class, which ultimately became one of South Dakota's economic and political backbones. Because the mining companies depended on wage laborers, company operations ensured the continuation of a working class.

The very nature of the workforce that made mining possible constituted another form of social structure. Activity among the various prospects, mines, and mills created a pronounced employment market that drew workers from points throughout the Rocky Mountain west and other areas in the nation. Some of those workers were immigrants, mostly from European countries. The cycles of boom and bust inherent to mining required that the workers be mobile, which contrasted sharply with South Dakota's sedentary farming and ranching. Each boom drew laborers from a variety of backgrounds while busts propelled them to other areas and economic sectors in South Dakota and elsewhere in the nation. The result was a mobile, adaptable, and diverse society varied in ethnicity, background, and cultural practices.

As historic resources, many prospect, mine, mill, and settlement sites may be allied with the social systems of class, workforce, and demography. Prospect sites, for example, can be associated with the demography of prospectors. As a group, prospectors tended to belong to lower classes, were highly mobile and independent, and many were foreign-born. They left an imprint on the culture of the American West that persists today. The mine and mill sites are associated with the class system and the demography of the mining industry. The mines and mills were major employers, and their workforces tended to be stratified and staffed by individuals from a variety of backgrounds. The workers had to be mobile and resourceful to cope with the cyclic closures of mines and mills. Capitalists owned the mines and mills, and the profits helped the capitalists to remain in the middle- and upper classes. The settlements tend to be associated with aspects of class and demography, as well. Settlements were stratified, possessed the diverse demography typical of the mining industry, and offered some opportunity for individuals to ascend in status.

The Great Depression, which spanned 1929 to 1942, was an important timeframe in social history. Resource extraction industries across the West, and especially mining, suffered deeply at first. Jobs were few, many individuals and families were forced out of South Dakota, and those who stayed sought income as best they could. Some individuals returned to the old mines in search of gold left by the past operators, and gleaned what they could in hopes of earning a subsistence-level income. By 1934, mining became a cottage industry among small outfits and families, and through their efforts, the industry enjoyed a minor revival. These conditions shaped an entire generation of people, who passed on values such as austerity, financial responsibility, and self-sufficiency. These values are still part of Western culture.

CHAPTER 3

MINING INDUSTRY PROPERTY TYPES AND THEIR ELIGIBILITY GUIDELINES

Introduction and Definitions

The chapter provides descriptions of the historic resources common to mining in South Dakota, and the requirements for assessing their eligibility to the National Register of Historic Places. The text is formatted for both resource experts and researchers knowledgeable about mining history, but not necessarily intimate with the process of evaluating eligibility. The material is designed to support the evaluation process, and it includes terminology and language specific to the National Register of Historic Places (NRHP) program. Other objectives are to guide interpretation of mining resources, standardize cultural resource work, and provide information for historic preservation projects.

The chapter treats each category of historic resource, known as a Property Type, as an independent group. The resources are categorized according to placer mining, hardrock prospecting, hardrock mining, and the beneficiation of ores. Under each Property Type, historic background is provided first to enhance understanding and interpretation. The background discusses terminology, technology, and processes that shaped the resources as they exist today.

Some of the Property Types include subtypes, which are distinguishable variations within the resource categories. The subtypes are described as physical entities, followed by their requirements for eligibility to the NRHP. Physical integrity is the first requirement to be discussed because resources that lack integrity are ineligible. Period of Significance is second and refers to the timeframe during which the subtype was universally important. Resources that date to a Period of Significance are probably associated with historical trends and patterns that were significant during that era. Application of the NRHP Criteria is discussed third and outlines the relevant Areas of Significance as defined by the NRHP. Knowing the Areas of Significance may assist in applying the NRHP Criteria, and the researcher should review Chapter 2.

The end of each Property Type section offers a list of features that are likely to be encountered at historic sites today. The purpose is to help dissect sites into their components, identify and interpret those components, and standardize terminology. Because buildings and structures have been removed from most sites, the list emphasizes archaeological features. The chapter assumes the following definitions for resources and site features.

Definitions for resources and site features

- *Building:* A building was a construct with a roof and one or more walls, and it sheltered activities within an interior space. For a resource to qualify as a building today, most of its walls should stand intact.
- *Building Ruin:* A building qualifies as a ruin if the walls are no longer complete and the roof is gone. A ruin is a type of archaeological feature.
- *Structure:* A structure is a construct built to serve a specific purpose other than shelter. Structures may have been countersunk into the ground as with cisterns; associated with industrial processes; facilitated a flow of materials like ditches; or a component of land improvement such as a retaining wall.
- *Engineered Structure:* An engineered structure was built according to a design or plan, complex in itself, and a component of a larger system. Some engineered structures were beneath the surface such as buried

pipelines and culverts. Underground mine workings are an advanced form of subsurface engineered structures.

- *Structure Ruin:* Structures qualify as ruins when their components are mostly collapsed or missing. Ruins are archaeological features.
- *Archaeological Feature:* Archaeological features are a broad category encompassing most of a site's attributes other than buildings, structures, and objects. The category refers to manifestations above ground, while those below-ground are subsurface features (see below). Archaeological features are distinct physical entities that often possess artifacts with interpretive value. Features commonly represent past buildings, structures, and other intentional constructs through material evidence. Examples include earthen platforms, foundations, ruins, depressions, topographic alterations, and debris. Archaeological features also can be the physical result of organic processes, and may not be the remnants of designed constructs. Placer workings, waste rock dumps, refuse scatters, and mine open-cuts are samples of such features. Collections of artifacts that represent activity areas apart from buildings and structures fall within the general category.
- *Subsurface Archaeological Feature:* This group includes features below ground-surface. Subsurface ruins such as collapsed root cellars, intentionally buried artifact deposits like privy pits, and naturally buried artifact deposits exemplified by refuse dumps qualify.
- *Object:* Objects are individual, small-scale constructs that are easily moved. Some objects were designed for mobility, such as vehicles and portable mining equipment. Others were designed to be stationary, but were either self-contained or functioned independently, like some pieces of machinery. When a component of a system, a machine qualifies as a structural or engineering feature.
- *Artifact:* The category includes all man-made items lying around a site. Most artifacts associated with mining resources can be categorized as structural materials, industrial debris, domestic refuse, or household items. Although artifacts are commonly attributable to archaeological features, they also constitute the physical makeup of buildings and structures. Artifacts are extremely important because they can help interpret the timeframe and function of an individual feature, and as well as the history of an entire site and its people.

Property Type: Placer Mine

The Nature of Placer Deposits

A placer deposit is a formation of soil or stream gravel featuring particles of metal or fragmented ore. Economic deposits offered profitable amounts of the desired metal, and they required processing to separate the metal from the worthless gravel matrix. Although placer deposits occasionally offered silver and tin, gold was the metal of interest in South Dakota, and the placer deposits there were rich enough to incite a number of rushes.

Gold is a relatively soft metal with a low melting temperature, and it oxidizes and forms chemical compounds only under unusual physical circumstances. The metal otherwise remains in its native state, even while disintegrating into smaller particles through physical reduction caused by erosion. Because of these characteristics, gold becomes a lasting constituent in placer deposits, but only after the metal is freed from its hardrock source.

The origins of gold reach back into geologic history. Superheated fluids and gases associated with the uplift of the Black Hills deposited the metal in geological structures known as veins, replacement bodies, and disseminated deposits. Quartz and other minerals within the veins, known as fill, usually carried the gold, and together manifested as hardrock ore. In some cases, the ore also offered silver and industrial metals, usually combined in chemical compounds with other minerals. Such hardrock deposits are described in more detail under the Nature of Hardrock Ore section below.

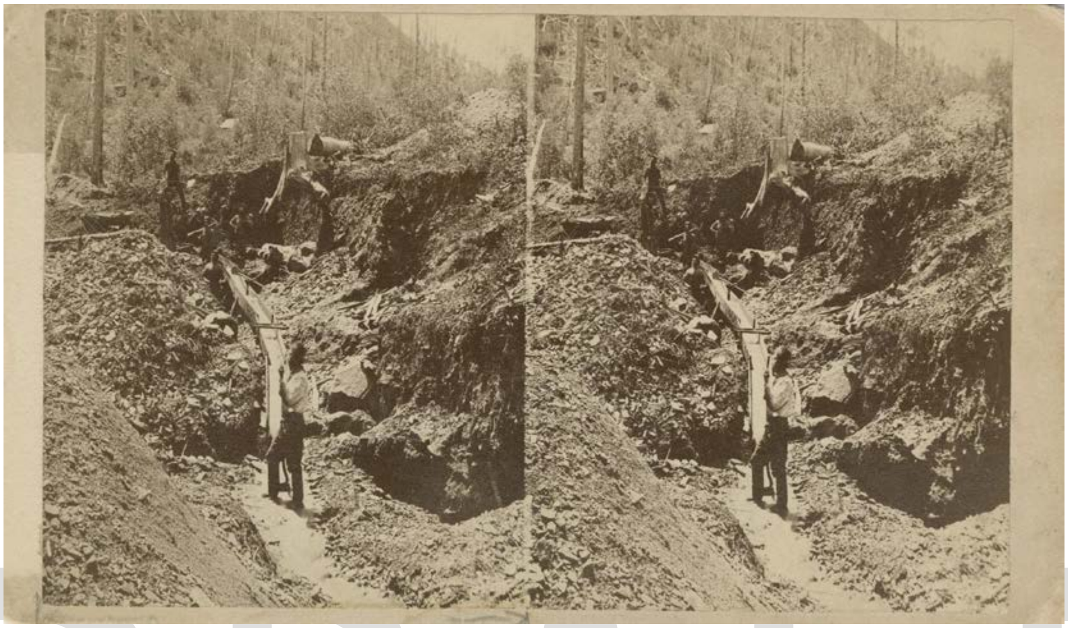

Figure 3.1: Placer mining at Bobcat Gulch near Lead. Courtesy South Dakota State Historical Society.

Over the course of eons, erosion gradually dismantled the Black Hills and the ore veins that cropped out on ground-surface. Most of the minerals and industrial metals suffered reduction and dissolution, were washed into waterways, and decomposed into sediments. Stream action concentrated the sediments on the floors of drainages, and high runoff mobilized the sediments and washed them farther downstream.

Because the gold was soft and inert, however, it remained in its native state while slowly disintegrating into smaller particles. As erosion freed the gold from its parent veins, the particles migrated into nearby drainages and slowly sifted downward into the gravel floors due to their heavy weight. As each high runoff event mobilized and shifted the stream gravel, the gold particles worked their way down toward the bedrock floor where they became concentrated and remained for thousands of years. Over time, water carried the gold from small, steep gulches near the parent veins into streams, then into the broad valleys.

Because erosion was an unending process, fresh gold was constantly freed and introduced in small volumes into the upper strata of a stream's gravel. Thus, prospectors learned to recognize fine gold near the surface of a gravel bed as an indicator of a richer deposit at depth. Usually, they found the profitable material only at depth, and that the surface material was uneconomical to process. Overall, miners termed the overall formation of gold-bearing gravel *placer deposits* and referred to broad areas of such gravel as *placer fields*.

In the Black Hills, miners encountered six principal types of placer deposits. The types are: gulch placers, stream placers, river bar placers, bench gravel, blanket deposits, and valley gravel. The terminology is general to placer mining in the American West, and Black Hills miners may have applied their own colloquial names. Some regions that were rich with placer gold, such as Lead and Deadwood, featured most types simultaneously. In these regions, methods evolved from the romantic individual miners to formally engineered company operations.

Gulch placers or *gulch washings* consisted of rich, gold-bearing gravel lining the floors of minor drainages that were often steep. Because gulch placers lay near a parent vein, offered few places for fine material to settle out, and were subject to high-energy stream flows, the gravel tended to be coarse, the gold particles large and rough, and the gravel beds thin. Easily discovered and worked with relatively little effort, the gulch placers were among the first to be found and yielded handsomely through hand-mining.

Miners recognized the second type of deposit as a *stream or river placer*, and it was created when minor tributaries introduced gold into principal waterways. The gravel was thick in these deposits and required extensive excavation and engineered structures to remove enough overburden to expose the deep gold-bearing layers. Usually, stream placers were the domain of mining companies with capital and substantial workforces.

River bar placers constituted the third type of deposit, and miners worked these extensively during the initial boom period. The deposits were beds of gravel exposed along the sides of principal streams and especially on the insides of meanders. They represented the historical level of a drainage floor, and often consisted of a combination of glacial till and general gravel. Although small mining outfits realized some success with rich bar placers, most required infrastructures to recover gold in economical volumes.

The mining industry recognized the fourth type of deposit as *bench gravel or terrace gravel*, and these formations were high on the sides of the principal river valleys. A combination of glaciation and streams left the gravel in thick formations, and over time, waterways eroded channels through the sediments, leaving gold-bearing gravel benches high and dry. Because the gold was disseminated throughout the gravel, hand-methods were uneconomical. Instead, companies tended to work the beds with engineered sluice and water diversion systems, and hydraulic operations.

The fifth type of placer formation, informally known as a *blanket deposit*, was limited to relatively dry areas that featured gold veins close to ground-surface. Erosion and weathering attacked the veins and freed the gold, but runoff was insufficient to shunt the metal directly into waterways. Thus, the deposit took form as a veneer of gold-bearing soil easily processed by hand. In some cases, miners accidentally unearthed the parent vein when scraping the soil off bedrock.

Deep placers, also known as *valley gravel*, constituted the sixth deposit. These filled the floors of broad drainages and consisted of fine gold mixed with glacial till and gravel, and nuggets concentrated along bedrock by stream action. Valley gravel deposits proved to be the most troublesome for decades. Mining companies assumed that the bedrock floor was lined with gold but had no economical means to remove the 25 to 70 feet of gravel overburden. During the 1900s, two movements began that demonstrated the profitability of the deep gravel. The first was deep pit mining, and the second was dredging, where floating gravel-processing factories recovered fine gold from sediments at all levels and scraped bedrock where possible. Overall, the gulch placers brought miners into the Black Hills, while the thicker deposits became a sustained, economic mainstay.

Prospecting for Placer Gold

Although some of the placer deposits required advanced extraction processes, most types could be discovered by basic prospecting. All a prospector need do was excavate pits in stream gravel and reduce the material in a gold pan. The presence of a few flakes of gold from the upper levels of a gravel bed suggested the potential for more at depth, spurring the prospector to dig deeper pits. By the early 1880s, experienced prospectors understood that the worth of a deposit could only be accurately assessed by testing gravel from near bedrock, which required considerable labor to expose. If the prospector confirmed the presence of gold in economic quantities, he was ready to begin mining.

Placer Mining Methods

Placer deposits stimulated considerable excitement in the Black Hills because they were within practical and economic reach of both individual miners and organized companies. Gulch, stream, and river bar placers could be worked by individual miners with pans and sluices, or by companies with the assistance of infrastructures. Bench and valley placers, however, tended to be the domain of well-organized companies because they required engineering and workforces to process high volumes of material. The company operations were industrial in nature and the most productive in terms of Black Hills placer history, and were far removed from the romantic miner with pan.

When working by hand, individual miners employed pans, cradles, and small sluices to separate gold from gravel. Miners merely excavated pits and trenches into gravel, and when they approached bedrock, shoveled the gold-bearing material into a cradle or sluice. A cradle was a portable wooden box with a rounded bottom, a slanted board featuring riffles, and a long handle. The miner rocked the cradle back and forth while introducing water, which washed off the gravel and left the heavy gold trapped behind the riffles. A sluice was a small, portable wooden flume with riffles nailed to the floor. The miner placed it in a stream and shoveled gravel into the interior, and the flow of water washed the light gravel away. When miners exhausted the gold-bearing gravel in their pits and trenches, they shifted laterally, began new excavations, and filled the old pits with new tailings. Over time, this created hummocky assemblages of tailings piles, pits, trenches, and buried excavations.

Organized mining companies relied on infrastructures to process gravel in high volumes from groups of claims. At small operations, the infrastructures may have been informally engineered by miners on an as-need basis, while the infrastructures were formally engineered by trained experts at large operations. Companies often erected systems of sluices, work stations, water-diversion structures to divert streams from their beds to expose gravel, and ditches and flumes to deliver water to otherwise dry areas. The sluices tended to be lengthy with several branches feeding into a trunk line, or several parallel sluices. Common sluices ranged from 2 feet wide and as deep, to 6 feet wide and 6 feet deep. They featured a relatively gentle gradient to prevent fine gold from being washed through and stood on timber piers supported by footers.

Operating a sluice was relatively simple. One group of workers used pitchforks to screen cobbles and boulders out of the gravel, and then carted the material away in wheelbarrows over plank runways. The workers dumped the coarse material into mounds and windrows away from the sluice. Another group of workers stood alongside the sluice and shoveled the fine sand into the current. After prolonged excavation, the workers reduced the height of the surrounding gravel until the sluice bed manifested as a raised berm.

When the sluice floor became choked with fine sediment, a worker closed the headgate and shut off the water flow so designated officials could recover the gold caught behind the riffles. The officials stepped down into the sluice and, under watch of a guard or superintendent, began removing large gold particles and scraping out gold-laden sand. The particles were collected and weighed while the sand was treated with mercury, which amalgamated with gold dust that was too fine to be easily picked out. After cleanup operations, the sluice was ready for more gravel and a worker opened the headgate, admitting water again.

While hand-methods were highly effective for gulch and blanket placers, the costs of labor were too high and the rate of processing too limited for most bench and deep placers. By nature, these deposits tended to feature fine gold disseminated through broad, deep gravel beds that had to be mobilized and processed in economies of scale for profitability. Such conditions required the investment of considerable capital to build the infrastructures necessary to achieve production in economies of scale, and mining companies carried out several distinct methods.

One of the most popular and earliest was known as *booming or hushing*, and it involved the sudden release of a torrent of water into placer workings from a nearby reservoir. The rush of water mobilized and carried gravel en masses through sluices, where riffles often retaining mercury collected the gold. Companies rarely employed booming alone and used the method to supplement the hand-mining described above.

To facilitate both the consumption of high volumes of water and the processing of large tonnages of gravel, companies formally engineered their infrastructures. Networks of supply ditches pirated water from area streams and directed it to the placer mine and the reservoir, distribution ditches shunted the liquid into the sluices, and boom ditches carried water from the reservoir into the workings. All featured headgates, and the sluice systems were as noted above.

Hydraulic mining, developed in California, was another method for processing thick gravel beds in economies of scale. A monitor, also known as a giant, was the key instrument. A monitor was a large nozzle that emitted a jet of water under pressure so high that miners were unable to pass sledge hammers through it. A worker played the jet against gravel banks, which crumbled and liquefied, and with the help of booming, flowed into sluices. The infrastructure for hydraulic mining was similar to that for booming with additional components for the monitors. To create the necessary pressure, ditches delivered water to a reservoir located far upslope from the mine, and a flume or pipe directed the water into a pressure box. The structure was basically a rectangular tank made of planks retained by stout framing at least 6 feet wide, 6 feet high, and 8 feet long. A penstock, often at least 24 inches in diameter, exited the structure's bottom and descended to the mine, decreasing in diameter incrementally to increase the water current's velocity and pressure. The pipe entered the placer workings and connected to a monitor located on a strategically placed station, which commanded a full view of the gravel banks.

Placer Mine Property Subtypes and Eligibility Guidelines

Placer mines were properties where organizations ranging in scale from individuals to capitalized companies processed stream gravel and soil for particles of gold. It should be noted that a difference exists between *placer mines* and *placer workings*. A placer mine was a specific tract of land, usually defined by claim boundaries, which an individual or company worked for gold. Small mines were little more than pits in stream channels surrounded by tailings piles, and large mines often featured advanced infrastructures. In the Black Hills, individual placer mines often lined miles of streams, one blending into another. Extensive assemblages of claims and excavations constitute placer workings.

When treating placer workings as historic resources, the constituent mines are best recorded on an individual basis. In so doing, it may be possible to determine the specific histories, trends, people, and companies that are important for assessing resource significance. Archival research and the physical examination of extensive workings are usually necessary to identify specific mines. Most workings, however, lack the definitive claim boundaries and landmarks necessary to identify specific mines.

In most cases, the historical category of placer deposit defines the resource types listed below. Gulch, stream, river bar, and blanket placers tend to possess distinguishing characteristics of their property subtype. Valley and bench placers are exceptions, having been worked by hydraulic methods, deep pits, and dredges.

Property Subtype: Gulch Placer

Resource Description: Both organized companies and individual miners created gulch placers when they worked narrow creek drainages for gold. Because gulches tended to be confined and steep, miners had to pile tailings in linear fashion along one or both sides to provide space for excavation and sluices. In many cases, the sluices were small, but some companies arranged lengthy sluices in or adjacent to the gulch floor. The structures were usually temporary and designed to be moved. Some gulch placers also featured earthen dams to divert stream flow, or control its release.

As placer mine resources, gulch placers are among the most common and usually take form as archaeological sites. The placers worked by individuals and small outfits tend to be simple resources. Their feature assemblages are limited primarily to excavations, tailings piles, and small diversion dams. Company operations may include evidence of sluice beds, diversion ditches, retaining walls, and buildings. Usually represented by earthen platforms, the past buildings were either residences or blacksmith shops. Because gulch placers are located in unstable physical environments, most suffered erosion. Tailings piles are often reduced to short linear segments, isolated mounds, and hummocky deposits. As water flows re-deposited the tailings along the gulch floor, the associated stream channel often becomes braided.

Figure 3.2: A party of miners processes gravel in a small sluice near Rockerville in 1889. The operation is typical of gulch placers. The miners use pick and shovel to break up soil on the far side of the sluice, screen out the large cobbles, and heave the earth into the sluice. Courtesy of the State Archives of South Dakota Historical Society.

Resource Eligibility: Gulch placers were important primarily during two Periods of Significance. The first spanned 1874 to 1880, when the Black Hills were in a frontier state and mining evolved into an industry. By 1880, gulch placers decreased in significance because miners exhausted the easily recovered gold. The second Period of Significance spanned 1933 to 1942, when South Dakota suffered during the Great Depression. Individuals without jobs or other sources of income returned to the gulch placers in hopes of recovering enough gold for a subsistence-level income.

To be eligible, a gulch placer must retain sound physical integrity and clearly represent its resource subtype. Because most sites suffered some decay and their structures have been removed, the integrity will probably be archaeological in nature. For a resource to retain a sufficient level of archaeological integrity, the material evidence must clearly represent the excavations, gravel processing methods, engineering features, and structures. Further, the material remains must date to one of the Periods of Significance noted above.

NRHP Criterion A: In addition to possessing integrity, gulch placers must meet at least one of the NRHP Criteria for eligibility. In terms of Criterion A, gulch placers may be associated with important trends and historical patterns. Depending on timeframe, several Areas of Significance may be relevant, and they are outlined in Chapter 2. Sites that date between 1874 and 1880 participated in the Area of *Exploration/Settlement* as physical anchors for the frontier movement. Gulch placers participated in the Areas of

Commerce and Economics by contributing to the development of local economies through their gold production. Within the Area of *Industry*, the sites were pioneering elements and building blocks of the mining industry. Sites that date between 1933 and 1942 may be important under the Areas of Commerce, Economics, and Social History. They were an important source of income for individuals, contributed to local economies when input was dearly needed, and participated in the evolution of culture and social structures during the Great Depression.

A site's timeframe must be established so relevant trends and patterns can be determined. Timeframe is, however, difficult to define for gulch placers because many lack sufficient assemblages of dateable artifacts and were not clearly described in archival sources. Without a firm timeframe, a site cannot be associated with trends and patterns.

NRHP Criterion B: Gulch placers may be eligible under Criterion B when they can be directly tied to an important person. Certain circumstances apply. First, the individual must have directly participated in the mining operation. Second, the site must retain physical integrity relative to that person's timeframe. Integrity on an archaeological level is sufficient if the features and artifacts clearly represent the operation. Few gulch placers will be eligible under Criterion B because it is extremely difficult to attribute a given site to an important person, and most sites lack sufficient integrity.

NRHP Criterion C: Sites may be eligible under Criterion C if they are sound examples of a gulch placer property subtype. The existing remains should date to one of the two Periods of Significance outlined above, when gulch placers were generally important. The archaeological features and artifacts must possess enough integrity to permit the virtual reconstruction of the placer operation. The excavations, tailings piles, work stations, and infrastructure, if any existed, should be discernable. If the site had an infrastructure still in evidence today, the *Engineering* Area of Significance may be applicable.

Gulch placers hold a likelihood of eligibility under Criterion C when they are contributing elements of historic mining landscapes. Even when a site is not completely intact in itself, it may provide enough visual impact to contribute to an area's setting and feeling. The site may also belong to a greater body of resources that, in total, represents an area's history.

NRHP Criterion D: Gulch placers may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. If a site had residential buildings occupied for long periods of time, then testing or excavation may reveal information regarding the demography and lifestyle of early placer miners on South Dakota's mining frontier. If the site had water or sluice systems still evident today, then extensive documentation might contribute to the field of frontier placer engineering. Because most gulch placers were simple and occupied briefly, however, few sites are expected to be eligible under Criterion D.

Property Subtype: Stream Placer

Resource Description: Companies and partnerships created stream placers when they worked streambeds for gold. Streams are small waterways that usually flow all year across broad, gently sloped drainage floors. Stream placers were similar to gulch placers but were better developed, more extensive, and usually featured water and sluice infrastructures. Small operations were simple, shallow, and had infrastructures limited primarily to several ditches that brought water to the workings. Miners dug pits down to bedrock and used any combination of gold pans, cradles, and small sluices to recover gold from the gravel. Today, small stream placers tend to manifest as archaeological sites. Structures such as sluices, retaining walls, and dams were either dismantled or damaged by stream flow and gravel deposition. As a result, excavated areas, tailings piles, ditch segments, and structural remnants such as sluice pilings and collapsed retaining walls usually remain.

Large stream placers, often run by organized companies, featured extensive workings and infrastructures spread over long segments of streambeds. When removing gravel, laborers created trenches, pits, and other large excavations, and erected retaining walls to impound the tailings. If the stream flowed all year, the miners may have piled tailings along the stream banks to maintain the waterway. New channels or flumes redirected streams around the workings, and provided a flow into lengthy sluices below earthen collection dams. By the 1930s, mining outfits frequently used rotating trommel screens to separate cobbles from the gold-bearing fine gravel. Like the small stream placers, the large sites now consist of archaeological features.

Because stream channels are unstable environments, today's stream placer sites can be expected to possess limited physical integrity. The workings may be filled with gravel, the tailings re-deposited, the margins eroded, and structures heavily damaged if not completely gone. Rock retaining walls, log cribbing, and earthen mounds in front of small basins may be left from dams. Below, linear arrangements of rock piles, posts, and gravel beds may represent the sluices.

Figure 3.3: The undated photo illustrates a typical stream placer mine in the Black Hills. Characteristic are piles of tailings, debris, log dams, and the sluices curving through the piles. A diversion flume crosses the foreground and carries water to another mine. Today, such a site may include the tailings, the dams, and archaeological evidence of the structures. Courtesy of the State Archives of South Dakota Historical Society.

Resource Eligibility: Stream placers were important primarily during two Periods of Significance. The first spanned 1874 to 1880, when the Black Hills were in a frontier state and mining evolved into an industry. By 1880, stream placers decreased in significance because miners exhausted the easily recovered gold. The second Period of Significance spanned 1933 to 1942, when South Dakota suffered during the Great Depression. Individuals without jobs or other sources of income returned to stream placers in hopes of recovering enough gold for a subsistence-level income.

As placer mine resources, stream placers are common, and most are in poor states of preservation due to erosion, flooding, and the movement of gravel. To be eligible, a stream placer must retain enough physical integrity to clearly represent its resource subtype. Because most sites suffered decay and their structures are gone, the integrity will probably be on an archaeological level. To retain integrity on an archaeological level, the material evidence must clearly represent the excavations, gravel processing methods, engineering features, and structures. Further, the material remains must date to one of the Periods of Significance noted above. Sites with high archaeological integrity are uncommon and can be important if they clearly exemplify the resource type. Intact structures are rare and may be important representative examples.

NRHP Criterion A: In addition to possessing integrity, stream placers must meet at least one of the NRHP Criteria for eligibility. In terms of *NRHP Criterion A*, stream placers are often associated with important trends and historical patterns. Depending on timeframe, several Areas of Significance may be relevant, and they are outlined in detail in Chapter 2. Sites dating between 1874 and 1880 participated in the Area of *Exploration/Settlement* as physical anchors for the frontier movement. Stream placers participated in the Areas of *Commerce and Economics* by contributing to the development of local economies through their gold production. Within the Area of *Industry*, the sites were pioneering elements and building blocks of the mining industry. Sites that date between 1933 and 1942 may be important under the Areas of Commerce, Economics, and Social History because they were a vital source of income for individuals, and contributed to local economies at a time when any form of input was needed.

A site's timeframe must be established so relevant trends and patterns can be determined. Timeframe is, however, difficult to define for stream placers because many lack sufficient assemblages of dateable artifacts and were not clearly described in archival sources. Without a firm timeframe, a site cannot be associated with trends and patterns.

NRHP Criterion B: Stream placers may be eligible under *NRHP Criterion B* when they can be associated with important people. Certain circumstances apply. First, the important person must have directly participated in the mining operation. Second, the site must retain physical integrity relative to that person's timeframe. Few stream placers will be eligible under Criterion B because it is extremely difficult to attribute a given site to an important person, and most sites lack sufficient integrity.

NRHP Criterion C: Sites may be eligible under Criterion C if they are sound examples of the stream placer property subtype. The existing remains should date to one of the two Periods of Significance outlined above, when stream placers were generally important. The archaeological features and artifacts must possess enough integrity to permit the virtual reconstruction of the placer operation. The excavations, tailings piles, work stations, and infrastructure should be discernable. Intact structures and fully represented infrastructure systems are rare and important examples, and strengthen a site's eligibility. If the site had an infrastructure still in evidence today, the *Engineering* Area of Significance may be applicable.

Stream placers hold a likelihood of eligibility under Criterion C when they are contributing elements of historic mining landscapes. Even when a site is not completely intact in itself, it may offer enough visual presence to contribute to an area's setting and feeling. The site may also belong to a greater body of resources that, in total, represents an area's history.

NRHP Criterion D: Stream placers may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. If a site had residential buildings occupied for long periods of time, then testing or excavation may reveal information regarding the demography and lifestyle of early placer miners on South Dakota's mining frontier. If the site had water or sluice systems still evident today, then extensive documentation might contribute to the field of frontier placer engineering. Because most stream placers were simple and occupied briefly, however, few sites are expected to be eligible under Criterion D.

Property Subtype: River Bar Placer

Resource Description: River bar placers attracted the same spectrum of mining outfits as stream placers, and they employed like methods of development and production. As a result, river bar placers possess characteristics similar to stream placers. The principal difference is that river bar placers tend to be located along the sides of stream drainages instead of directly on the floors.

Placers worked by small outfits usually manifest as excavations, tailings piles, minor gullies, and feed ditches. Large operations include ditch systems, distinct sluice beds, and dams for booming and feeding the sluices.

Resource Eligibility: Because river bar placers were similar in most respects to stream placers, their eligibility requirements are the same.

Property Subtype: Blanket Placer

Resource Description: Blanket placers were among the simplest mines, and they were worked by small outfits by hand, and with little infrastructure. These resources lie on open, gently sloped ground, and feature thin beds of soil over bedrock. Miners usually shoveled the soil into piles and screened out cobbles with pitchforks, rakes, and wire mesh in wooden frames. In some cases, a ditch traversing the highest area provided water for sluices. In those placers lacking water, the miners used portable dry-washing machines to concentrate the gold-bearing gravel with blasts of air. A bellows or hand-cranked blower lifted light soil off the gravel, which the miner carried to a source of water for final separation.

As historic resources, blanket placers are remarkably simple and usually manifest as broad areas with inconsistent soil deposits, numerous excavations, and hummocky ground. The excavations are shallow, and the mounds of backdirt are low, small, and haphazard. Tailings mounds are distinct and consist of well-sorted cobbles that miners raked out of the soil or their sluices.

Resource Eligibility: Blanket placers were important primarily from 1874 to 1880, when the Black Hills were in a frontier state and offered easily recovered surface gold. By 1880, miners exhausted most of the blanket deposits.

Blanket placers are uncommon placer mine resources and have a potential to be fairly well preserved when left undeveloped. To be eligible, a blanket placer must retain sound physical integrity and clearly represent its resource subtype. Because most sites had few if any structures and the equipment was removed when the placer was exhausted, the integrity will probably be on an archaeological level. Integrity requires the material evidence to clearly represent the excavations and gravel processing methods. In many cases, distinct excavations, mounds of backdirt, and the piles of sorted tailings are sufficient. Although a site should date to the Period of Significance noted above, establishing timeframe is difficult because blanket placers offer few artifacts.

NRHP Criterion A: In terms of *NRHP Criterion A*, blanket placers can be associated with the Areas of Significance relevant to the mining frontier. Sites may have participated in the Area of *Exploration/Settlement* as physical anchors for the frontier movement. Blanket placers participated in the Areas of *Commerce and Economics* by contributing to the development of local economies through their gold production. Within the Area of *Industry*, the sites were pioneering elements and building blocks of the mining industry.

A site's timeframe must be established so relevant trends and patterns can be determined. Timeframe is, however, difficult to define for blanket placers because many lack sufficient assemblages of dateable artifacts and were not clearly described in archival sources. Without a firm timeframe, a site cannot be associated with trends and patterns.

NRHP Criterion B: Blanket placers may be eligible under *NRHP Criterion B* when directly associated with important people. Certain circumstances apply. First, the important person must have directly participated in the mining operation. Second, the site must retain physical integrity relative to that person's timeframe. Integrity on an archaeological level is sufficient if the features and artifacts clearly represent the placer operation. Few blanket placers will be eligible under Criterion B because it is extremely difficult to attribute a given site to an important person.

NRHP Criterion C: Sites may be eligible under Criterion C if they are sound examples of the blanket placer property subtype. The existing remains should date to the Period of Significance outlined above, when blanket placers were generally important. The archaeological features and artifacts must possess enough integrity to permit the virtual reconstruction of the placer operation. The excavations, tailings piles, and work stations should be discernable. Remnants of equipment are rare and important, and strengthen a site's eligibility. In such cases, the *Engineering* Area of Significance may be applicable.

Blanket placers hold a likelihood of eligibility under Criterion C when they are contributing elements of historic mining landscapes. Even when a site is not completely intact in itself, it may provide enough visual impact to contribute to the setting and feeling of an area. The site may also belong to a greater body of resources that, in total, represents an area's history.

NRHP Criterion D: Blanket placers may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. Detailed documentation of the excavations, tailings piles, artifact concentrations, and flat areas may reveal patterns of how miners worked blanket placers. Work stations, processing methods, and camp locations might become apparent. Because most blanket placers were simple and haphazard, few sites are expected to be eligible under Criterion D.

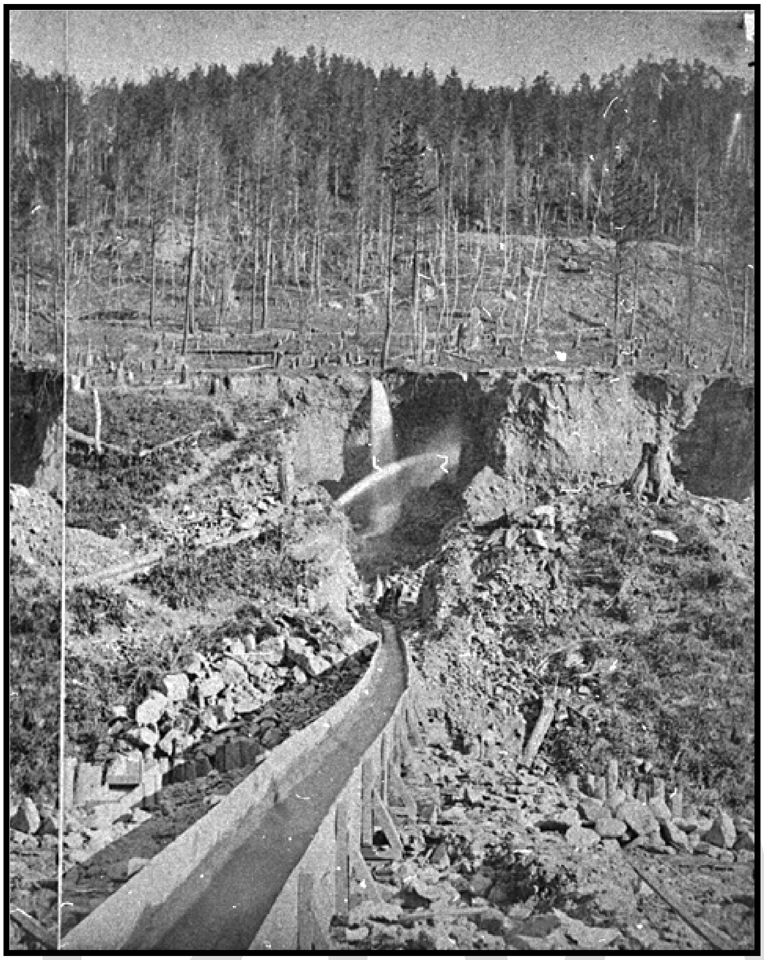

Figure 3.4: Hydraulic mining utilized jets of water to erode thick gravel banks, and ditch flows to wash the material through lengthy sluices. In 1878, this Deadwood mine was a microcosm of hydraulic mining. A monitor emits an arced jet against a precipitous cut-bank of gravel, and a waterfall from a ditch carries the liquefied gravel into the sluice. Courtesy of the State Archives of South Dakota Historical Society.

Figure 3.5: The monitor, also known as a giant, was the key instrument in hydraulic mining. In this undated scene at Rockerville, miners operate the monitor at reduced pressure to scour the ground and wash gravel away. Note how the monitor connects with a feed pipe. Courtesy of the State Archives of South Dakota Historical Society.

Property Subtype: Hydraulic Placer

Resource Description: Hydraulic mining operations used jets of water to liquefy high volumes of gravel and direct the slurry through sluices in economies of scale. Although companies applied the practice to river bar placers, they primarily worked thick bench gravel. Most sites remaining today are complex, landscape in scale, and feature a succession of topographic zones. Broad deposits of braided tailings form the lowest portion of the site, and they transition upward into areas of earthen mounds, abandoned water channels, and tailings piles. These topographic aspects represent the early workings. Deep incisions, gullies, and abrupt, precipitous cut-banks are the highest zone and represent the most recent workings. In this region, workers stacked tailings in windrows, erected retaining walls, created channels, and built earthen dams to direct slurry into sluices.

Hydraulic mining required an extensive infrastructure to deliver water both to the monitors and to wash gravel through sluices. Ditches, pipelines, and flumes often captured water from regional drainages and directed it to a reservoir upslope from the site. Pipelines carried the water from the reservoir dam to pressure boxes, and penstocks descended to monitor stations in the workings. Raised, linear beds supported the pressure boxes and pipelines, and may be evident today. The monitor stations were open, flat, commanded a view of the workings, and tended to feature assemblages of structural artifacts. A separate network of ditches and flumes directed more water through the workings. Some ditches went to satellite reservoirs for booming, and others into the heads of sluices. To support industrial activity, hydraulic mines also included a shop, warming cabin, supports for pipelines, and roads. If the mine was more than one mile from the nearest settlement, the mining company often provided housing for the workers.

When hydraulic mines were abandoned, their equipment and structures were usually removed because they held some value, and the workings were subjected to erosion. The workings tend to manifest today as localized landscapes of eroded channels, braided gravel beds, tailings piles, and barren landforms similar to badlands. Archaeological features and artifacts typically represent the water infrastructure. Flume beds contoured across hillsides, pressure boxes stood on cut-and-fill platforms or foundations' downslope, and raised gravel berms supported pipelines and penstocks. Small reservoirs with earthen dams retained water for booming, and eroded channels carried the water directly into the workings. Archaeological features and localized topography within the workings reflect sluice systems and work areas. Alignments of rocks, log posts, and gravel beds supported the sluices, and elevated platforms may have been work stations. Monitor stations tend to be circular platforms cleared of rocks on prominent points. Cut-and-fill platforms typically supported blacksmith shops, and they feature artifact assemblages of anthracite coal for the forge, as well as forge-cut iron scraps and hardware.

Resource Eligibility: Hydraulic placers were important primarily from 1880 until around 1910. During first half of the 1880s, the initial wave of gold rush participants exhausted the easily recovered placer gold, leaving disseminated deposits that were economical primarily through production in economies of scale. Organized companies then dominated placer mining, and many employed hydraulic methods.

Hydraulic placers are relatively rare resources. To be eligible, a hydraulic placer must retain physical integrity on a broad scale and possess attributes characteristic of its resource subtype. The most important attributes are landscape features typical of hydraulic mining, including gravel outwash fans, incised channels, tailings dumps, and barren landforms with abrupt cut-banks. These workings should be clearly discernable and reflect the mobilization of gravel in massive tonnages in an upward progression. Features representing the infrastructure are important contributing elements of a site and strengthen the case for eligibility. In general, few sites possess intact infrastructure features due to erosion and later mining activity. Aspects of the water system can be found on slopes above the main workings, and evidence of the sluices and workstations lie in the areas of most recent activity. Because infrastructure components suffered decay and the structures were removed, infrastructure integrity will probably be on an archaeological level. Infrastructure aspects retain a sufficient level of archaeological integrity when they can be interpreted and their role in the infrastructure determined.

NRHP Criterion A: In terms of *NRHP Criterion A*, hydraulic mines can be associated with a number of important trends and historical patterns. Several Areas of Significance may be relevant, and they are outlined in detail in Chapter 2. The Area of *Industry* is the most important and fundamental. Companies employed hydraulic practices that were universal throughout the mining West. They imported trained experts, invested heavily in infrastructure and development, and employed large workforces. Such operations quickly replaced the primitive and small outfits, and helped Black Hills placer mining reach industrial proportions. The industry was a significant force that shaped South Dakota and other Areas of Significance noted below.

Most hydraulic mines participated in the Areas of *Commerce and Economics*. The gold output, wages paid to labor, and purchases of supplies contributed to commerce and economies on local and statewide levels. The consumption of goods and supplies also fostered the development of banking and other commercial systems.

Large mines may have participated in the Area of *Community Planning and Development* in several ways. One was by anchoring local settlements through economic support and employment. Another was by housing a workforce on-site in boardinghouses or cabins. Mine-specific residence was an important settlement pattern typical of the mining West. By housing workers on-site, mining companies participated in the widespread but disseminated settlement of entire regions.

Mines that employed large workforces also may have participated in *Social History*. Those workforces were often stratified and contributed to the development of class and the demography of the West.

NRHP Criterion B: Hydraulic mines hold a high potential to be eligible under *NRHP Criterion B* because they were usually designed and supervised by trained mining engineers. The important individual must have spent an appreciable amount of time at the site. If the significance is through the person's presence on-site and their direct participation in operations, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The engineer must be identified, their role in the mine outlined, and a brief biography including their importance outside of the mining operation explained.

NRHP Criterion C: For a hydraulic mine to be eligible under *NRHP Criterion C*, the resource must clearly represent a hydraulic placer mine. Integrity must be at least on a landscape level. Such a level merely requires that the local topographic features clearly reflect hydraulic mining operations. Evidence of water allocation and distribution systems, the sluice systems, and support facilities are important contributing elements and strengthen eligibility because these are rarely preserved. If the infrastructure is still in evidence today, the *Engineering* Area of Significance may be applicable.

Hydraulic placers hold a likelihood of eligibility under Criterion C when they are contributing elements of historic mining landscapes. Even when a site is not completely intact in itself, it may provide enough visual impact to contribute to the setting and feeling of an area. Some sites may be extensive enough to constitute landscapes in themselves.

NRHP Criterion D: Hydraulic mines can offer contributions under *Criterion D*. Studies of the infrastructure features, including water allocation and distribution systems, sluice beds, and work areas may enhance the current understanding of engineering adapted to hydraulic mining. If a site possesses building platforms, then testing and excavation of buried archaeological deposits may reveal information regarding workers' lifestyles and social structures of the workforce, as well as the functions of ancillary buildings.

Features Common to Placer Mine Sites

Boom Dam: A dam intended to impound water for booming operations. Boom dams often featured a spillway or other form of breach that directed water into a boom ditch or drainage.
Boom Ditch: A ditch that directed water from a boom dam directly into placer workings.
Building Platform: A flat area that supported a building.
Building Ruin: The collapsed remains of a building.
Collection Ditch: A ditch that collected runoff from a placer mine for secondary uses or to impound sediment. A collection ditch should be located downstream from a placer mine.
Cut-Bank: The headwall of an excavation.
Dam: A water impoundment structure. Some dams for placer mines were earthen while others consisted of log cribbing filled with earth.
Ditch: An excavation that carried water to or from a placer mine. Ditches often tapped streams in adjacent drainages and featured a gentle gradient.
Flume: A wooden structure that carried water to or from a placer mine, or carried a stream around a placer mine.
Flume Remnant: Structural remnants of a flume can include collapsed sections made of planks, or the footers that the flume stood on. Footers manifest as log pilings, rock alignments, or timbers on the ground.
Headgate: Headgates admitted water into flumes, ditches, and sluices. They had plank walls with removable slats.
Monitor Station: A platform, tongue of earth, or perch where a hydraulic monitor was stationed. Monitor stations were usually circular, cleared of rocks, and had a footing near center for the nozzle. The stations were strategically located amid hydraulic workings.
Penstock: A component of a hydraulic mine, a penstock was a high-pressure pipeline that descended from a pressure box down into the workings, where it connected to monitors. The diameter constricted incrementally to increase the water velocity and pressure.
Penstock Bed: Penstocks rested on linear gravel beds, possibly with stone or timber footers to support the pipe. Gullies may denote the locations of blow-off valves.
Pipeline: Long assemblages of pipes carried water to reservoirs, ditch systems, and placer workings. The pipes were of riveted or welded steel, or wood staves.

Pipeline Bed: A linear bed that carried a pipeline, usually gentle in gradient. Sections may be raised with others cut from hillslopes.
Placer Pit: A circular or ovoid excavation where miners sought deep layers of gravel.
Placer Trench: A linear excavation where miners sought deep layers of gravel.
Placer Tailings: The hallmark of placer mining, tailings usually consist of ovoid or linear piles of gravel and rounded river cobbles.
Pressure Box: A wooden or masonry structure, usually far upslope from a hydraulic mine, that directed water into a penstock. The pressure box's elevation and the penstock's descent provided enough pressure for hydraulic mining. Pressure boxes were rectangular tanks at least 6 feet wide, as high, and 8 feet long.
Pressure Box Platform: Pressure boxes stood on earthen platforms cut out of the ground below a ditch or reservoir. A penstock, or its bed, will descend from the platform, which may feature stone masonry or timber footers.
Refuse Dump: A collection of industrial and structural debris cast-off during mining operations.
Reservoir: A void behind a dam for water storage.
Shop Platform: Most company placer mines had simple blacksmith shops where tools were maintained and hardware manufactured. Shops stood on platforms of earth or tailings, which usually represent the building's footprint. An artifact assemblage of shop refuse including anthracite coal, hardware, and forge-cut iron scraps is a defining characteristic.
Shop Ruin: A collapsed shop building.
Shop Refuse Dump: Blacksmiths threw shop refuse outside their buildings. When work was sustained, the volume of material became high enough to qualify as a dump. The artifact assemblage includes anthracite coal, forge-cut iron scraps, hardware, and forge clinker, a scorious residue generated by burning coal.
Sluice: A sluice was an indispensable structure for placer mining. It was a lengthy wooden flume with plank walls and a floor featuring riffles. A water current carried gravel through the sluice and the riffles caught the gold. Such a function required that the sluice be located on the floor of placer workings. Sluices ranged in size from 2 feet wide and 2 feet deep, to 6 feet wide and as deep. Piles of rocks and timber piers supported sluices.
Sluice Bed: When dismantled, sluices left piers, posts, rock supports, and planks on linear gravel beds.
Supply Ditch: A ditch that delivered water to a placer mine.
Work Station: A platform alongside a sluice where workers supervised operations and maintained the sluice.

Figure 3.6: The infrastructure for hydraulic mines included components outside of and above the placer workings. A pressure box was a rectangular tank that received water from a ditch and diverted it into a pipeline known as a penstock. The pipeline carried the water under pressure down to monitors in the workings. Source: Eric Twitty.

<u>Property Type: Dredge Placer</u>

Valley gravel placers were a source of angst and annoyance in the Black Hills for decades. They offered fine gold throughout, as well as the promise of coarse gold in the lower strata along bedrock. But the fine gold was too disseminated for profitable recovery with conventional placer methods, and the gravel too thick to reach bedrock. Dredging proved to be effective for such deposits in other states, and in 1911, investors instituted the practice in the Black Hills with limited success. By overturning the floors of several valleys for gold, the companies created the dredge placer resource type. Dredge placers are treated differently here from the other types of placer mines because of their large scale, unique distinguishing characteristics, and history or origin.

Dredges were little more than floating gravel-processing factories that recovered fine gold from all strata of valley gravel and scraped bedrock for coarse gold where possible. Most dredges built prior to the 1930s consisted of a wooden hull similar to a barge, with gantries at both ends, and a superstructure at center. The gantry on the bow supported a bucket-line that exhumed the gravel and delivered it to processing machinery in the superstructure. The bucket-line dumped raw gravel into a hopper, and a conveyor lifted the material into a set of cylindrical trommel screens. As the trommels rotated, they ejected oversized cobbles and boulders onto another conveyor known as a tailings stacker. Suspended by the stern gantry, the tailings stacker dumped the waste behind the dredge in a continuous stream. Meanwhile, the fine sediment that sifted through the rotating trommels proceeded directly into sluices, either on pontoons alongside the dredge or in the superstructure. The sluices recovered the gold. A steam engine and locomotive boiler drove the machinery, but by the late 1910s, some dredges were electrified.

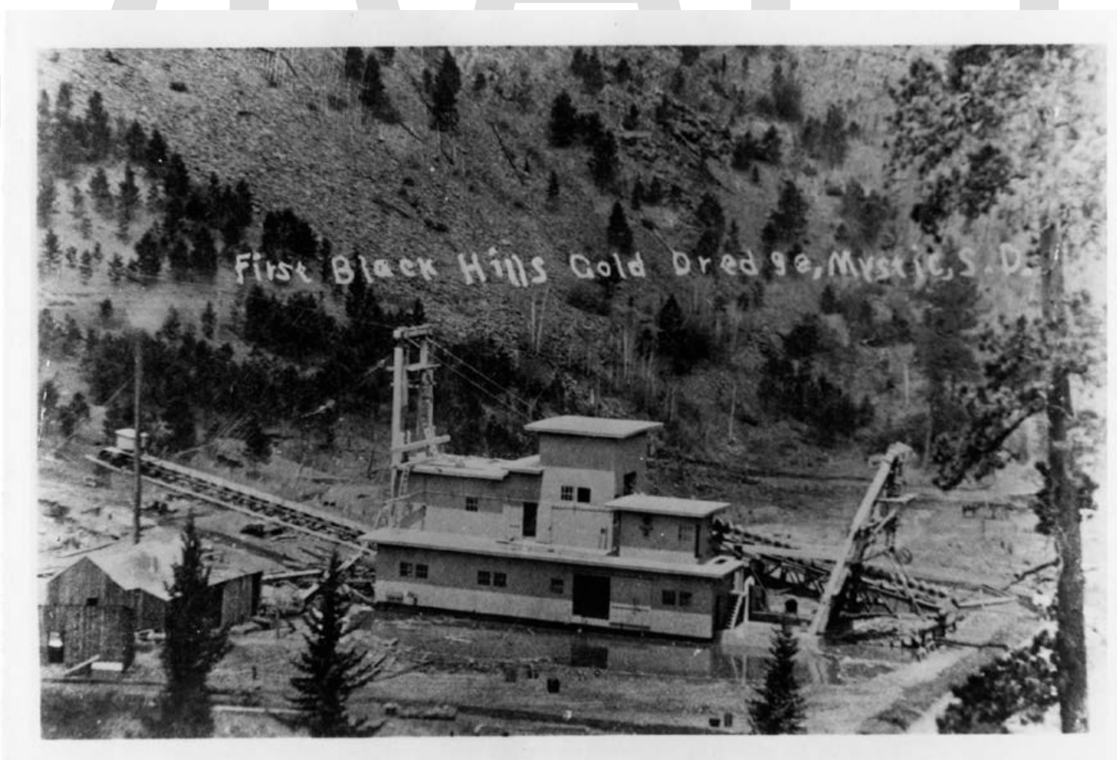

Figure 3.7: Gold Dredge at Mystic. Courtesy South Dakota State Historical Society.

The dredge floated in a pond of its own making, inching its way forward by devouring gravel in front and filling the pond behind with tailings. Unlike traditional boats, dredges had no propulsion. Instead, a worker adjusted mooring cables with steam winches, maneuvering the dredge in gradual arcs to direct the bucket-line into fresh material. To access the deep layers of gravel, another worker controlled the pitch of the bucket-line and attempted to lightly scrape bedrock, where the highest concentrations of gold lay.

A dredge operation was no small undertaking. Besides building the dredge itself, companies spent lofty sums securing water rights and quiltworks of claims. A company also had to provide support facilities to maintain the dredge and house the crew, ranging from four to fifteen workers. If away from an established settlement, the facilities constituted their own small camp, which was portable to follow the dredge. In a machine shop, workers manufactured hardware, repaired broken parts, and maintained equipment and cables. The superintendent conducted business affairs at an office and kept the gold in a safe, and workers lived in a boardinghouse. A metallurgist separated gold from amalgam and fine sediment in an assay shop or retort room. The buildings, almost always of frame construction, were simple, unadorned, and intended to be moved every few months to be near the dredge.

Over the course of months if not years, dredge companies worked valley deposits in linear rows, moving up a drainage until reaching the property boundary, and then reversing course and paralleling the original path. All the while, the dredge continually excavated its own pond and left arced piles of coarse cobbles behind. The company ceased operation either when the dredge exhausted the property, or encountered ground choked with boulders.

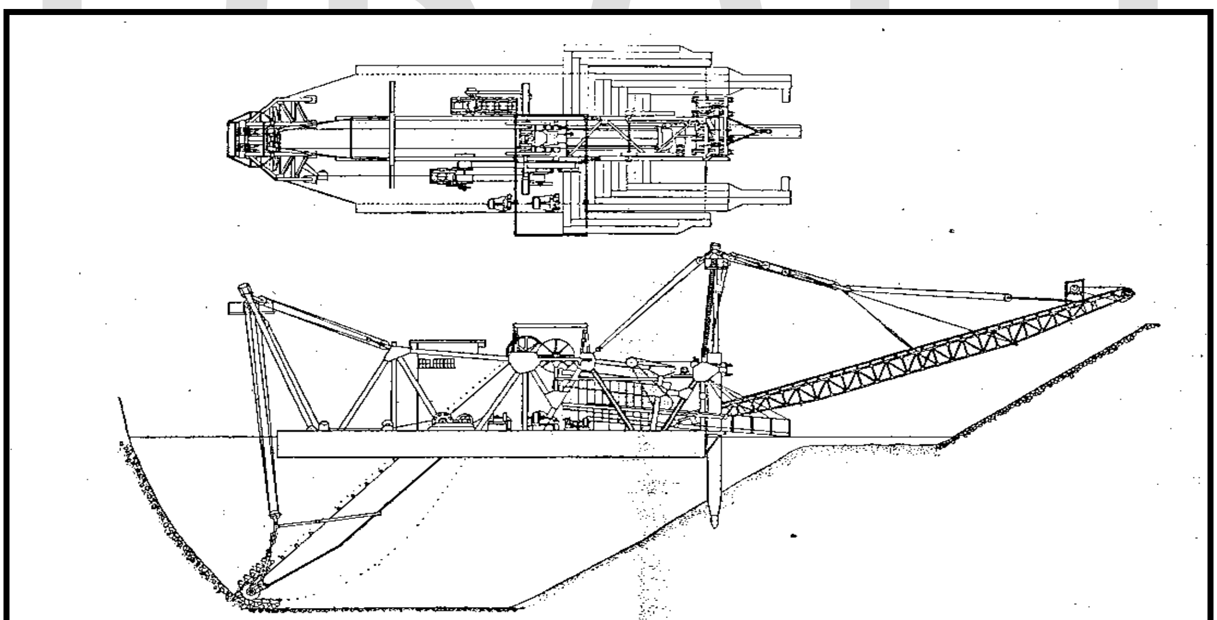

FIGURE 12.—Plan and elevation of electrically driven gold dredge.

Figure 3.8: Dredges were floating factories that scooped gravel from deep river deposits and separated out gold. The profile at bottom illustrates a dredge floating in a pond of its own creation. The bucket-line at lower left excavated gravel and dumped into a screening and sluice system on the hull. The boom at right was a tailings stacker, and it ejected spent gravel behind the dredge. Source: Janin, 1918.

Dredge Placer Property Type and Eligibility Guidelines

Dredge placers are among the most distinct mining resources today. They consist of small-scale feature complexes in larger landscapes created by sustained dredge operations. Dredge ponds, ditch systems, and arced rows of tailings covering sections of valley floors constitute the landscapes. The small feature complexes, left from the support facilities, are usually located on unaltered ground along the edges of the landscapes.

Most complexes are now represented by archaeological features and artifacts. Dredge companies created the archaeological sites when they moved the camp or dismantled the buildings at the end of operations. Foundations and earthen platforms usually reflect the buildings, whose functions can be determined from associated artifact assemblages. High proportions of domestic refuse indicate residential buildings, and shop refuse and industrial hardware define shop facilities. Industrial hardware common to dredge maintenance includes heavy timbers, cables, structural fittings, and canvas drive-belts. Dredge placer complexes possess other features such as privy pits, refuse scatters, and equipment yards.

Figure 3.9: Ponds, windrows of tailings, and abrupt contacts between dredge workings and unaltered ground are characteristic of dredge sites. Dredge hulls such as the one at lower right, at Mystic, can be recorded and assessed as individual sites. When combined with the dredged workings, they constitute important mining landscapes. Courtesy of the State Archives of South Dakota Historical Society.

<u>Resource Eligibility:</u> In the context of South Dakota mining, dredging was of minor importance because its geographic extent, gold output, and timeframe were limited. Dredging was important, however, on a local level between 1913 and around 1920 through contributions to specific areas and communities.

To be eligible, a dredge site must retain physical integrity on a broad scale and possess attributes evocative of its resource subtype. The most important attributes are landscape features typical of dredging, including tailings piles and windrows, ponds, and abrupt contacts between dredged ground and adjoining, unaltered land. Features representing the dredge pond, dredge hull, and camp are important contributing elements of a site and strengthen the case for eligibility. Because most infrastructure components suffered decay and the buildings were removed, integrity will probably be archaeological in nature. Infrastructure aspects retain a sufficient level of archaeological integrity when they can be interpreted and their role in the dredging operation determined.

NRHP Criterion A: Dredge sites are associated with trends and historical patterns important primarily on a local level. Several Areas of Significance may be relevant, and although they are mentioned below, the Areas are explained in more detail in Chapter 2.

The Area of *Industry* is among the most applicable. Dredge operations revived placer mining in a few areas by working deep gravel deposits left fallow in the past as unprofitable. These areas were in decline because the surface placers were exhausted, and conventional methods were inadequate to produce gold from the deep gravel. Dredging was an effective technological solution. The dredge operations became important, if not brief, components of the local mining industries and supported communities in decline.

Dredging participated in the Areas of *Commerce and Economics* through gold output, wages paid to labor, and purchases of supplies. These factors contributed to commerce and the economies local to the dredge operations. Dredging also participated in the Area of *Community Planning and Development*. Through economic contributions and by providing employment, the dredging operations temporarily stabilized some settlements that were otherwise in decline. Those settlements then continued as viable entities, albeit temporarily.

NRHP Criterion B: Dredge sites hold a high potential for eligibility under *Criterion B* because they were usually designed and supervised by trained mining engineers. The individual of note must have played a direct role in the operation and been on-site for a sustained amount of time. If the significance is through the person's presence and their participation, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The person must be identified, their role in the operation outlined, and a brief biography including their importance outside of the dredge operation explained. Usually, important people invested in or owned dredge companies but were based elsewhere. Absentee involvement is too indirect an association.

NRHP Criterion C: For a dredge site to be eligible under *Criterion C*, the resource must possess characteristics clearly attributable to dredging. Substantial portions of the landscape must be intact at the least, and the local topographic features should possess the tailings piles typical of dredging. When present, the dredge pond, the dredge hull, and remnants of the camp are important contributing elements and strengthen arguments in favor of eligibility. Although most dredging operations relied on camps to house workers and support facilities, few dredge sites anywhere in the West today possess clear evidence of their camps. Thus, camp aspects that may remain at a site are particularly important, even when reduced to archaeological features.

The *Engineering* Area of Significance may be applicable to dredge sites under Criterion C in some circumstances. The dredge, or its hull, may represent gold dredge engineering, which was a specialty in the mining industry. Evidence of the water infrastructure may reflect how dredge companies allocated and distributed water for operations. Remnants of walkways, roads, and anchor points for guy cables can portray large-scale patterns of operations planning.

NRHP Criterion D: Dredge sites likely offer contributions under *Criterion D*. Studies of the infrastructure features and dredged ground may enhance the current understanding of engineering and operations. The dredge hull itself, if intact, can provide information about design, equipment, and engineering of dredges. If a dredge site possesses building platforms, then testing and excavation of buried archaeological deposits may reveal information regarding workers' lifestyles and social structures, as well as the functions of ancillary buildings. Little is currently known about the above topics because dredge sites are rare and few formal studies have been completed to date.

Features Common to Dredge Placers

Building Platform: Buildings associated with dredging were usually frame constructs standing on earthen platforms. The platform may outline the building's footprint.
Building Ruin: The collapsed remains of a building.
Cut-Bank: The headwall of an excavation created by dredging. Cut-banks usually outlined the areas worked by dredging.
Dam: A water impoundment structure. Some dams retained dredge ponds, and others collected water for distribution to dredge workings. Dams ranged in construction from earthen berms to log cribbing filled with gravel.
Ditch: An excavation that carried water to or around dredge workings. Ditches often tapped streams in adjacent drainages and featured gentle gradients.
Dredge: A dredge, discussed above, consisted of a hull, a bucket line that scooped gravel, processing equipment, and a bucket line that dumped tailings behind. A frame structure on the deck enclosed the processing machinery and the powerplant.
Dredge Hull: Salvage operations usually removed equipment off dredges, leaving the rectangular hull.
Dredge Hull Remnant: A dredge hull may be partially buried or decayed, leaving framing and partial walls.
Dredge Pond: The pond in which a dredge floated. Dredge ponds are usually surrounded by stacked tailings and may feature a cut-bank where the dredge ceased work.
Dredge Tailings: Dredges left telltale piles of tailings consisting of river cobbles and gravel. The piles may be pyramidal or arced and often lie in series along a drainage floor.
Placer Tailings: The hallmark of placer mining, tailings usually consist of relatively low piles of gravel and rounded river cobbles. General placer tailings can be expected in the same areas where dredges operated.
Refuse Dump: A collection of industrial and structural debris cast-off during operations.
Reservoir: A void behind a dam for water storage.
Shop Platform: Dredging operations depended on shops for the maintenance of equipment and manufacture of hardware. Because of the advanced nature of the equipment, the shops had blacksmithing, machining, and carpentry capabilities. The shop buildings usually stood on earthen platforms amid the dredge camp. Artifact assemblages including cables, blacksmith refuse, hardware, and anthracite coal are distinguishing characteristics.
Shop Ruin: A collapsed shop.
Shop Refuse Dump: Shop work usually generated high volumes of refuse thrown outside the shop building. The deposits include refuse such as anthracite coal, forge-cut iron scraps, hardware, cables, and forge clinker, which is a scorious residue generated by burning coal.
Supply Ditch: A ditch that delivered water to a dredge operation.

Property Type: Hardrock Prospect

The Nature of Hardrock Ore Deposits

Placer gold was of supreme importance to the Black Hills because it initially drew prospectors and miners. But it was hardrock ore that kept them in the region. In general, economic minerals and metals found in the dense, metamorphic and igneous rock formations of the Black Hills constituted hardrock ore. The principal precious and semi-precious metals were gold and silver, and the principal industrial metals were copper, lead, and tin. Outside of the Black Hills, uranium drew interest but saw only limited production.

The nature of the ore formations and their geographic locations influenced how companies mined them. The ore formations were functions of the events that built the Black Hills. During the formative period, plastic bodies of magma slowly intruded the basement rocks deep under the surface and exerted great pressure. As these bodies made their way upward, pockets of liquid rock and superheated fluids and gases attempted to escape through paths of least resistance. Faults and fissures provided these paths, and they ranged from microscopic to several feet in width and tended to be oriented vertically. As the gases and fluids lost pressure and heat during ascent, insoluble minerals first precipitated out on the fault walls, followed by soluble minerals with low melting points. The result was irregular and mineralized bands or seams encased in surrounding rock. As elsewhere in the West, the mining industry recognized the formations as *veins*.

The presence of ore in a vein was not guaranteed, and instead a rare phenomenon. Although veins featured interesting minerals characteristic of geothermal activity, most were actually barren of metals. In rare cases, the fluids and gases deposited metals such as gold and silver in pockets and stringers within the mineralized bands, and these were the formations sought by prospectors. When veins offered ore, the metals were often disseminated in concentrations that were barely economical to mine. Although such low-grade ore was unexciting, it was the foundation of the hardrock mining industry because it was the most common type of payrock. On occasion, veins featured rich pockets or stringers of ore, and while often limited in volume, these bonanza formations were the hope of every mining outfit.

Prospecting for Hardrock Ore

Finding an ore formation was the first step in hardrock mining, and this was the task of the prospector. Popular history suggests that individuals or pairs of prospectors found rich gold and silver veins by simply excavating pits with pick and shovel, or by wandering the countryside until they encountered rich outcrops in bedrock. In actuality, successful prospecting involved a basic knowledge of mineralogy and geology, hard work, patience, and strategy and planning. Prospectors also rarely worked alone because parties ensured safety and security, increased the likelihood of finding ore through group efforts, and hastened examination and sampling.

The prospecting process often began with a cursory survey of an area for geological and topographical features suggestive of ore bodies. Prospectors examined bedrock for seams, joints, quartz veins, dykes, unusual mineral formations, and minerals rich with iron. In regions where vegetation and soil concealed bedrock, prospectors also scanned the landscape for anomalous features such as water seeps, abrupt changes in vegetation and topography, and changes in soil.[1]

If an area offered some of these characteristics, the party of prospectors may have shifted to more intensive examination methods. One of the oldest and simplest sampling strategies, employed for locating gold veins, began by testing stream gravel for gold eroded off a parent vein. By periodically panning samples, a party could track the gold upstream, and when members encountered the precious metal no more, they knew they were near the point of entry. The party then turned toward one of the stream banks and began excavating test pits and panning the soil immediately overlying bedrock in hopes of finding a continuation of the gold. They tested soil samples horizontally back and forth across the hillslope to define the lateral boundaries of the gold flecks, then moved a short distance upslope and repeated the process. Theoretically, each successive row of pits should have been shorter than the previous one, since erosion tended to distribute gold in a fan radiating from its point source. By excavating several rows of pits, the prospectors were able to triangulate the fan's upslope apex where, they hoped, the vein lay. Employing such a sampling strategy occasionally paid off, but the party undertook considerable work in the form of digging multiple pits with pick and shovel, hauling soil samples to a body of water, and panning in cold streams.[2]

One of the greatest drawbacks to systematic panning was that it detected only gold, while some areas in the Black Hills also offered the other minerals noted above. To find minerals in addition to gold, prospectors scanned the stream gravel and other areas of exposed soil for what they termed *float*, or isolated fragments of ore-bearing rock. As with free-gold, natural weathering fractured ore bodies and distributed the pieces downslope, often in the shape of a fan. If the prospectors encountered ore specimens, they walked transects to define the boundaries of the scatter, narrowing the search to the most likely area. Applying the same methods used to locate gold veins, prospectors excavated groups or rows of pits and traced ore samples until they could project where the vein supposedly lay. With high hopes, the prospectors sank several prospect pits down to bedrock and chipped away to expose fresh minerals.[3]

If the exposed bedrock suggested the presence of an ore body, the party of prospectors may have elected to drive either a small shaft or an adit (small tunnel) with the intent of sampling the mineral deposit at depth and confirm its continuation. After clearing away as much fractured, loose bedrock as possible, a pair of prospectors began boring blast-holes with a hammer and drill-steels. They often bored between 12 and 18 holes, 18 to 24 inches deep, in a pattern designed to maximize the force of the explosive charges they loaded. Prior to the 1880s, prospecting parties usually used blasting powder, and by the 1890s, most converted to stronger but more expensive dynamite. Until economic ore had been proven, the operation was classified as a *prospect adit* or *prospect shaft*.

Deep Prospect Operations

In terms of mining resources, prospects are manifestations of an effort to locate economic ore. Prospects ranged in scale from shallow pits as noted above to extensive underground operations. In general, a lack of significant production serves as a unifying definition for prospects, although some may have yielded small volumes of ore. An operation became a mine

[1] Bramble, 1980:11-13; Peele, 1918:381-385; Young, 1946:19-26.
[2] Ibid.
[3] Ibid.

only when an outfit began actual production in meaningful tonnages. The absence of ore storage facilities, minimal property development, and the investment of little capital are hallmarks of prospect operations.

When a prospect outfit explored the subsurface geology for ore, they either drove a horizontal *adit* (small tunnel), or sank a vertical or inclined *shaft* to intersect the mineral formation of interest (see Feature Descriptions for definitions). Prospectors chose adits and shafts for specific reasons. An adit was the easiest and least costly passage, but often had to penetrate barren rock to reach the mineral formation. A shaft was more work and required time, but could be kept within the confines of a mining claim and allowed the prospector to closely track the formation, which was usually almost vertical.

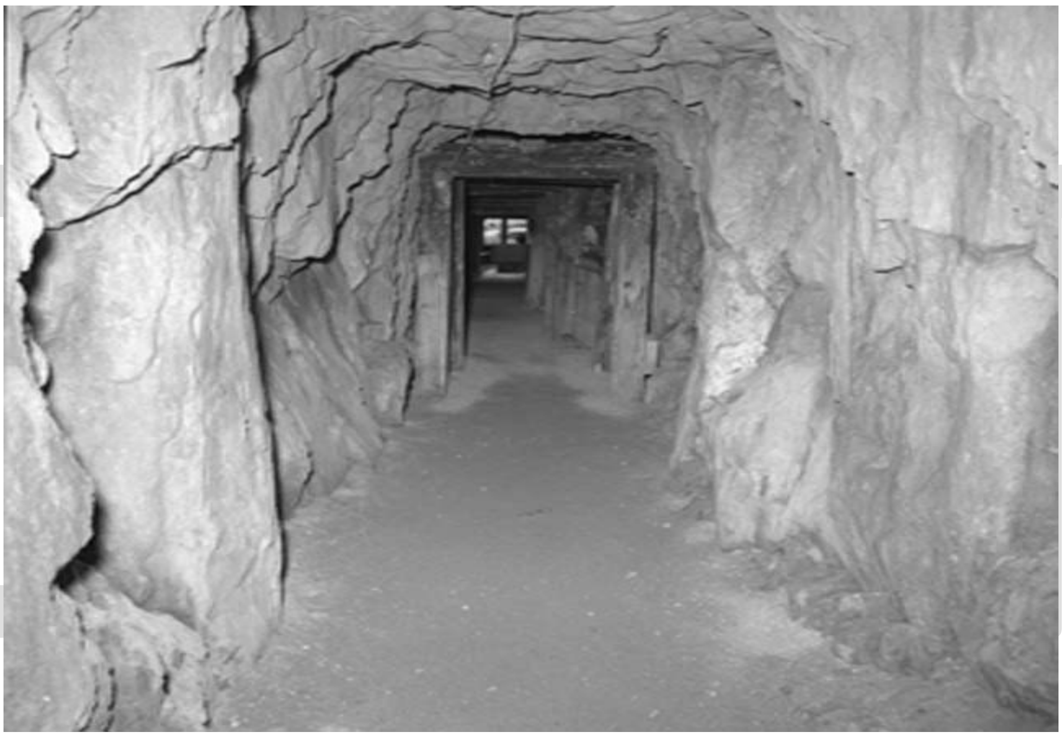

Figure 3.10: Keystone Mine Entrance. Courtesy South Dakota State Historical Society.

Once an adit or shaft reached the formation, the prospectors drove short passages to examine the formation at some depth, sample the content for ore, and determine the orientation and direction. To do so, the prospectors used drill-steels to bore blast-holes, inserted explosive charges into the holes, and set the round off. When driving an adit, they shoveled the resultant fractured rock into either a wheelbarrow or an ore car on a rail line, pushed it out of the workings, and dumped the rock at the adit's mouth. Over time, the buildup of the unwanted material formed a *waste rock dump*. When sinking a shaft, the prospectors shoveled waste rock into an ore bucket, raised it out of the workings, and dumped the material around the shaft collar. As the prospectors pursued various leads and mineral formations, they extended the underground passages horizontally and vertically, requiring a simple underground infrastructure.

The activity underground required the support of facilities on the surface, and these facilities, however simple, constituted a *surface plant*. Most prospects tended to be simple, shallow, and therefore lacked machinery or complex structures. Deep prospects, however, required formally engineered surface plants. At a minimum, the surface plants usually included a shop, a transportation system, the shaft or adit, and a waste rock dump of some volume.

The shop was vital facility. When working in rock, prospectors dulled drill-steels and picks, which required sharpening on-site. To accomplish this, outfits usually equipped their shops with a forge, a workbench, hand-tools, and possibly a hand-powered appliance such as a drill press. Shop buildings tended to be of frame or log construction, less than 15 by 20 feet in area, and near the mine opening to minimize the handling of heavy materials. Where the workings were shallow, prospectors occasionally erected forges in the open.

Transportation systems permitted prospectors to move waste rock out of and supplies into the underground workings. Prospectors used wheelbarrows in shallow adits and ore cars in longer passages. The rail lines for ore cars were relatively simple, exiting the adit and terminating on the waste rock dump. Usually, deep shafts also featured mine rail lines on the surface so prospectors could send waste to the dump.

All shafts had a hoisting system so waste rock could be raised out of the workings and onto the surface. Manual hoists were sufficient for shallow shafts, but work at depth required mechanization, engineering, and planning. The hand windlass was the most primitive hoist and had a depth capacity of around 100 feet. A windlass consisted of a frame around the shaft collar and two vertical posts usually four feet high that braced a spool. To operate a windlass, a prospector turned a crank handle that wound the spool, and when the ore bucket reached the surface, he wrestled it to the shaft collar and dumped it. Because windlasses were small and portable, prospectors usually removed them when they abandoned a shaft, leaving little evidence.[4]

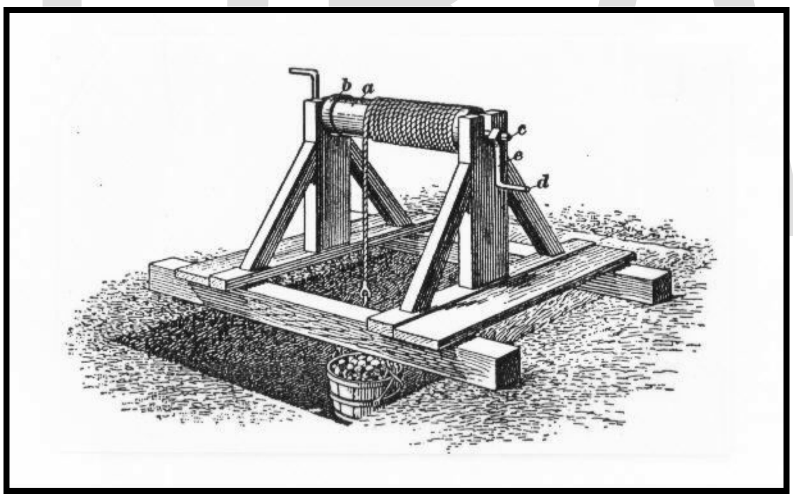

Figure 3.11: The windlass was an institution among prospectors, and nearly all shafts less than 100 feet deep were equipped with this simple, inexpensive, and portable type of hoist. Source: Twitty, 2002:145.

[4] Twitty, 2002:145.

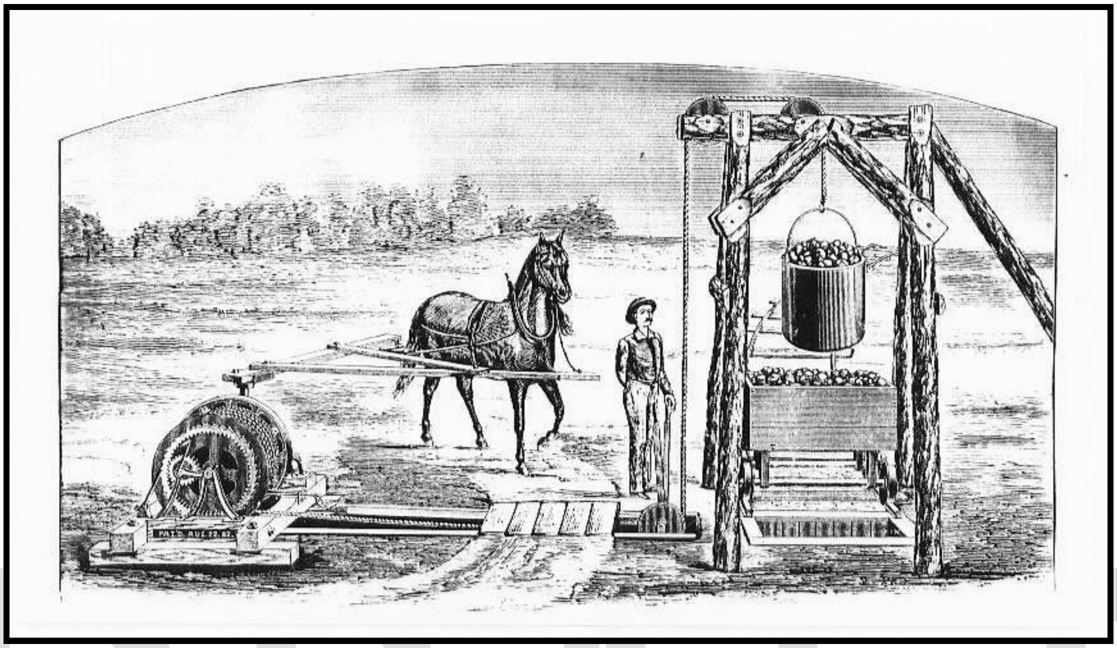

Figure 3.12: Horse whims were the most primitive type of mechanical hoist, and because of their simplicity and portability, they were a favorite among prospectors. The unit shown is a geared whim, which was popular from the 1880s through the 1910s. The hoist operator controlled a brake and clutch via levers mounted to the shaft collar. The control linkages and hoist cable passed through the trench. Source: Ingersoll Rock Drill Company, 1887:60.

When the depth of the shaft exceeded 120 feet, prospectors turned to mechanical hoists. Outfits working in remote locations often selected a *horse whim*, which was powered by a draft animal. Two types of whims were popular during different eras. The first, generally used into the 1880s, consisted of a horizontally oriented cable reel turned by a draft animal on a circular track around the apparatus. A cable passed from the reel through a shallow trench to a headframe standing over the shaft. At the headframe, the cable passed through a pulley at the base and over a second pulley at the top, then down the shaft. Brake and clutch levers were on the headframe so the operator could observe the ore bucket, and solid linkages extended through the trench to the whim. The headframe stood on timber footers, and it facilitated emptying the ore bucket into an ore car. By the 1880s, prospectors adopted the factory-made *geared whim*, which consisted of a vertical cable drum geared to a capstan. A draft animal, tethered to a harness beam bolted to the capstan, walked a track around the whim to wind the cable.[5]

[5] Twitty, 2002:159-162.

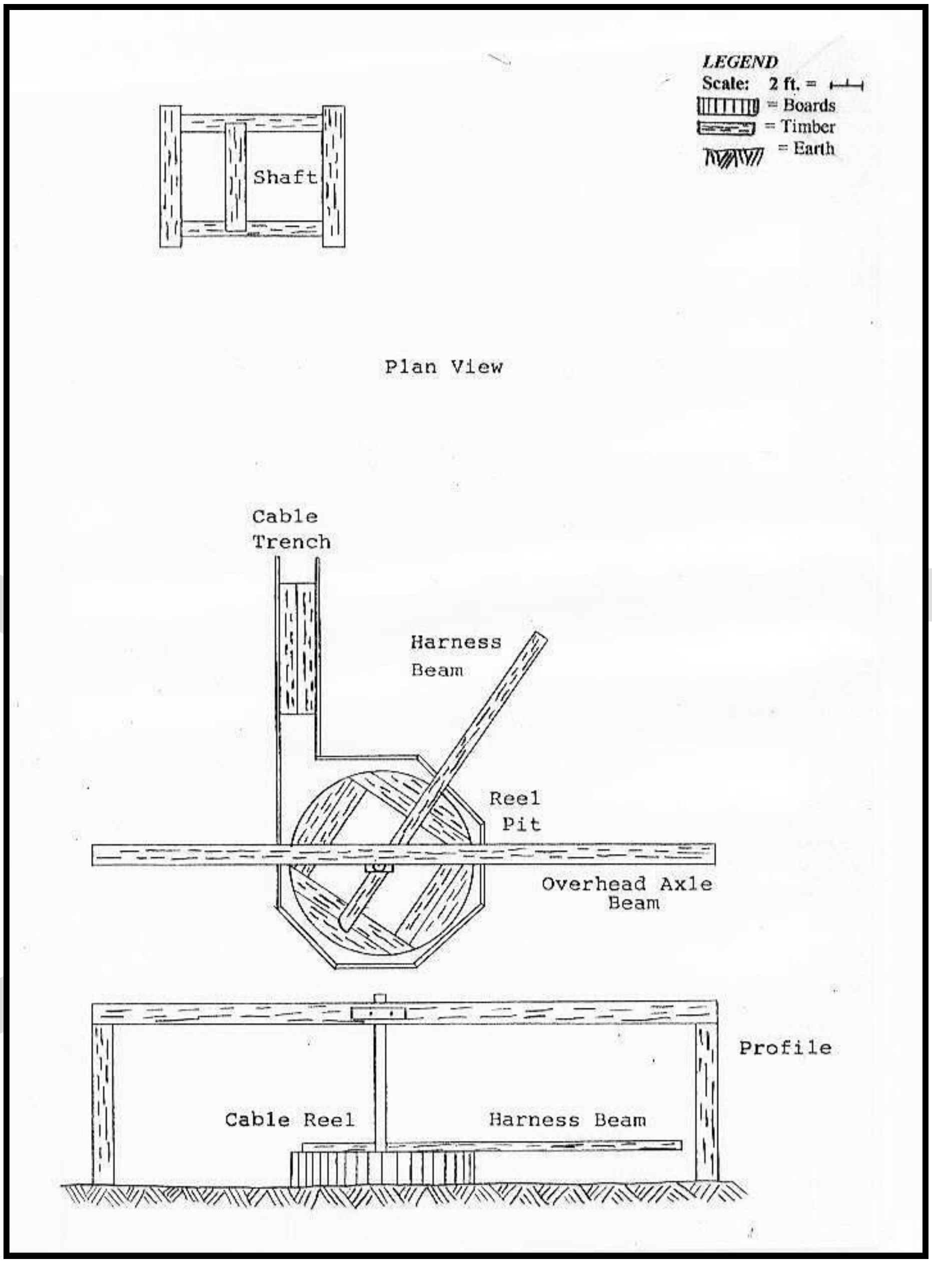

Figure 3.13: The plan view, top, and elevation, bottom, depict a horizontal reel horse whim, which was a universal prospecting hoist prior to the 1880s. The reel was mounted to an axle on a timber footer buried in the floor of a plank-lined pit. Usually, only the pit and cable trench remain at prospect shaft sites today. Source: Twitty: 2002:158.

Horse whims were slow, cumbersome, and had depth capacities of around 300 feet. Those prospect outfits wishing to work at greater depth had to install a power hoisting system to overcome such limitations. Such systems consisted of a hoist, a power source, a headframe, a hoisting vehicle, and a rail line to shuttle rock away from the shaft. Prior to 1910, steam was the common motive source, and afterward gasoline and electric hoists became popular. In general, mining engineers considered hoists less than 5 by 6 feet in footprint, and most gasoline models, to be for deep prospecting. It should be noted, however, that poorly financed operations frequently used substandard hoists for minor ore production. All steam hoists required a boiler, and prospect outfits favored portable units because of their low cost, ease of transport, and simplicity. For a detailed description of the various types of hoists, headframes, and boilers employed by prospect outfits, see the list of Feature Types below.[6]

When sinking a shaft, prospectors chose one of three general configurations according to purpose and hoisting system. Shafts 4 by 6 feet in-the-clear, the interior dimension, were typically shallow and equipped with hand windlasses. The small shafts were exclusively for probing mineral formations and took less time to sink. Usually, prospectors sank rectangular shafts commonly 4 by 8 feet in-the-clear to provide adequate space for production, should they strike ore. At deep prospects, the shafts were often divided into two *compartments*. The *hoisting compartment* was the larger and accommodated the hoisting vehicle, and the *utility compartment* or *manway* was the smaller and featured ladders.

Installation of a mechanical hoist required basic engineering within the ability of experienced prospectors. To ensure an orderly and functioning system, outfits arranged the system components according to a datum line oriented 90 degrees to the shaft. The headframe stood over the shaft on timber footers equal in length to the structure's height. The hoist was usually located twice as far away, and whims had enough space for the animal track, usually 20 feet in diameter. For detailed descriptions of hoisting system components and characteristic archaeological evidence, see the Feature Types listed below.[7]

Prospect outfits erected buildings to shelter vital surface plant components, but invested as little time and capital as possible. At small sites where most of the work was seasonal and on the surface, the outfits often provided no formal buildings and instead covered their blacksmith shops with tarps or wall tents. When an outfit expected the work to last more than a few months, it erected fully enclosed buildings that were crude, inexpensive, and easily constructed. At prospect adits, *tunnel houses* enclosed the adit portal, the shop, and a work area where prospectors dressed timbers for underground support. Tunnel houses were usually less than 20 by 30 feet in area and permitted the prospect outfit to function in all weather. Today, they may be identified by platforms, foundations, footprints, and structural debris. At prospect shafts, *hoist houses* enclosed the hoisting system and usually the shop. In some cases, well-capitalized outfits erected *shaft houses* that also enclosed the shaft collar and a work area. Evidence for these two types of structures is similar to that for tunnel houses.

In sum, prospect outfits constructed simple and compact surface plants that were equipped with portable and inexpensive components. Although most prospects lacked machinery and were labor-intensive, deep operations featured some power appliances. Buildings, machinery, and other facilities usually shared the same orientation as the shaft or adit and were clustered together around the opening. Because equipment for deep prospecting was intended to be portable, items were usually removed when the site was abandoned, and archaeological evidence usually remains today. Whims left depressions and trenches, power hoists left foundations, and headframes can be represented by timber footers or impressions left by the footers.

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[6] Twitty, 2002:175, 320.

[7] Twitty, 2002:160.

Hardrock Prospect Property Subtypes and Eligibility Guidelines

Property Subtype: Prospect Complex

Resource Description: When prospectors attempted to locate mineral formations underlying the soil, they often excavated groups of pits and trenches to expose bedrock. If the prospectors uncovered a promising lead, they drove short adits and shafts to explore and sample the formation at depth. Collectively, a group of pits, trenches, adits, and shafts can be termed a prospect complex. Pits and trenches will be surfacial, shafts and adits should be shallow, and the sum represents mineral sampling and a search for ore. It should be noted, however, that some prospectors drove shallow adits and shafts merely to fulfill assessment obligations to retain title to their mining claims. Experienced prospectors often followed an organized, strategic pattern when excavating their workings, which may become apparent when the features of a prospect complex are mapped.

If a prospector invested an appreciable amount of time in a complex, he usually constructed a few infrastructure components to support his work. One of the most common was a field forge where the prospector maintained his tools and fabricated basic hardware. Field forges were usually made with dry-laid rock masonry or small logs. Some were in the open, and many were sheltered in wall tents or tarps. Shafts required a hoist, and prospectors favored hand windlasses for their portability and low cost. Adits required wheelbarrows or ore cars to haul rock out. Because prospectors usually removed their equipment when they abandoned a site, archaeological features and excavations tend to represent prospect complexes today.

Resource Eligibility: Prospect complexes were important during several Periods of Significance that differ by region. As manifestations of the frontier prospecting movement, the complexes were important on a statewide level from 1874 to 1885. During this time, prospectors defined the extent and distribution of the state's hardrock ore veins, and the results became the foundation for the state's principal mining industry and associated settlement pattern. Afterward, prospecting contracted in importance to local areas, each with its own Period of Significance defined as the first several years of activity. Continued ore discoveries allowed the mining industry in some areas to remain viable after the early and principal mines declined in production.

Prospect complexes are among the most common mining resources and typically manifest as seemingly random groups of pits, trenches, shallow adits, and shafts. Because of this, most will be ineligible unless they meet several conditions. When a group of excavations is considered as an individual resource, it must reflect an organized and planned effort to locate a mineralized formation. The excavations should follow a geometric pattern reflecting a sampling strategy. Disturbance to the excavations and intervening ground must be minimal, and evidence of surface facilities such as the blacksmith shop should retain integrity at least on an archaeological level. Random groups of excavations can qualify if they are contributing elements of historic mining landscapes. The landscape should retain integrity in the form of an intact natural setting.

NRHP Criterion A: Prospect complexes are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although mentioned below, the Areas are explained in more detail in Chapter 2.

Sites that date between 1874 and 1885 participated in the Area of *Exploration/Settlement* as physical anchors for the mining frontier. The complexes were manifestations of the prospectors who opened the Black Hills to settlement, explored the geography of western South Dakota, and proved the presence of ore. Within the Area of *Industry*, some sites that date after 1885 may be important on a local level for their role in the continuation of prospecting. After 1885, the boom declined in the Black Hills, although later prospecting was significant because it provided additional ore that allowed an area's mining industry to remain viable.

A site's timeframe must be established so relevant trends and patterns can be determined. Timeframe is, however, difficult to define for prospect complexes because most lack sufficient assemblages of dateable artifacts and were not clearly described in archival sources. Without a firm timeframe, a site cannot be associated with trends and patterns.

NRHP Criterion B: Prospect complexes may be eligible under *NRHP Criterion B* when they can be directly attributed to a significant person. The important person must have directly participated in the prospect operation and been present on the site for a substantial period of time. Second, the site must retain physical integrity relative to that person's timeframe. Few complexes will be eligible under Criterion B because it is extremely difficult to attribute a given site to an important person.

NRHP Criterion C: Sites may be eligible under *NRHP Criterion C* if they are sound examples of an organized and planned prospect effort. The assemblage of excavations must conform to a systematic pattern, and evidence of support facilities such as the blacksmith shop should be clearly represented, if any existed. The *Engineering* Area of Significance may be applicable to such sites because they reflect how educated and experienced prospectors employed strategic sampling and knowledge of vernacular engineering to prove the existence of ore.

Prospect complexes may be eligible under Criterion C if they are contributing elements of a historic mining landscape. Even when a group of excavations appears unimportant as an individual entity, it may provide context or belong to a greater body of nearby resources representing an area's history.

NRHP Criterion D: Prospect complexes may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. By charting the distribution of excavation types and sizes, patterns may become apparent. The patterns could reflect planning, sampling methods, and strategy specific to an area's geology or timeframe. Regional differences can be determined by comparing prospect complexes. The methods and planning that prospectors employed is an important research topic, and few studies have been completed to date.

In general, few prospect complexes are expected to qualify under Criterion D. Most excavations in prospect complexes were random, and buried archaeological deposits are usually absent.

Property Subtype: Prospect Shaft

Resource Description: A prospect shaft was by definition an exploratory operation abandoned in an unproductive and primitive state. Prospect shafts were vertical or inclined and had small waste rock dumps reflecting shallow workings. Most prospect shafts also had simple surface plants equipped with little more than a hoisting system and a blacksmith shop, usually at the shaft collar. Hoisting systems consisted of portable appliances and ranged from manually operated windlasses to small mechanical units. Substantial operations often erected one or two buildings of vernacular construction. In some cases, a small shaft house enclosed the shaft collar and blacksmith shop. Hoist houses sheltered mechanized hoists separately, and shaft houses encompassed all facilities under one roof. Vernacular is defined as the adaptation of conventional construction methods to the materials and environment of the Black Hills. Further, vernacular buildings were not formally designed by architects and were, instead, erected as needed and planned in the field for function.

As historic resources, most prospect shafts manifest as archaeological sites today, and few possess intact machinery or standing buildings. The equipment of value was usually removed when a shaft was abandoned, and any buildings probably collapsed because of poor construction. The sites are simple, compact, and usually limited to the shaft, its waste rock dump, and a few archaeological features representing the surface plant. Common features include building platforms and ruins, blacksmith forges, and machine foundations clustered near the shaft. The shafts themselves usually manifest as areas of subsidence, created when the support timbering decayed and imploded. Collapsed shafts can appear similar to large prospect pits, except the volume of waste rock should exceed the subsidence area.

Resource Eligibility: Prospect shafts were important during several Periods of Significance that differ by region. As manifestations of the frontier prospecting movement, shafts were important on a statewide level from 1874 to 1885. During this time, prospectors defined the extent and distribution of the state's hardrock ore veins, and the results became the foundation for the state's principal mining industry and associated settlement pattern. Afterward, prospecting contracted in importance to local areas, each with its own Period of Significance spanning the first several years of development. Continued ore discoveries allowed the mining industry in some areas to remain viable after the early and principal mines declined in production.

Prospect shafts are among the most common mining resources, and most are in poor states of preservation due to decay, collapse of the shaft, or closure projects. Because of their commonality, prospect shafts must retain high integrity to be eligible. Integrity on an archaeological level is sufficient for eligibility, but only if the features and artifacts clearly represent the prospect operation, the content of the surface plant, and timeframe. The shaft, the hoisting system, the shop, and any other facilities should be readily apparent. Sites with high archaeological integrity are uncommon and can be important if they clearly exemplify the resource type. Intact shaft collars, machinery, and structures are rare and may be important representative examples.

NRHP Criterion A: Some prospect shafts are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although mentioned below, they are explained in more detail in Chapter 2.

Sites that date between 1874 and 1885 participated in the Area of *Exploration/Settlement* as anchors for the mining frontier. The shafts were physical manifestations of the prospectors who opened the Black Hills to settlement, explored the geography of western South Dakota, and proved the presence of ore.

In the Area of *Industry,* prospect shafts were among the first substantial hardrock developments in advance of a regional mining industry. Shafts represent the investment of time and labor, quantification of regional geology and mineralogy, and the evolution from surface prospecting to work underground. These elements were an important initial phase of hardrock mining. Some sites that date after 1885 may be important on a local level for their role in the continuation of prospecting. After 1885, the boom declined in the Black Hills, although later prospecting was significant because it revealed additional ore that allowed an area's mining industry to remain viable.

A site's timeframe must be established so relevant trends and patterns can be determined. Timeframe is, however, difficult to define for prospect shafts because many lack sufficient assemblages of dateable artifacts and were not clearly described in archival sources. Without a firm timeframe, a site cannot be associated with trends and patterns.

NRHP Criterion B: Prospect shafts may be eligible under Criterion B under certain circumstances. First, an important person must have directly participated in the prospect operation and worked in or at the shaft. Second, the site must retain physical integrity relative to that person's timeframe. Integrity on an archaeological level is sufficient if the features and artifacts clearly represent the operation. Few shafts will be eligible under Criterion B because it is extremely difficult to attribute a given site to an important person, and most lack necessary integrity.

NRHP Criterion C: Sites may be eligible under Criterion C if they are outstanding examples of a typical prospect shaft operation. Because most equipment and buildings were removed when a shaft was abandoned, integrity is usually on an archaeological level. The shaft, hoisting system, blacksmith shop, and other facilities should be represented by features and artifacts. Intact structures and equipment, a high degree of integrity, or character defining engineering or architectural features strengthen a site's potential eligibility. Important engineering and architectural features include intact buildings, structures, machinery, and shaft collars. The *Engineering* Area of Significance may be applicable to such sites because they reflect an adaptation of known technology and engineering to the most primitive environmental conditions including difficult terrain, inaccessibility, unknown geological conditions, and an undeveloped landscape. If buildings still stand, then the Area of *Architecture* may apply. Buildings represent the adaptation of local materials, lumber, and known construction methods to meet the needs of deep prospecting on the frontier.

Prospect shafts may be eligible under Criterion C if they are contributing elements of a historic mining landscape. Even when a shaft appears unimportant as an individual entity, it may provide context or belong to a greater body of nearby resources representing an area's history.

NRHP Criterion D: Prospect shafts may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. If a shaft site possesses completely intact structures and buildings, detailed examination may reveal how prospect outfits adapted conventional mining architecture and engineering to South Dakota's frontier. Few studies within this arena of inquiry have been completed to date.

If the workers lived on-site, the residential area may offer meaningful buried archaeological deposits such as privy pits. Testing and excavation could exhume artifacts capable of illuminating the currently dim portrait of the types of workers employed at prospect operations, and how they lived.

In general, few prospect shaft sites are expected to qualify under Criterion D. Buried archaeological deposits are usually absent, and nearly all sites lack intact buildings and structures.

Property Subtype: Prospect Adit

Resource Description: An adit was a horizontal entry underground usually 3 by 6 feet or or smaller. Prospectors drove adits instead of shafts because they required less capital and effort. By definition, a prospect adit was an unproductive exploratory operation with shallow workings and a small waste rock dump. Surface plants were equipped with little more than a blacksmith shop and a means of hauling waste rock out of the workings. If an adit's length exceeded the penetration of fresh air, the prospectors may have installed a hand-powered blower, a bellows, or a windsock to force air underground through tubing.

As historic resources, most prospect adits manifest as archaeological sites today, and few possess intact structures or buildings. Most equipment of value was removed when an adit was abandoned, and the buildings usually collapsed because they were poorly constructed. The sites are simple, compact, and usually limited to the adit, its waste rock dump, and a few archaeological features representing the surface plant. Shop ruins or platforms, forges, and timber dressing areas are the most common archaeological features. The decay of support timbering caused most adit portals to collapse, leaving linear areas of subsidence that can appear similar to lengthy trenches. In such cases, the volume of waste rock should exceed the area of subsidence.

Resource Eligibility: Prospect adits were important during several Periods of Significance that differ by region. As manifestations of the frontier prospecting movement, adits were important on a statewide level from 1874 to 1885. During this time, prospectors defined the extent and distribution of the state's hardrock ore veins, and the results became the foundation for the state's principal mining industry and associated settlement pattern. Afterward, prospecting contracted in importance to local areas, each with its own Period of Significance defined as the first several years of development. Continued ore discoveries allowed the mining industry in some areas to remain viable after the early and principal mines declined in production.

Prospect adits are among the most common mining resources, and most are in poor states of preservation due to decay, collapse of the adit, or closure projects. Because of their commonality, prospect adits must retain high integrity to be eligible. Integrity on an archaeological level is sufficient for eligibility, but only if the features and artifacts clearly represent the prospect operation, the content of the surface plant, and timeframe. The adit, the shop, and any other facilities should be readily apparent. Sites with high archaeological integrity are uncommon and can be important if they clearly exemplify the resource type. Intact adit portals, machinery, and structures are rare and may be important representative examples.

NRHP Criterion A: Some prospect adits may be associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although mentioned below, they are explained in more detail in Chapter 2.

Sites that date between 1874 and 1885 participated in the Area of *Exploration/Settlement* as physical anchors for the mining frontier. The adits were manifestations of the prospectors who opened the Black Hills to settlement, explored the geography of western South Dakota, and proved the presence of ore.

In the Area of *Industry*, prospect adits were among the first substantial hardrock developments in advance of a regional mining industry. Adits represent the investment of time and labor, quantification of regional geology and mineralogy, and the evolution from surface prospecting to work underground. These elements were an important initial phase of hardrock mining. Some sites that date after 1885 may be important on a local level for their role in the continuation of prospecting. After 1885, the boom declined in the Black Hills, although later prospecting was significant because it provided additional ore that allowed an area's mining industry to remain viable.

A site's timeframe must be established so relevant trends and patterns can be determined. Timeframe is, however, difficult to define for prospect adits because many lack sufficient assemblages of dateable artifacts and were not clearly described in archival sources. Without a firm timeframe, a site cannot be associated with trends and patterns.

NRHP Criterion B: Prospect adits may be eligible under Criterion B under certain circumstances. First, an important person must have directly participated in the prospect operation and worked in or at the adit. Second, the site must retain physical integrity relative to that person's timeframe. Integrity on an archaeological level is sufficient if the features and artifacts clearly represent the operation. Few adits will be eligible under Criterion B because it is extremely difficult to attribute a given site to an important person, and most lack necessary integrity.

NRHP Criterion C: Sites may be eligible under Criterion C if they are outstanding examples of a typical prospect adit operation. Because most equipment and buildings were removed when an adit was abandoned, integrity is usually on an archaeological level. The adit, blacksmith shop, and other facilities should be represented by features and artifacts. Intact structures and equipment, a high degree of integrity, or character defining engineering or architectural features strengthen a site's potential eligibility. Important engineering and architectural features include intact buildings, structures, machinery, and adit portals. The *Engineering* Area of Significance may be applicable to such sites because they reflect an adaptation of known technology and engineering to the most primitive environmental conditions including difficult terrain, inaccessibility, unknown geological conditions, and an undeveloped landscape. If buildings still stand, then the Area of *Architecture* may apply. Buildings represent the adaptation of local materials, lumber, and known construction methods to meet the needs of deep prospecting on the frontier.

Prospect adits may be eligible under Criterion C if they are contributing elements of a historic mining landscape. Even when an adit appears unimportant as an individual entity, it may provide context or belong to a greater body of nearby resources representing an area's history.

NRHP Criterion D: Prospect adits may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. If an adit site possesses completely intact structures and buildings, detailed examination may reveal how prospect outfits adapted conventional mining architecture and engineering to South Dakota's frontier. Few studies within this arena of inquiry have been completed to date.

If the workers lived on-site, the residential area may offer meaningful buried archaeological deposits such as privy pits. Testing and excavation could exhume artifacts capable of illuminating the currently dim portrait of the types of workers employed at prospect operations, and how they lived.

In general, few prospect adit sites are expected to qualify under Criterion D. Buried archaeological deposits are usually absent, and nearly all sites lack intact buildings and structures.

Features Common to Hardrock Prospect Resources

Boiler: Boilers generated steam that powered machinery, and were rarely used for heating. In general, the mining industry ran on steam power into the 1910s, when electricity and petroleum engines became commonly accepted. Boilers came in a variety of types, sizes, and duties, but prospect outfits chose a narrow range due to constraints. Because prospect outfits had little capital, simple needs, and worked in remote locations, they almost always selected inexpensive, light-duty, portable boilers over the efficient units preferred by mining companies. The boiler types common to deep prospecting are noted below in order of size. As a general rule, intact boilers are considered rare and important engineering features.

Upright boilers were the least costly, easiest to transport, but least efficient of the portable types. Upright boilers featured a vertical, cylindrical shell with a firebox at bottom and a smokestack at top. Flue gases left the firebox, rose through a cluster of tubes in the shell, and exited the smokestack. Upright boilers were self-contained, stood on cast iron bases, and ranged in size from 2 feet in diameter and 7 feet high to 5 feet in diameter and 12 feet high. Because they were self-contained, upright boilers required no formal foundations, although workers often placed them on rock pads.

The *locomotive boiler* was one of the most popular portable boilers and derived its name from its use in railroad engines. The locomotive boiler consisted of a horizontal shell perforated with flue tubes, a firebox underneath one end, and a smokestack at the other. The firebox and shell were riveted together as a single unit, and brackets and skids supported the apparatus. Hot flue gases left the firebox, traveled through the tubes, and exited the smokestack. Small boilers featured a shell 2 feet in diameter, stood 4 feet high including the fire box, and were up to 10 feet in length. Large units featured a 5 foot diameter shell, stood 9 feet high, and were up to 23 feet long. Boilers commonly employed at mines were usually in between in size.

To overcome inefficiencies of the locomotive boiler, manufacturers offered the *Pennsylvania boiler*, which was self-contained and portable. Although Pennsylvania boilers were similar in appearance to locomotive units, the flue gases followed a path designed to impart more heat. They left the firebox, traveled through a set of lower tubes, gathered in a chamber at the boiler's rear, returned through a set of upper tubes, and exited a smokestack located over, but sealed from, the firebox. As a general description, Pennsylvania boilers featured a horizontal shell with a firebox under one end, a sealed rear, and a manifold for a smokestack over the firebox.

Boiler Platform: Because portable boilers were self-contained and free-standing, prospect outfits usually stood them on platforms located near the hoist. Sustained operation of a boiler generated specific types of artifacts, which usually define a boiler location. The artifact assemblage should include clinker, which was a scorious, dark residue, as well as unburned bituminous coal, ash, water-level sight-glass fragments, boiler grate fragments, and pipe fittings.

Occasionally, prospectors supported a boiler with rock or brick foundations, which may be present on the boiler platform. Some outfits installed upright boilers on square or circular dry-laid rock pads, or over shallow pits to allow ashes from the firebox to drop through. The pad's size should approximate the boiler's diameter.

Pennsylvania boilers and locomotive boilers stood on skids, which usually required no support. However, where the ground was soft or uneven, workers often laid parallel rock alignments to prevent the boiler from settling. In the absence of rock supports, the skids occasionally became embedded in the ground and left two parallel depressions the length and width of the boiler. For locomotive boilers without skids, workers erected a rock or brick pylon to support the high end, and laid a rock or brick pad to support the firebox.

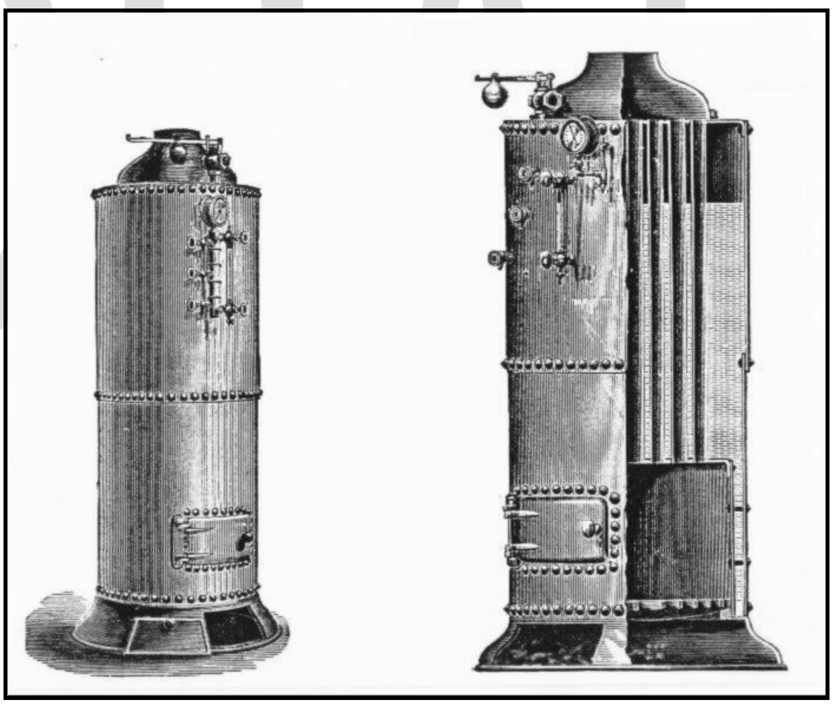


Figure 3.14: Upright boilers were the least expensive and most portable type of boiler, but also inefficient. Flue gases rose from the firebox at bottom, through the flue tubes, and out a smokestack at top. Note the water level sight tube, pressure gauge, and pressure valve. Source: Rand Drill Company, 1886:47.

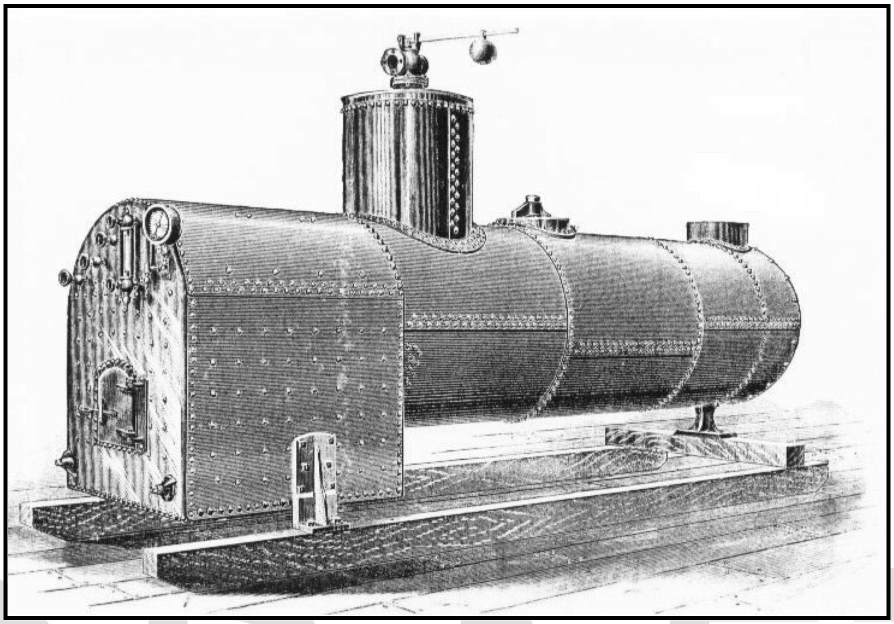


Figure 3.15: The locomotive boiler was one of the most popular steam generators. Flue gases traveled from the firebox at left through flue tubes in the tank and out a smokestack at right. Source: Rand Drill Company, 1886:45.

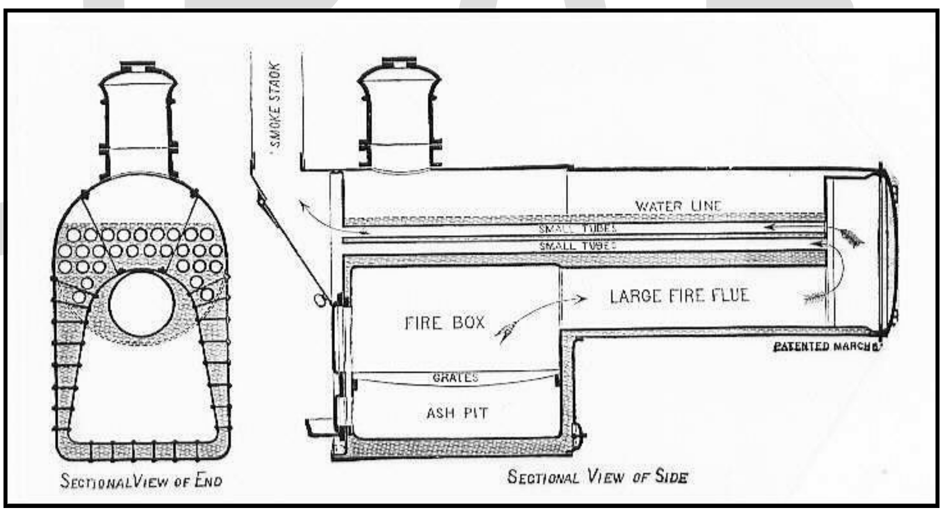


Figure 3.16: The Pennsylvania boiler was portable, stood on skids, and provided greater fuel economy than the locomotive type. Note the path traveled by the flue gases, which prolonged contact with the boiler surfaces. Source: Rand Drill Company, 1886:46.

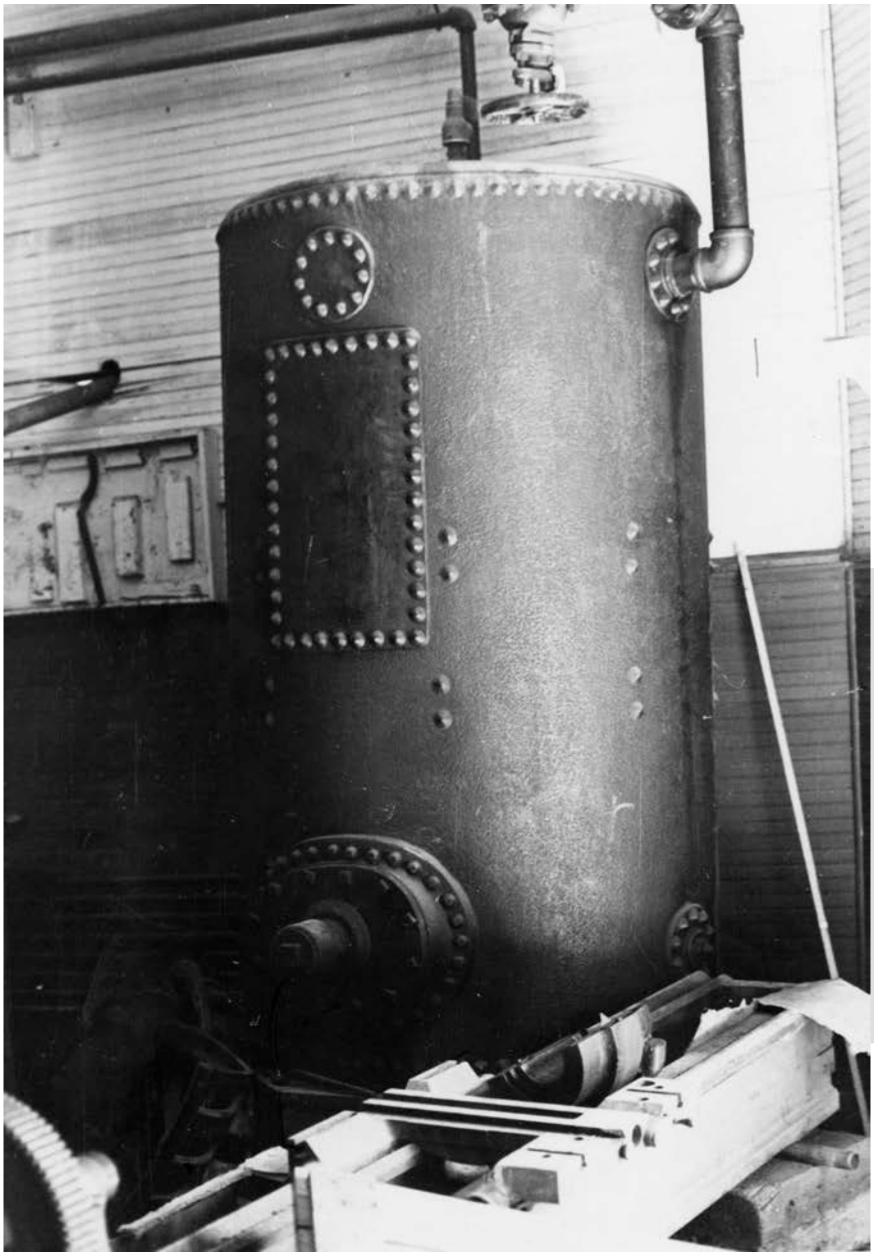


Figure 3.17: Golden Crest Boiler. Courtesy South Dakota State Historical Society.

Claim Marker: Prospectors erected claim markers at the corners of their claims, which were usually 300 or 500 feet wide, and 1,500 feet in length. Markers ranged from cairns to blazes on trees to up-ended boulders. When a surveyor mapped and registered a claim, he usually etched the mineral survey number into a corner rock.

Claim Stake: A claim stake was the universally recognized form of claim marker. Claim stakes were usually 4x4 posts 4 feet high, although prospectors often substituted logs.

Draft Animal Track: Horse whims required a circular track around the apparatus so the draft animal could wind the cable drum. The tracks tended to be around 20 feet in diameter and cleared of major obstacles. Prospectors often graded semi-circular platforms adjacent to a shaft for a track.

Forge: Nearly all prospect operations of substance featured a forge where a blacksmith heated steel implements. Most forges were vernacular in construction in that they were assembled with local materials.

Prospectors built walls 3 by 3 feet in plan and 2 feet high with rocks or small logs, inserted a tuyere, and filled the interior with sorted gravel. In some cases, prospect outfits imported factory-made iron pan forges to their sites.

Forge Remnant: Forges collapsed over time and may manifest as a mound of gravel and remnants of the walls, usually impregnated with coal and forge clinker. When coal burned at high temperatures, it left a scorious, dark residue known as *clinker*.

Headframe: Mechanical hoisting systems required a pulley over the shaft to guide the cable and allow prospectors to manipulate the ore bucket. Headframes associated with horse whims were often large tripods or tetrapods. *Two-post gallows* headframes usually served power hoists, and they consisted of two posts and diagonal backbraces on timber footers. Cross-members at the top featured a large pulley known as a *sheave* that guided the hoist cable into the shaft. Headframes associated with prospect shafts were less than 25 feet high.[8]

Headframe Ruin: The collapsed remnants of a headframe.

Headframe Foundation: Headframe foundations usually manifest as parallel timbers that straddle a shaft and extend toward the area where a hoist was located.

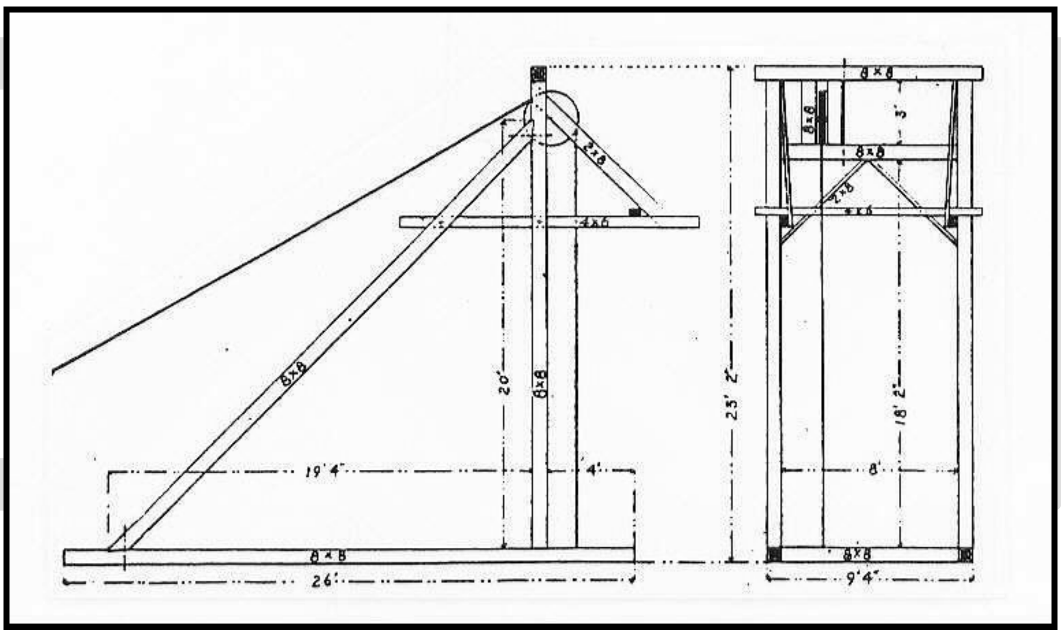


Figure 3.18: The two-post gallows headframe was the most common type for prospect shafts. Sinking-class versions tended to be less than 25 feet high and stood on timber footers. Source: *Engineering & Mining Journal* 3/7/03 p366.

[8] Twitty, 2002:177.

<u>*Hoist:*</u> Almost all shaft operations required a hoist to raise rock out of the underground workings. While windlasses and horse whims are versions of hoists, the term used here refers to mechanical, power-driven types. The hoist's basic form remained fairly constant between the 1870s and 1950s, and most changes involved different sources of power. Steam reigned supreme between the 1870s and 1910s, and petroleum engines dominated afterward, except for in a few areas with electric service. As a general rule, existing hoists are rare and important engineering features.

The *single-drum steam hoist* was the most common type employed between the 1870s and 1910s. Single-drum steam hoists consisted of a cable drum flanked by two steam cylinders, all assembled on a common cast iron bedplate. The steam cylinders powered the cable drum through reduction gears or rubber rollers that pressed against the drum. The hoist operator controlled a brake, clutch, and throttle via levers and foot pedals at the rear. Hoists less than 6 by 6 feet in area were for deep prospecting, while larger units were for light to moderate production.

Single-drum electric hoists were common between the 1910s and 1970s in those areas with electric service. Factory-made models consisted of a cable drum, a shaft featuring a bull gear, and an electric motor, all bolted to a common cast iron bedplate. The duty and size rating for electric hoists were similar to their steam-driven predecessors. Large units often featured an electric motor bolted to a separate mount adjacent to the bull gear. Between the 1910s and 1940s, prospect outfits attempting to save capital stripped the drive trains off obsolete steam hoists and retrofitted them with a motor.

Between around 1900 and the 1930s, prospect outfits in remote areas often employed *gasoline hoists*. Factory-made models featured a cable drum and reduction gears assembled on the front of a tall cast iron frame. A single-cylinder gasoline engine was usually at the rear, and the controls were either on the side or at the rear. The engine was distinct and consisted of a large, horizontal cylinder, dual flywheels, an exhaust pipe, and fine machine linkages. Between the 1920s and 1940s, some prospect outfits employed custom-built gasoline models that combined obsolete steam hoists with automobile engines.

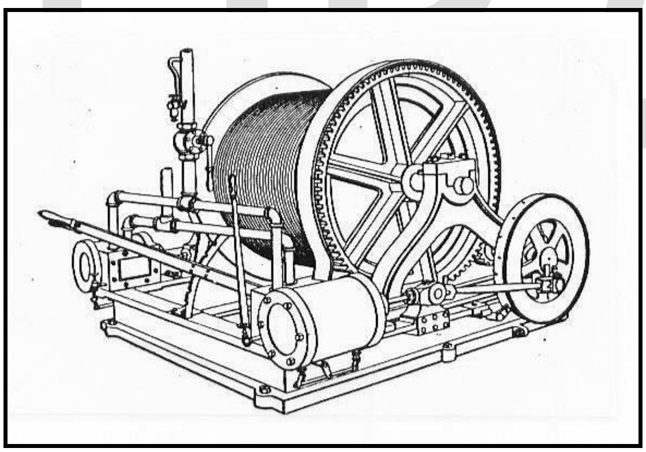


Figure 3.19: Single-drum geared steam hoists were the most common power type between the 1870s and 1910s. Gasoline and electric models became popular afterward. Source: International Text Book Company, 1906, A50:8.

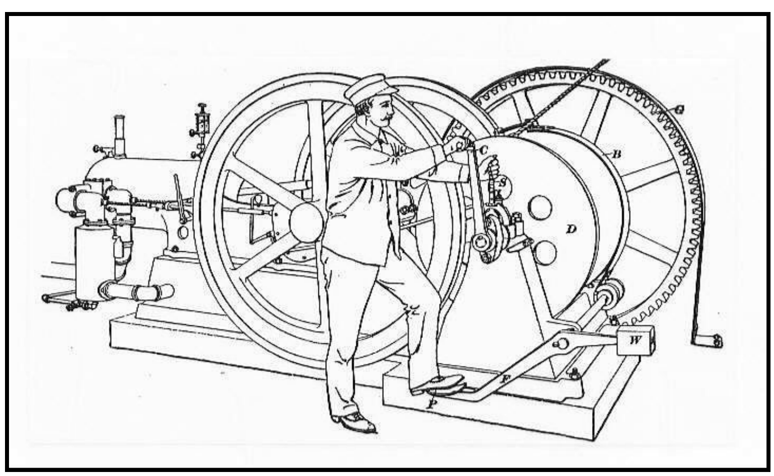


Figure 3.20: This type of gasoline hoist was employed for deep prospecting and minor ore production between around 1900 and 1930. A single-cylinder engine is at left, dual flywheels are at center, and the cable drum is at right. Source: International Textbook Company, 1906, A50:31.

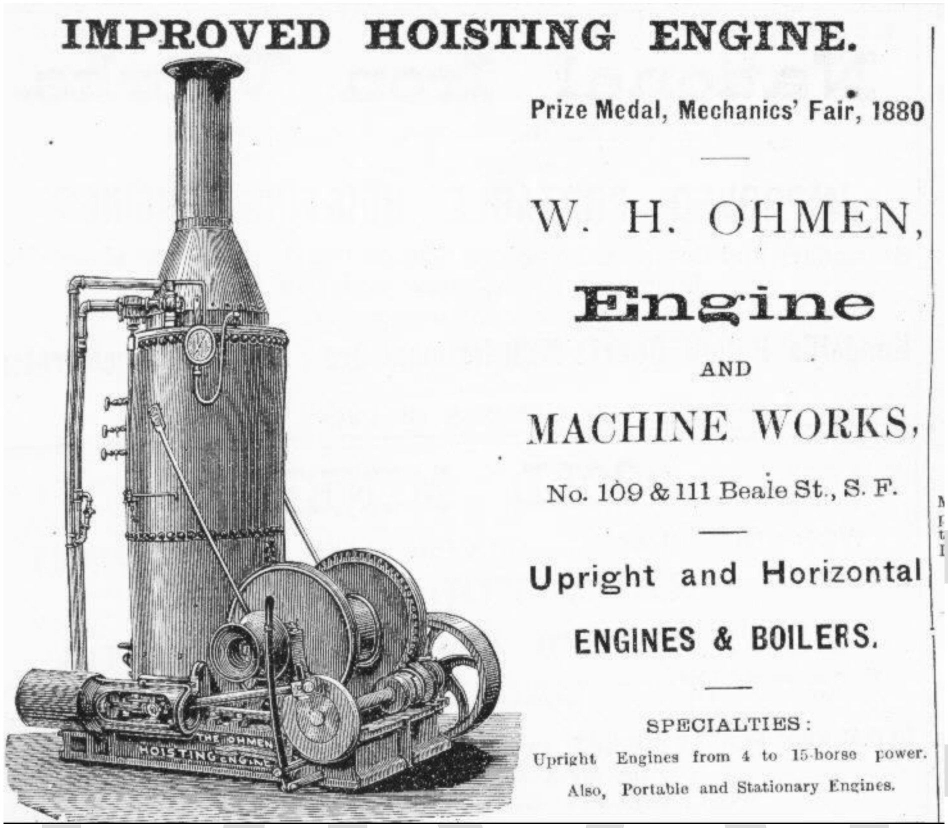


Figure 3.21: Donkey hoists were popular for deep prospecting after the 1880s because they were self-contained and required little site preparation other than a flat area. Source: *Mining & Scientific Press* 1881.

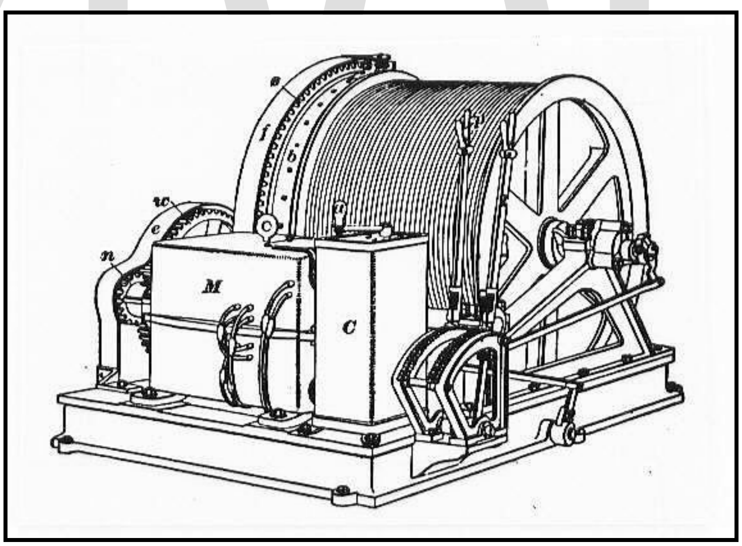


Figure 3.22: The single-drum electric hoist grew in popularity during the 1910s where power was available. The motor is in the case in front, drive gearing is at left, and the upright box is a speed controller. Source: Twitty, 2002:224.

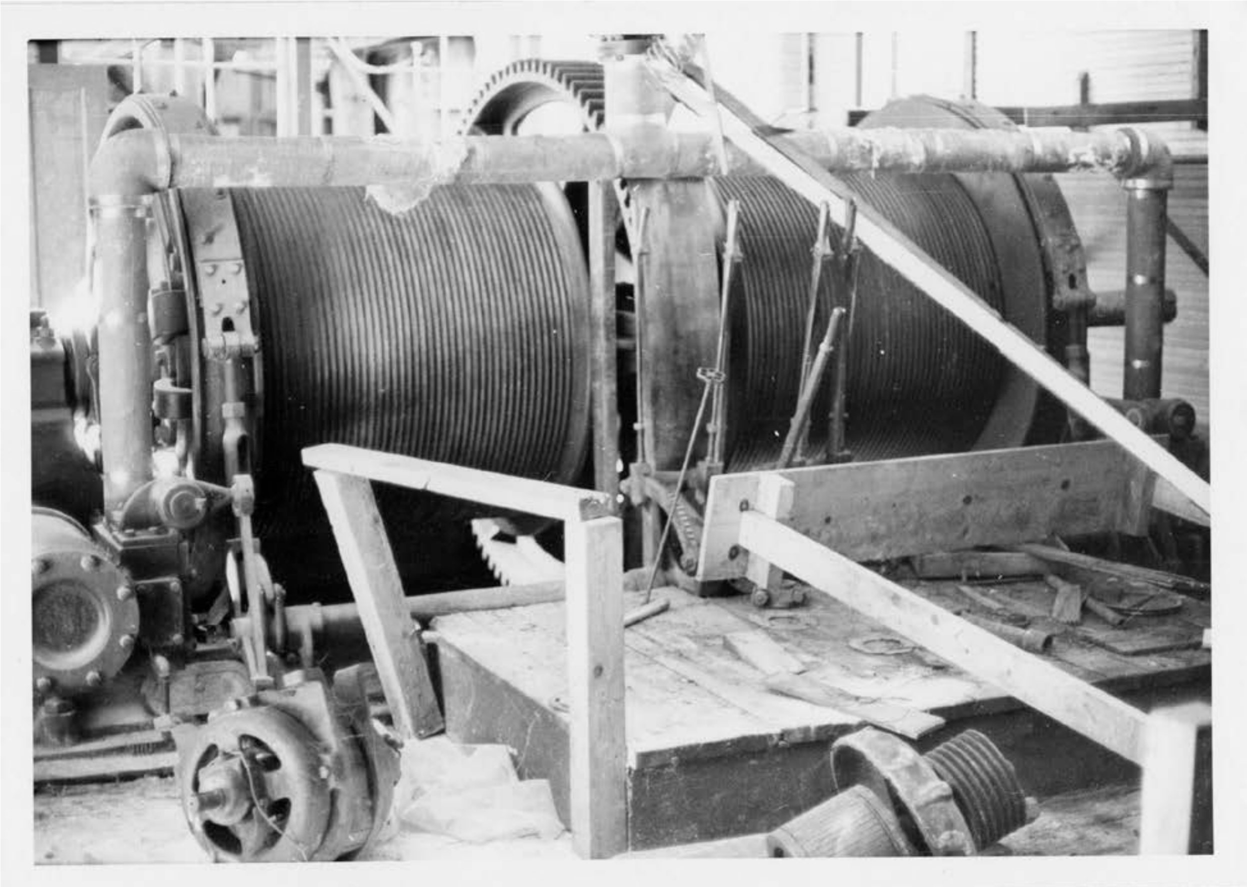


Figure 3.24: Golden Crest 50-Ton Hoist. Courtesy South Dakota State Historical Society.

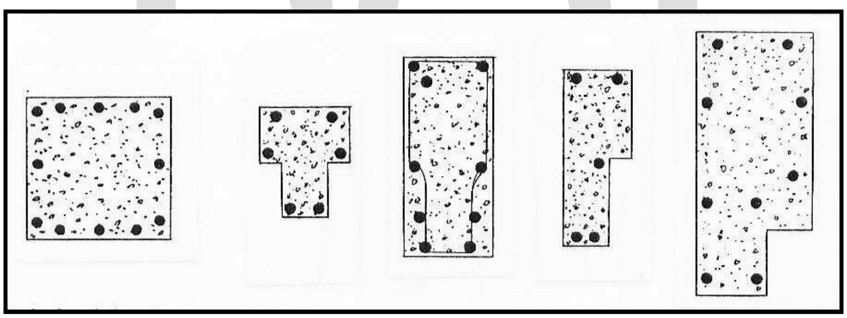


Figure 3.25: Hoist foundation plan views. Single-drum steam hoists were bolted to foundations like the one at left, and the other foundations were for various types of gasoline hoists. Source: Twitty, 2002:187, 241.

<u>*Hoist Foundation:*</u> Nearly all mechanical hoists were anchored to foundations that kept them in place, aligned with the shaft and headframe. Because of their ease of construction and low cost, prospectors usually assembled the foundations with timbers, and occasionally with stone or concrete. Timber foundations decay and become buried over time, and they often manifest today as rectangular groups of four to six anchor bolts projecting out of a hoist house platform.

A foundation's footprint can reflect the type of hoist. *Horse whims* were usually bolted to timber foundations 2 by 2 feet in area at the bottom of a shallow pit. The trench for the cable and control linkages often extends from the pit to the shaft. Foundations for *horizontal reel whims* feature four anchor bolts and may retain the hub that the reel rotated on. Foundations for *geared whims* often consist of four anchor bolts projecting out of parallel timbers.

Foundations for *single drum steam hoists* are usually rectangular, flat, and feature at least four anchor bolts. They can range in size from 6 by 6 feet to as little as 2 by 3 feet in area. Foundations for *single drum electric hoists* appear very similar to those for steam hoists. The state of weathering and the associated artifact assemblage may help define which type of hoist the foundation anchored. Steam hoists often left behind plumbing and gaskets, and the site should possess evidence of an associated boiler.

Foundations for *gasoline hoists* are fairly distinct. Their footprint is that of an elongated rectangle at least 2 by 6 feet in area oriented toward and aligned with the shaft. Due to the engine's severe vibrations, the foundations were often of concrete and at least one foot high. The surface usually features at least six anchor bolts, with the rear two closer together than the rest. Gasoline hoists can leave distinct artifacts such as thin wires, spark plugs, small pipes, and fine machine parts.

Hoist House: Hoist houses, usually at least 20 feet from the shaft, enclosed a hoist, its power source, and often a blacksmith shop. Most prospect outfits followed a form conventional to the mining industry, which was rectangular in footprint with a front-gabled or shed roof. Hoist houses were vernacular in that they had no recognized architectural style, consisted of available materials, and were built as needed by the outfit. In general, logs were commonly used prior to 1890, and lumber as early as 1880.

Hoist House Platform: Hoist houses stood on platforms of leveled earth or waste rock at least 20 feet from, and aligned with, the shaft. Often, a platform is all that represents a hoist house, and it usually reflects the building's size and footprint. Evidence of a hoist and a shop is usually present.

Hoist House Ruin: The collapsed remnants of a hoist house.

Horse Whim: A horse whim was the most primitive type of mechanical hoist, and it was powered by a draft animal. Two types of whims were popular at different times (discussed above), and the researcher should specify the type of whim when recording a site. The *horizontal reel whim* consisted of a horizontally oriented cable reel at least 3 feet in diameter, fitted with a harness beam on top. The *geared whim* was compact and featured a vertical cable drum in a frame. A capstan, geared to the drum, featured a harness beam on top.

Horse Whim Pit: Prospectors often placed horse whims in shallow pits so the hoisting cable could pass through a trench to the headframe and pose no obstacle to the encircling draft animal. They often lined the pits with planks or logs to retain soil. Over time, the lining collapsed, leaving a concave depression where the whim was anchored, and a linear depression extending to the shaft. The pit should be at the center of a draft animal track.

Mine Track: A rail line for ore cars. Prospect outfits preferred factory-made steel rails. Because these were difficult to obtain on the frontier, some outfits substituted scrap iron nailed to 2x4s.

Mine Track Remnant: When prospectors dismantled a rail line, they often left in-situ ties, impressions of ties, and sections of rails.

Pack Trail: A path less than 8 feet wide that provided access to prospect workings.

Prospect Adit: A horizontal entry underground denoted by a waste rock dump. An adit tended to be short and less than 3 by 6 feet in-the-clear, while a tunnel was larger. When collapsed, adits appear as trenches.

Prospect Pit: A circular or ovoid excavation surrounded by a small volume of waste rock.

Prospect Shaft: A vertical or inclined opening underground of shallow depth. When intact, shafts tend to be rectangular, and either 4 by 6 or 4 by 8 feet in-the-clear, the interior dimension. When collapsed, shafts manifest as circular areas of subsidence.

Prospect Trench: A linear excavation flanked by a small volume of waste rock.

Shop: A building that enclosed blacksmith facilities where a worker fabricated and maintained tools and hardware. Simple shops usually featured a forge, a workbench, and possible hand-powered appliances such as a drill-press. Most prospect outfits followed a form conventional to the mining industry, which was rectangular in footprint with a gabled roof. Shops were vernacular in that they had no recognized architectural style, consisted of available materials, and were built as needed by the outfit. In general, logs were commonly used prior to 1890, and lumber as early as 1880.

Shop Platform: Shops usually stood on earthen platforms near the entry underground. The platforms may feature forge remnants and almost always possess artifacts such as forge-cut iron scraps, anthracite coal, and clinker, which is a scorious, ashy residue created by burning coal.

Shop Ruin: The collapsed remnants of a shop.

Waste Rock Dump: The waste material removed from underground workings.

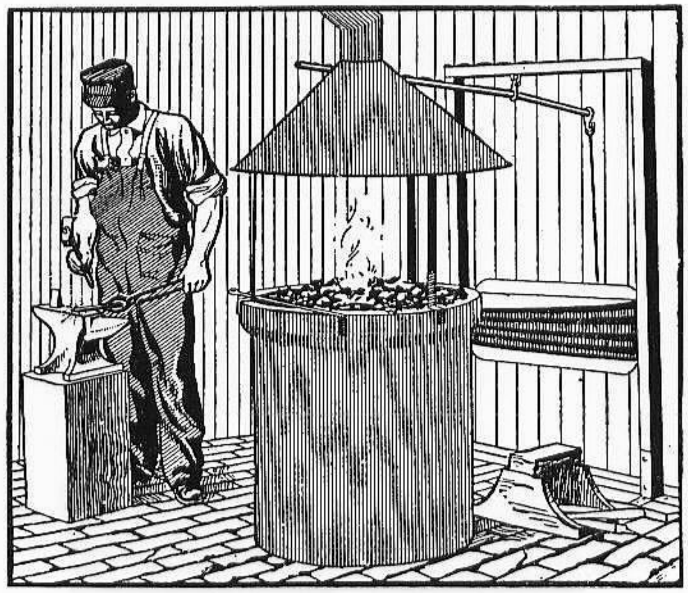


Figure 3.26: The illustrated shop is representative of those at prospects and small mines. Such shops usually consisted of little more than a forge, an anvil, and hand-tools, which restricted work to drill-steel sharpening and the manufacture of light hardware. Source: Drew, 1910:1.

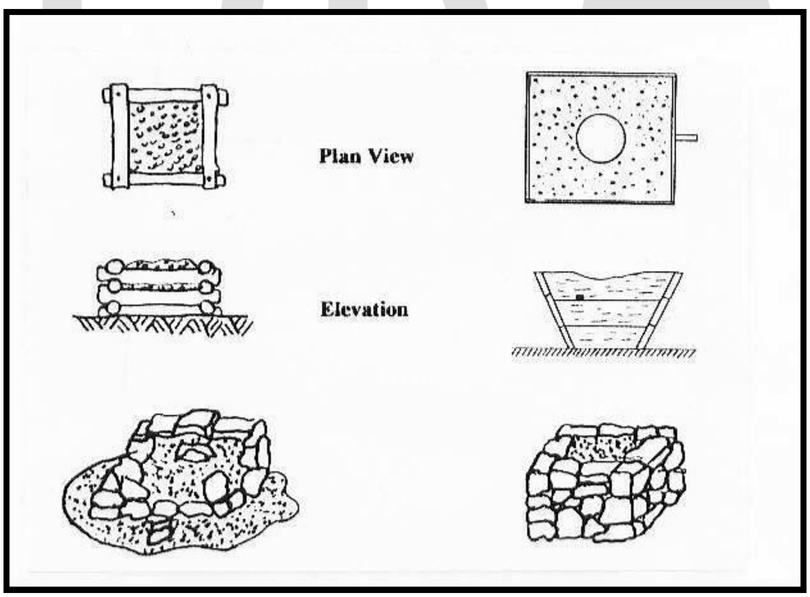


Figure 3.27: Above are examples of the common forges used in blacksmith shops. At upper left is a gravel-filled log forge, at right is a wood box forge, and at lower right is a dry-laid rock forge. Over time, rock forges decay and collapse, and manifest as the remnant at lower left. Source: Eric Twitty.

<u>Property Type: Hardrock Mines</u>

The Nature of Hardrock Mines

Hardrock mines were underground operations that produced ore. Production, however, was not a guarantee of profitability, and many mines failed due to reasons such as high operating costs, over-capitalization, under-estimation of ore reserves, and most commonly debt. Each mine was a custom affair and usually a company endeavor. The well-financed operations were extensive, managed by experts in business, and had mechanized surface plants designed by trained engineers. Most mines, in contrast, were small, labor-intensive, and produced ore in limited tonnages. The facilities at the small operations were usually engineered in a vernacular sense by miners with experience but little formal training. The miners built the facilities as needed with available materials, known practices, and little formal design. They also chose familiar equipment instead of the most effective apparatuses. Despite the differences, most mines shared a few basic characteristics such as ore storage facilities, more than one building, substantial waste rock dumps often at least 125 by 125 feet in area, and roads for the transportation of materials and ore.

Small, marginal mines resembled deep prospects because their surface plants were similar in content and layout. The mines shared the same needs as deep prospects, and so their surface plants possessed the same facilities. However, the small mines possessed additional facilities and other characteristics not found at prospects. First, small mines usually had an ore storage or processing facility. Ore bins, discussed under Feature Types below, permitted the mining company to store ore between shipments. Miners transported payrock in ore cars through the surface plant to the ore bin, usually built on the flank of the waste rock dump. The least productive, capital-poor operations tended to construct roofless, *flat-bottom ore bins*. Operations with capital and a sense of longevity erected *sloped-floor bins*, which were structurally superior, contained more rock, and permitted the ore to be poured into a wagon.

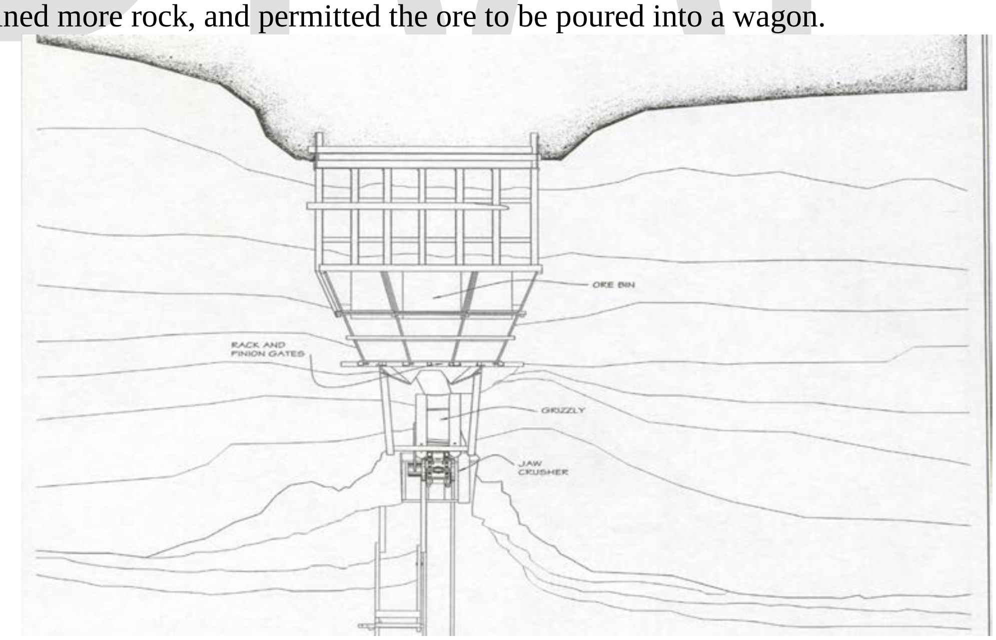


Figure 3.28: Primary ore bin.

Like prospects, nearly all mines featured a shop near the shaft or tunnel. To meet a greater need for materials-handling and fabrication, shops at mines tended to be larger and better equipped. Metal- and woodworking appliances such as lathes and drill-presses were common, and by the 1910s, some companies installed drill-steel sharpening machines.

Substantial, productive mines begin to differ from prospects and small mines in the scale and content of their surface plants. In general, mining companies erected formally engineered structures and relied on machinery to increase production and decrease operating costs. Mining engineers applied the term *production-class* to facilities designed for efficiency, longevity, and high capacity.

Production-class hoisting systems permitted high tonnages of payrock to be raised from deep workings. The general layout and types of components were similar, only larger in scale and structurally superior. Prior to the 1910s, substantial mines employed steam hoists, used electric models afterward, and rarely installed gasoline hoists. Mining engineers defined steam and electric hoists suited for production as being at least 6 by 6 feet in area, with larger units accommodating greater production. Most hoists were enlarged versions of the single-drum steam or electric models. Because these were slow and inefficient, a few heavily capitalized mining companies employed *direct-drive steam hoists*. These machines featured powerful steam pistons directly coupled to the cable drum, resulting in rapid speeds and lower energy consumption. But because the hoists were costly, required formal engineering, and had to be run by an expert hoistman, they were rarely used.

Companies intent on heavy production found that the common two-compartment shaft restricted the volume of ore that could be hoisted out. To overcome such restrictions, they sank three-compartment shafts with two for hoisting and one as the utility compartment. The system required a *double-drum hoist* to raise and lower two hoisting vehicles in a balanced fashion. The configuration increased production and decreased energy consumption, but was costly. Mining companies could choose from two general categories of double-drum hoists. The least expensive featured a geared drive like their single-drum cousins, and it suffered the same inefficiencies and slow speed. The most advanced operations employed *double-drum direct-drive steam hoists*, which were similar to the single-drum version noted above. These enormous hoists stood on foundations consisting of dressed sandstone and granite blocks, and were as much as 30 by 40 feet in area.

Because the simple ore bucket employed by small operations was an insufficient hoisting vehicle for heavy production, many mining companies used *cages* instead. Similar to an open elevator car, a cage ran on guide rails bolted to timbering the length of the shaft. To send a load to the surface, a miner underground merely had to push an ore car onto the cage, which another worker wheeled off at the shaft collar. Today, shafts and headframes featuring guide rails reflect the use of cages for hoisting.

To match the duty of the hoist and hoisting vehicle, mining companies usually erected well-built headframes. Most companies favored the four-post derrick, the six-post derrick, an enlarged two-post variety, or the A-frame. Naturally, headframes for three-compartment shafts featured two wheels on top known as *sheaves* for the two hoisting cables. By the 1910s, some companies replaced the cage with a *skip*, which was an iron box that ran on guide rails. Guides in the headframe upset the skip, which dumped its contents into a bin attached to the headframe's side. When a headframe has a bin and the shaft features guide rails, it can be assumed that the hoisting vehicle was a skip. In general, mining engineers considered headframes higher than 30 feet to be production-class structures.

Mining engineers deemed portable boilers insufficient in steam and fuel efficiency for sustained production. Instead, engineers favored stationary units. The *return-tube boiler* was by far the most common and powered engines for a variety of industries across the nation. Return-tube boilers were distinct and consisted of a cylindrical plate iron shell encased in a masonry setting. The shell featured numerous flue tubes and stood horizontally on the setting. A cast iron façade was bolted across the setting's front and shrouded a firebox and ash pit below, and doors provided access. The *water-tube boiler* was the most advanced and efficient steam generator that mining companies could employ, and due to their high cost and need for maintenance, they saw little application. Water-tube boilers featured a cluster of water-filled iron tubes suspended from a central overhead drum, all encased in a large brick setting. A façade covered the tubes and firebox, and steel girders usually supported the assembly of tubes and drum. For detailed descriptions of return-tube and water-tube boilers, see the Feature Types below.

Highly productive, large-scale mines included additional facilities amid their surface plants. The compressed air system was one of the most common, and it permitted miners underground to use mechanical rockdrills to bore blast-holes.

As with prospecting, drilling and blasting was the primary means of advancing underground workings in mines. Prior to the 1870s, miners almost exclusively drilled by hand with hammers and drill-steels, inserted explosive charges in the holes, and set off the round. In an effort to increase the length and diameter of blast-holes and decrease drilling time, machinery manufacturers introduced rockdrills during the 1870s. Some of the first rockdrills were powered by steam while others were powered by compressed air, which quickly proved the most efficient for mining. The costs of purchasing and maintaining the drills and the necessary compressed air systems proved to be quite high, and as a result only the most progressive and heavily financed companies employed the machines. Rockdrills saw increased use through the 1880s as manufacturers effected improvements and reduced the costs, and by the 1890s the machines became common among well-capitalized operations. Through the 1890s and into the 1900s, costs continued to decrease while manufacturers improved compressed air systems, and a wide spectrum of companies were able to employ the machines. By the Great Depression, most mining companies perceived rockdrills as a requirement for profitable work.

Compressed air systems featured components that compressed the air, moderated the air's flow, and delivered it underground to the points of work. The *compressor* can be viewed as the system's heart, and it was a large machine that featured one or more compression cylinders. Between the 1870s and 1950s, compressors evolved in terms of size, form, and power source, and the specific models are discussed under Feature Types below. Once the air was compressed, it left the machine through a *main* to a *receiving tank*, which moderated the flow of air and dampened the pulses created by the compressor. Receiving tanks, similar in appearance to small boilers, were riveted iron cylinders that featured input and output pipes, a drain valve, and an ovoid cleaning port. The compressed air left the receiving tank through another main and into the mine. As with most other surface plant components, compressed air systems were arranged according to the mine's master datum.

The need for efficient transportation gave rise to a type of facility unique to mining. To overcome the impediments of winter weather, snow, and hostile terrain, companies built *aerial tramways* that descended from a mine to a shipping point or concentration mill. In broad form, tramways consisted of a system of cables and tram buckets that shuttled between upper and lower terminals. The buckets rode a *track cable*, which was fixed between the terminals, and were pulled up or lowered down by a *traction cable*. Upper terminals always featured a means of loading ore into the buckets, and lower terminals featured a bin to receive unloaded ore. Companies erected one of several forms of tramways depending on the available capital, level of production, and scale of operation.

The *single-rope reversible system* was the simplest, which made it popular among small operations. The system consisted of a single track cable spanning between upper and lower terminals, and a single traction cable, powered by a winch or hoist, that pulled the bucket up and lowered it down. Prior to the 1920s, mining operations used steam hoists as the winch, and afterward they used gasoline engines.

The *double-rope reversible system* consisted of two track cables and a pair of tram buckets linked by a cable loop. Double-rope systems were a step above single-rope types and usually operated via gravity. A worker in the top terminal filled an empty bucket and lowered it with a brake, and as the bucket descended, it pulled the light, empty one up. Where the pitch was steep and short, the cables spanned the entire distance between the terminals, while towers supported the cables on lengthy systems.

The *Hallidie System* featured a series of buckets fixed to an endless-loop cable that passed around large wheels, known as *sheaves*, in the upper and lower terminals, and rode over rollers on frame towers between. This system permitted a constant procession of tram buckets to pass through the terminals, and for this reason, it became popular among companies with moderate to high production. The tram required a small workforce and coordinated action to operate. When a bucket entered the upper terminal, it passed around the sheave and by an ore chute descending from an overlying bin. While the bucket was in motion, workers opened the chute, filled the bucket, quickly closed the chute again as the bucket passed, and repeated the process for the next bucket. The full vehicle exited the upper terminal and coasted down to the bottom terminal where a device upset it. The bucket discharged its contents into an underlying ore bin, which accumulated payrock for shipment. Because of the system's complexity, need for a crew, and requirements for loading the buckets, the terminals were usually enclosed within substantial frame structures. Nearly all Hallidie systems were powered by gravity, and most featured a series of frame towers that supported the cable.

The *Bleichert double-rope system* was similar to the Hallidie type in concept, but it featured improvements that increased capacity. In overview, a Bleichert system consisted of a pair of heavy track cables, a separate traction cable loop, and the top and bottom terminals. Like the Hallidie type, the traction cable tugged the tram buckets around the circuit, and it rode on a series of frame towers. One of the main differences was that the buckets coasted over the track cable on special hangers with pulleys. The track cable was stationary, supported by cross-members on the crowns of the towers, and the ends anchored to the top and bottom terminals.

Another principal improvement over the Hallidie system was that workers could uncouple the tram buckets from the traction cable. When a bucket entered the top terminal, a worker uncoupled it from the traction cable and pushed it onto a hanging rail bolted to the building's framework. He then shuttled the bucket to an ore chute, parked and filled the bucket, pushed it to the rail's end, and re-coupled it. The bucket exited the structure and rode the track cable down to the lower terminal where another worker uncoupled it, dumped the ore, and sent it back up to the system's head. Overall, the improvements offered several advantages. First, the buckets were larger and could carry more ore, and the system had an overall greater carrying capacity. Second, workers could fill the buckets at leisure while minimizing spillage. Last, Bleichert systems were able to cover greater distances. The disadvantages were that they required advanced engineering and were considerably more expensive. Given the above, only the large and well-capitalized companies were able to justify Bleichert systems.

In conjunction with superior means of transporting payrock, many substantial mining companies also constructed ore storage and processing facilities capable of accommodating greater production. Some mines were fortunate enough to feature straightforward and consistent payrock that miners sent directly to ore bins on the surface. To handle significant tonnages, productive companies usually erected large sloped-floor bins. Multiple cells added structural rigidity, as well as permitting some separation for different grades and lots produced by independent parties leasing sections of the workings.

In some mines, the ore formations were complex and offered a variety of grades and compounds. Mining companies found that separating the grades and manually removing waste rock prior to shipment to a mill increased an ore's value per ton. In such cases, the companies erected *ore sorting houses* to accomplish the separation. These facilities featured three general components that relied on gravity to draw payrock through the structure, and like ore bins, were usually built on the flank of a waste rock dump or hillside. The structure's top floor was concurrent in elevation with the mine opening so workers could deliver the ore in cars. The top floor featured either a *receiving chute* or a *receiving bin*, if the volume of production was high. The ore slid down the chute and across a grizzly, which was a screen of iron rods or wire mesh with narrow gaps. When blasted, the degree to which ore fractured was often a function of its richness; metal-rich material fractured into *fines* while impoverished, waste-laden material broke into cobbles. As the crude ore passed over the grizzly, the fines dropped through and collected in *holding bins* underneath the structure. The waste-laden cobbles tumbled over the grizzly and collected at a *sorting station* usually located on a second floor. There, workers manually separated out waste and knocked off metalliferous material either on *sorting tables* or on the floor. They shoveled the waste into an ore car parked in the structure, and when full, pushed the car out and across a trestle where they discharged the unwanted contents. Workers shoveled or swept the *recovered ore* through ports in the floor, which dropped into the holding bins below.

The shop was another facility that differed in size, scale, and complexity for large operations. In general, the use of machinery and the need for hardware created a heavy demand for advanced metalwork and carpentry. Large workforces also dulled high numbers of drill-steels and picks. To meet such needs, mining companies erected spacious shops equipped with power-driven appliances. Further, particularly large companies constructed separate buildings for machine work, carpentry, and blacksmithing. Where possible, companies located the shop adjacent to the mine opening to minimize the undue handling of heavy materials. Many shops featured a basic array of power appliances, including a drill-press, a lathe, a trip hammer, and a pipe cutter. By the 1910s, machinery manufacturers offered mechanical drill-steel sharpeners to increase the volume of work completed by blacksmiths. Most power appliances had to be anchored to foundations, which ranged from timbers to concrete pads.

Overall, the surface plants erected by advanced, productive companies required buildings superior to those typical of small outfits. For efficiency, substantial companies generally clustered their mechanical components and shops together in either large tunnel houses or shaft houses. Ancillary facilities such as separate shops, electrical transformers, explosives magazines, offices, and quarters for draft animals were enclosed in individual buildings. In general, the surface plants for substantial operations featured the primary shaft- or tunnel houses surrounded by smaller structures.

Except for a few deviations, most mining companies designed their buildings according to function and economics with little thought of adornment or architectural style. Although many buildings were formally designed, they were still vernacular in that they adapted conventional construction methods to forms common to the industry, and the needs of a specific mine. Foundations for mine buildings were often temporary and consisted of timbers, logs, posts, or rock alignments. Floors were often of earth or planks where necessary. To support small structures, companies usually built post-and-girt frames. To support large structures that bore great weight, they designed vernacular frames with heavy timbers or variations of square-set frames. Before corrugated sheet iron became common by the late 1890s, mining companies sided their structures with planks, and by the 1900s, many companies also used tarpaper for smaller buildings.

In terms of the physical appearance of mine buildings, two trends regarding materials, design, and workmanship are apparent. Buildings erected prior to the decline of hardrock mining during the 1910s tended to follow a formal design and were well-constructed with virgin or original materials. The overall style can be referred to as *Western mining vernacular*. During the Great Depression a change occurred, which was largely a function of a lack of capital, resources, and experienced mine labor. Workmanship tended to be poor, buildings smaller, a high degree of salvaged materials used, and design and structural features based around available materials. Many buildings erected during the Depression and the 1940s often appear ramshackle, crude, battered, and assembled by inexperienced individuals. Buildings with such style can be described as *Depression-era mining vernacular*.

Hardrock Mine Property Subtypes and Eligibility Guidelines

<u>*Property Subtype: Shaft Mine*</u>

<u>*Resource Description:*</u> Shaft mines were operations that produced ore from vertical or inclined openings. As historic resources, small mines tend to be slightly different from the large sites. The small mines are simple, limited in size, and may have featured facilities like those at deep prospect operations. The presence of an ore bin or sorting house, or the evidence thereof, can distinguish a small mine from a deep prospect. The large mines are extensive, have numerous features, and massive waste rock dumps.

In all cases, companies almost always arranged the critical surface plant components around the shaft collar, and a hoisting system usually formed the core of the surface plant. The typical hoisting system included a mechanical hoist, a headframe, and a boiler (associated with steam hoists). Remnants of the hoisting system will be aligned with the shaft, and they are usually within a platform or footprint of a hoist house or shaft house. If the mine relied on steam power, then evidence of a boiler will probably be near the hoist foundation.

Figure 3.29: The unidentified mine at Deadwood exemplifies a large and complex shaft operation. The building in the foreground with smokestack houses a boiler, and the tall structure behind encloses the mine's headframe and steam hoisting system. Courtesy of the State Archives of South Dakota Historical Society.

Figure 3.30: Although gold mining dominated the Black Hills, a few regions yielded mica, as well. Mica mining relied on the same methods and facilities employed for gold. The White Spar mica mine near Custer, is typical of small to medium-sized shaft operations. The building is characteristic of small shaft houses, enclosing a hoisting system, steam boiler, blacksmith shop, and the headframe under the cupola. The building is an excellent example of mining industry vernacular, designed for function and economy, probably in the field by the mining company.

Although the shaft house is unique to this mine, it is based on a general form common to the mining industry. Courtesy of the U.S. Geological Survey, Sterret, D.B., 89.

A hoist house or shaft house enclosed the hoisting system and almost always a shop. The common surface plant also featured an ore bin or sorting house and possibly a compressed air system. At small mines, air compressors were within the hoist house or shaft house, while large mines often featured an independent compressor house. The ore bins stood on the flanks of the waste rock dump, and when dismantled, they often manifest as log piling or cribbing foundations.

Most sites are archaeological in nature because the machinery, buildings, and other materials of value were usually salvaged for reuse. The process was usually thorough at the small mines, leaving almost exclusively archaeological features and artifacts. Large mines, in contrast, occasionally retain a few structures and machines, although they too are represented primarily by archaeological features. Mines can be preserved and possess most of their surface plant components, but this is exceptional. For a detailed list of common surface plant components, see the feature list below.

<u>*Resource Eligibility:*</u> In a broad sense, hardrock mines were important on a statewide level during two lengthy time periods spanning 1875 to around 1920, and from 1933 until 1942. They were also important in specific regions during other times, depending on ore type and local history.

Hardrock mines were important on a statewide level from 1875 to 1880 as a foundation for South Dakota’s mining frontier. After 1880, mining evolved into a productive industry that underwrote the economy, drove development, and attracted settlement and business. Although production declined during the 1900s, mining as a statewide industry remained viable until around 1920. Some areas such as Lead continued to thrive afterward. The industry resumed its broad significance in 1933 due to a combination of factors. President Franklin Delano Roosevelt increased the prices of gold and silver to levels that interested both investors and local individuals. The unemployed perceived the old mines as sources of income, and were stimulated by the price increases. Both companies and individuals then worked large and small mines alike until 1942. At that time, mobilization for World War II drew off materials and labor, and the Federal government outlawed gold mining.

Shaft mines are a common resource type, and most sites lack structures and machinery because they were removed for reuse. This should in no way be equated with poor integrity. Rather, integrity refers to a site’s ability to clearly represent the historic mining operation, as well as the overall resource type. If the assemblage of archaeological features and artifacts is relatively complete, then a site retains integrity on an archaeological level. When the archaeological evidence clearly reflects the mining operation, the content of the surface plant, and timeframe, a shaft mine can represent its own history, as well as the overall resource type. Integrity at least on an archaeological level is required for eligibility.

Intact buildings, engineered structures, or machinery strengthen a site’s eligibility because these are rare and important examples. If a shaft mine possesses the above but has been otherwise disturbed, it may still be eligible. The buildings and engineered aspects must, however, be in their place of use, and the site complete enough to provide physical context.

Many shaft mines have experienced decay and disturbance in a variety of forms, and the impacts to a site's integrity should be carefully assessed. Natural decay such as heavy erosion, soil creep, and revegetation can destroy important features and bury others. If the shaft collapses into a large subsidence funnel or is closed with invasive methods, key features are often lost. Typically, a mine's most important surface plant components were clustered around the shaft. Bulldozing, property development, and environmental remediation have a high potential to compromise integrity.

In many cases, productive mines were worked periodically during different periods of time. Each successive operation left its own imprint on a site, erasing aspects of earlier occupation and altering others. Assessing integrity and timeframe can be difficult in such cases. If a site retains a majority of its original aspects, even on an archaeological level, then the site retains integrity relative to its original timeframe. If a subsequent operator added surface facilities, removed others, and left an otherwise heavy imprint, then the site retains integrity relative to that operation. Overall, sites that experienced sequential operations can be representative examples of mines that were worked multiple times.

NRHP Criterion A: Shaft mines are often associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although reviewed below, they are explained in more detail in Chapter 2.

Shaft mines that date between 1874 and 1885 participated in the Area of *Exploration/Settlement* as anchors for the mining frontier. The mines were a principal reason behind the exploration, settlement, and development of industry in the Black Hills.

Shaft mines participated in the Areas of *Commerce* and *Economics* primarily on a local level. The mining companies fostered local commercial systems by paying wages to workers and consuming high volumes of goods. The productive operations also contributed to local economies through their output, and by attracting investment and disbursing the funds.

In the Area of *Industry*, shaft mines were a foundation of the mining industry on a cumulative basis. That industry was a significant force that shaped history on local, statewide, and national levels. The industry was a major employer, fostered commerce on a broad scale, was a magnet for Euro-American settlement, and influenced politics and government. The industry also produced an enormous amount of gold, as well as silver and industrial metals.

Shaft mines participated in the Area of *Social History* in several ways. As places of employment, the mines supported populations in areas that Euro-Americans may have otherwise overlooked. In so doing, the mines contributed to the evolution of South Dakota's social geography. In addition, the populations possessed a demography characteristic of Western mining. Individuals were of varying backgrounds, ethnicities, education levels, and socioeconomic status. The boom and bust inherent in the mining industry, including the shaft operations, required the workers to be mobile, and they spread their traditions as they moved about. As major employers, shaft mines also contributed to the development of social classes.

NRHP Criterion B: Shaft mines have a potential for eligibility under Criterion B if an important person was associated with the site. Some mines, especially large complexes, can be traced to important individuals such as engineers and managers. If the significance is through the person's presence on-site and direct participation in operations, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The individual's role in the operation must be clearly defined, and a brief biography explaining their significance provided. An important person's investment in a property or involvement with a company is too indirect an association for Criterion B. The individual of note must have been present on-site and played a fundamental and direct role in its physical development.

NRHP Criterion C: Sites may be eligible under Criterion C if they are outstanding examples of a typical shaft mine. Because most equipment and buildings were removed when a mine was abandoned, integrity is usually on an archaeological level. The shaft, hoisting system, blacksmith shop, and other facilities should be represented by features and artifacts. Intact structures and equipment, a high degree of integrity, or character defining engineering or architectural features strengthen a site's potential eligibility. Important engineering and architectural features include intact buildings, structures, machinery, and shaft collars. The *Engineering* Area of Significance may be applicable to shaft mines. They often exemplify design and the application of technology and engineering specific to vertical mine workings and geological conditions. If buildings still stand, then the Area of *Architecture* may apply. Buildings represent the adaptation of design, materials, and construction methods typical of the mining industry, and to meet the needs of shaft operations.

Shaft mines may be eligible under Criterion C if they are contributing elements of a historic mining landscape. Even when a mine appears unimportant as an individual entity, it may provide context or belong to a greater body of nearby resources representing an area's history.

NRHP Criterion D: Shaft mines may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. Buried archaeological deposits are a common source of information, and they can manifest as privy pits, thick boiler clinker dumps, and refuse layers in waste rock dumps. Deposits amid a mine's surface plant may include artifacts capable of enhancing our current understanding of workplace behavior, diet, and substance abuse. If the workers lived on-site, residential deposits may illuminate the currently dim portrait of mine workers and their lifestyle.

If a site possesses structures and buildings, detailed examination may reveal how mining companies adapted conventional mining architecture and engineering to South Dakota's industry. Individual systems often lend themselves to detailed studies, and examples include compressed air, steam, hoisting, and ore sorting.

Accessible and intact underground workings are an important source of information because few formal studies have been carried out regarding the underground work environment, engineering, equipment, and practices. Currently, historical references are the principal body of information that researchers rely on for studying the above aspects of mining. Documentation of underground workings will contribute material fact to this arena of inquiry.

In general, large and complex mine sites tend to possess at least one of the information sources noted above and will qualify under Criterion D. Small mine sites, on the other hand, are usually simple, lack buried deposits of substance, and no longer have structures, systems, or buildings.

Property Subtype: Tunnel Mine

Resource Description: Tunnel mines, like shaft mines, were usually company endeavors that produced ore. The difference between the two types of mines, however, is that the company drove a horizontal tunnel to work an ore body. In general, a tunnel was larger than 3 by 6 feet in-the-clear to accommodate traffic and mine utilities. Companies almost always arranged critical surface plant components around the tunnel portal. Large tunnel mines possessed complex, mechanized surface plants with multiple structures, while small operations were simple and may have featured similar facilities to those erected at deep prospects. The presence of an ore bin or sorting house, or the evidence thereof, can distinguish a mine from a deep prospect.

As historic resources, small mines tend to be slightly different from the large sites. In both cases, most are archaeological in nature because the machinery, buildings, and other materials of value were usually salvaged for reuse. The process was usually thorough at the small mines, leaving almost exclusively archaeological features and artifacts. Large mines, in contrast, occasionally retain a few structures and machines, although they too are represented primarily by archaeological features. Mines can be preserved and possess most of their surface plant components, but this is exceptional.

The small mines are limited in size, while the large sites are extensive, have numerous features, and massive waste rock dumps. The features representing the surface plant are clustered around the tunnel, and ancillary facilities may be farther away. A tunnel house often enclosed the shop and compressed air system, if the mine had one. The tunnel house may be represented by a platform or footprint at the tunnel portal, and it will probably feature evidence of the shop. A foundation for a compressor may lie within, as well. If the machinery was powered by steam power, then evidence of a boiler will probably be on the tunnel house platform. Large mines often featured an independent compressor house that also enclosed the boiler. Most mines also had ore bins on the flanks of the waste rock dump, and they often manifest as log piling or cribbing foundations when dismantled. For a detailed list of common surface plant components, see the feature list below.

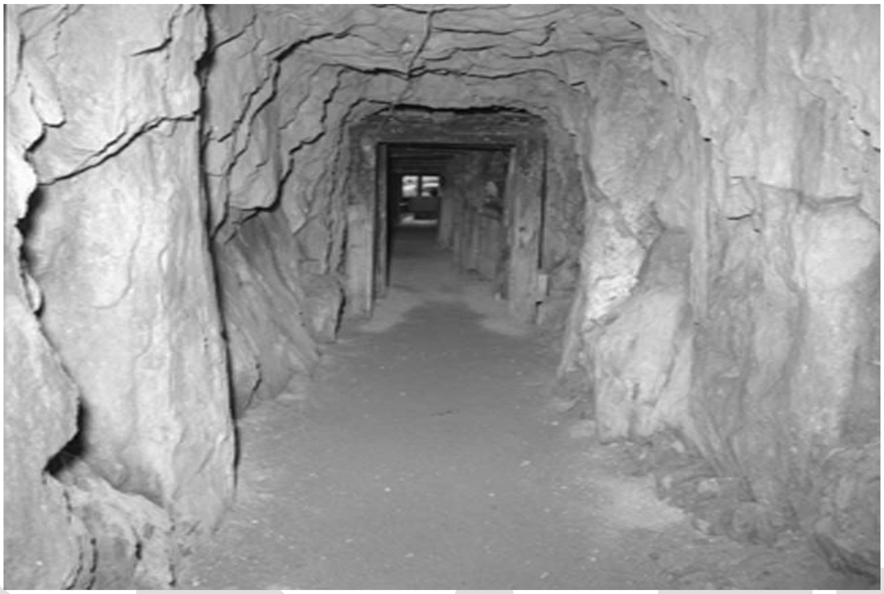


Figure 3.31: Keystone Mine Tunnel. Courtesy South Dakota State Historical Society.

Resource Eligibility: In a broad sense, hardrock mines were important on a statewide level during two lengthy time periods spanning 1874 to around 1920, and from 1933 until 1942. They were also important in specific regions during other times, depending on ore type and local history.

Hardrock mines were important on a statewide level from 1874 to 1880 as a foundation for South Dakota's mining frontier. After 1880, mining evolved into a productive industry that underwrote the economy, drove development, and attracted settlement and business. Although production declined during the 1900s, mining as a statewide industry remained viable until around 1920. Some areas, such as Lead, continued to thrive afterward. The industry resumed its broad significance in 1933 due to a combination of factors. President Franklin Delano Roosevelt increased the prices of gold and silver to levels that interested both investors and local individuals. The unemployed perceived the old mines as sources of income, and were stimulated by the price increases. Both companies and individuals then worked large and small mines alike until 1942. At that time, mobilization for World War II drew off materials and labor, and the Federal government outlawed gold mining.

Tunnel mines are a common resource type, and most sites tend to be incomplete and retain limited integrity. The absence of structures and machinery should in no way be equated with poor integrity. Rather, integrity refers to a site's ability to clearly represent the historic mining operation, as well as the overall resource type. Most mine sites lack structures and machinery because they were removed for reuse, but distinct archaeological evidence can remain. If the assemblage of archaeological features and artifacts is relatively complete, then a site retains integrity on an archaeological level. When the archaeological evidence clearly reflects the mining operation, the content of the surface plant, and timeframe, a tunnel mine can represent its own history, as well as the overall resource type. Integrity at least on an archaeological level is required for eligibility.

Intact buildings, engineered structures, or machinery strengthen a site's eligibility because these are rare and important examples. If a tunnel mine possesses the above but has been otherwise disturbed, it may still be eligible because surviving architecture and engineered aspects are significant. The buildings and engineered aspects must, however, be in their place of use, and the site complete enough to provide physical context.

Many tunnel mines have experienced decay and disturbance in a variety of forms, and the impacts to a site's integrity should be carefully assessed. Natural decay such as heavy erosion, soil creep, and revegetation can destroy important features and bury others. If the tunnel is closed with invasive methods, key features are often lost. Typically, a tunnel mine's most important surface plant components were clustered around the tunnel portal. Bulldozing, property development, and environmental remediation also have a high potential to compromise integrity.

In many cases, productive mines were worked periodically during different periods of time. Each successive operation left its own imprint on a site, erasing aspects of earlier occupation and altering others. Assessing integrity and timeframe can be difficult in such cases. If a site retains a majority of its original aspects, even on an archaeological level, then the site retains integrity relative to its original timeframe. If a subsequent operator added surface facilities, removed others, and left an otherwise heavy imprint, then the site retains integrity relative to that operation. Overall, sites that experienced sequential operations can be representative examples of mines that were worked multiple times.

NRHP Criterion A: Tunnel mines are often associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although reviewed below, the Areas are explained in more detail in Chapter 2.

Tunnel mines that date between 1874 and 1885 participated in the Area of *Exploration/Settlement* as anchors for the mining frontier. The mines were a principal reason behind the exploration, settlement, and development of industry in the Black Hills.

Tunnel mines participated in the Areas of *Commerce* and *Economics* primarily on a local level. The mining companies fostered local commercial systems by paying wages to workers and consuming high volumes of goods. The productive operations also contributed to local economies through their output, and by attracting investment and disbursing the funds.

In the Area of *Industry*, tunnel mines were a foundation of the mining industry on a cumulative basis. That industry was a significant force that shaped history on local, statewide, and national levels. The industry was a major employer, fostered commerce on a broad scale, was a magnet for Euro-American settlement, and influenced politics and government. The industry also produced an enormous amount of gold, as well as silver and industrial metals.

Tunnel mines participated in the Area of *Social History* in several ways. As places of employment, the mines supported populations in areas that Euro-Americans may have otherwise overlooked. In so doing, the mines contributed to the evolution of South Dakota's social geography. In addition, the populations possessed a demography characteristic of Western mining. Individuals were of varying backgrounds, ethnicities, education levels, and socioeconomic status. The boom and bust inherent in the mining industry, including the tunnel operations, required the workers to be mobile, and they spread their traditions as they moved about. As major employers, tunnel mines also contributed to the development of social classes.

NRHP Criterion B: Tunnel mines have a potential for eligibility under Criterion B if an important person was associated with the site. Some mines, especially large complexes, often can be traced to important individuals such as engineers and managers. If the significance is through the person's presence on-site and direct participation in operations, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The individual's role in the operation must be clearly defined, and a brief biography explaining their significance provided. An important person's investment in a property or involvement with a company is too indirect an association for Criterion B. The individual of note must have been present on-site and played a fundamental and direct role in its physical development.

NRHP Criterion C: Sites may be eligible under Criterion C if they are outstanding examples of a typical tunnel mine. Because most equipment and buildings were removed when a mine was abandoned, integrity is usually on an archaeological level. The tunnel, blacksmith shop, ore bin, and other facilities should be represented by features and artifacts. Intact structures and equipment, a high degree of integrity, or character defining engineering or architectural features strengthen a site's potential eligibility. Important engineering and architectural features include intact buildings, structures, machinery, and tunnel portals. The *Engineering* Area of Significance may be applicable to tunnel mines. They often exemplify design and the application of technology and engineering specific to the development of ore formations through horizontal tunnels. If buildings still stand, then the Area of *Architecture* may apply. Buildings represent the adaptation of design, materials, and construction methods typical of the mining industry, and to meet the needs of tunnel operations.

Tunnel mines may be eligible under Criterion C if they are contributing elements of a historic mining landscape. Even when a mine appears unimportant as an individual entity, it may provide context or belong to a greater body of nearby resources representing an area's history.

NRHP Criterion D: Tunnel mines may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. Buried archaeological deposits are a common source of information, and they can manifest as privy pits, thick boiler clinker dumps, and refuse layers in waste rock dumps. Deposits amid a mine's surface plant area may include artifacts capable of enhancing our current understanding of workplace behavior, diet, and substance abuse. If the workers lived on-site, residential deposits may illuminate the currently dim portrait of mine workers and their lifestyle.

If a site possesses structures and buildings, detailed examination may reveal how mining companies adapted conventional mining architecture and engineering to South Dakota's industry. Individual systems often lend themselves to detailed studies, and examples include compressed air, steam, ventilation, and ore sorting.

Accessible and intact underground workings are an important source of information because few formal studies have been carried out regarding the underground work environment, engineering, equipment, and practices. Currently, historical references are the principal body of information that researchers rely on for studying the above aspects of mining. Documentation of underground workings will contribute material fact to this arena of inquiry.

In general, large and complex mine sites tend to possess at least one of the information sources noted above and will qualify under Criterion D. Small mine sites, on the other hand, are usually simple, lack buried deposits of substance, and no longer have structures, systems, or buildings.

Features Common to Hardrock Mine Resources

Mine sites can possess an array of archaeological, engineering, and architectural features representing the surface plant. To help researchers identify and understand the features, their types are listed below according to the common systems that comprised surface plants. Because mines shared many of the same facilities as prospects, the features in common are not repeated below. Instead, the researcher should review Prospect Site Feature Types for complete context.

General Feature Types

Adit: An adit was a horizontal opening usually less than 3 by 6 feet in-the-clear (interior dimensions), while tunnels were larger. Collapsed adits manifest as linear areas of subsidence similar to trenches. Waste rock should be nearby.
Building Platform: A flat area upon which a building of uncertain function stood. The type of building may be determined through artifact analysis.
Cribbing: A latticework of logs usually intended to be filled with waste rock or earth. Some cribbing structures served as retaining walls for platforms and waste rock dumps, while others were foundations for structures.
Explosives Magazine: Organized mining outfits erected magazines to store explosives away from a mine's surface plant. Many magazines were dugouts, some were stout stone structures, and others were no more than small sheds much like doghouses.
Hoist House: See Prospect Feature Types above.
Hoist House Platform: See Prospect Feature Types above.
Hoist House Ruin: See Prospect Feature Types above.
Machine Foundation: A generic term used for a foundation that anchored an unknown type of machine. If the machine type is known, specify. Machine foundations feature anchor bolts and can be of timber, masonry, or concrete.
Mine Track: A rail line that facilitated the movement of ore cars around a mine.
Mine Track Remnant: When a rail line was dismantled, workers often left ties, impressions from ties, portions of rails, and the rail bed.
Pipeline: An assembly of pipes usually intended to carry water. Pipelines should not be confused with compressed air mains, which extended from a compressor into the underground workings.
Pipeline Remnant: When disassembled, pipelines left evidence such as linear depressions, series of footers, and lengths of pipe.
Privy: Most mines of substance featured a privy for the crew's personal use. Privies usually are small frame buildings with a door in the front and a bench inside with one or several cutouts for toilet seats. The buildings were vernacular in construction and stood on foundations of logs, lumber, or rocks over a pit.
Privy Pit: A privy pit was the waste receptacle underneath a privy building. When a pit was full, workers relocated the building, sometimes threw refuse into the depression, and covered it with a cap of earth or waste rock. Pits tend to manifest today as depressions less than 5 feet in diameter, often with artifacts and other materials in their walls and bottoms.
Refuse Dump: A collection of discarded hardware, structural materials, and other items.

Road: Mines required roads so wagons or trucks could deliver supplies and haul off ore. Roads were usually at least 8 feet wide.

Shaft: A vertical or inclined mine opening usually 4 by 8 feet in-the-clear (interior dimensions) or larger. Most shafts at mines were divided into compartments. The largest was the *hoisting compartment* and the smaller, usually less than 3 feet wide, was the *utility compartment*. Highly productive mines may have featured shafts with two hoisting compartments and one utility compartment. Evidence of a double-drum hoist should be associated with a three-compartment shaft. Collapsed shafts manifest as funnels of subsidence.

Shaft House: A shaft house was a large building that enclosed the shaft collar, the hoisting system, and usually a shop. Large shaft houses may have also encompassed an air compressor. Mine tracks extended away from the shaft and passed out of the building.

Like typical mine buildings, shaft houses were vernacular in design and construction. They had no recognized architectural style, were assembled from available materials, and were built for function. Although each was unique, they were based on a handful of forms conventional to the mining industry. The most basic was rectangular in footprint with a front-gabled or shed roof and a cupola for the headframe. Large shaft houses may have been L-shaped, cross in plan, or possessed multiple extensions. The roof was highest over the headframe and sloped down toward the hoist. Logs were commonly used for small buildings prior to 1890, and lumber for large shaft houses as early as 1880.

Shaft House Platform: Shaft houses usually stood on leveled platforms of earth or waste rock. When dismantled, shaft houses left distinct footprints surrounding evidence of the hoist, boiler, and shop. Differences in soil types and consistencies can reflect a shaft house's footprint. Large shaft houses often stood on rock foundations that can define the structure's perimeter.

Shaft House Ruin: The collapsed remains of a shaft house.

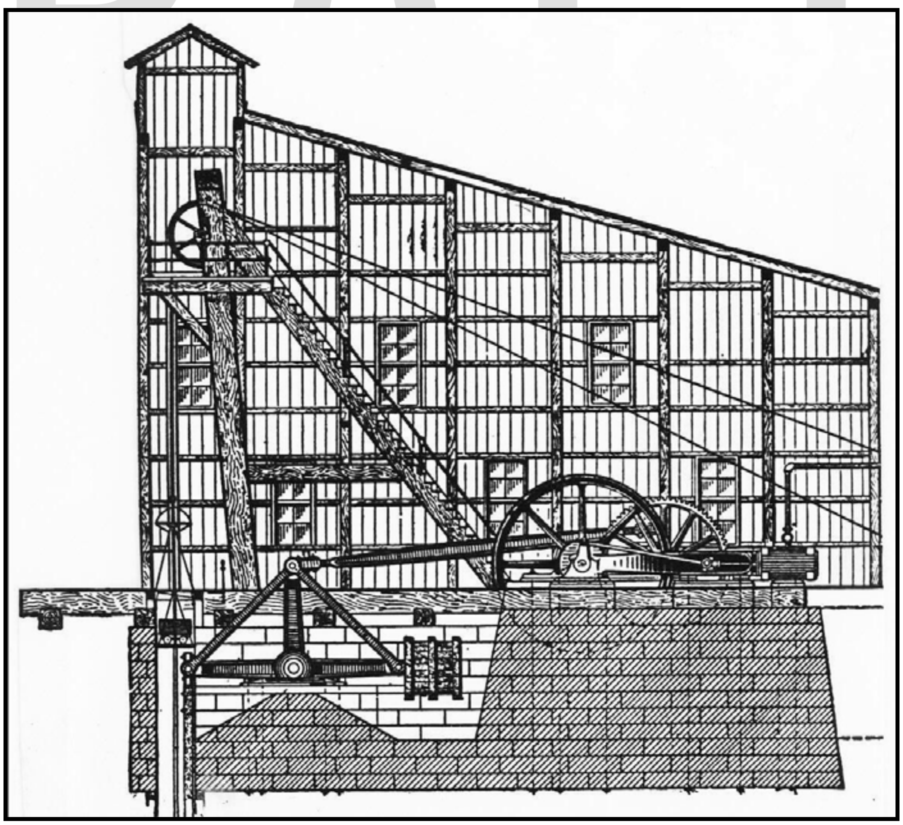


Figure 3.32: Shaft houses enclosed the shaft collar, headframe, hoist, power system, and usually the blacksmith shop. The shaft house in the profile also features a Cornish pump and steam engine. Source: International Textbook Company, 1899, A43:3.

Figure 3.33: In this hoist house example dating to the 1930s, the left roofline features an angled cupola for the hoist cable, which ascended to a headframe left and out of view. Source: Eric Twitty.

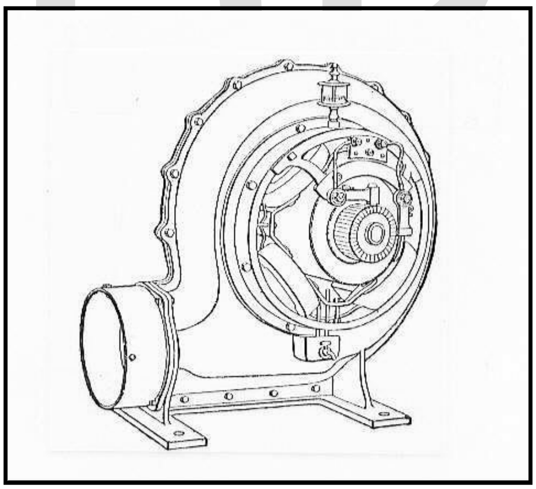
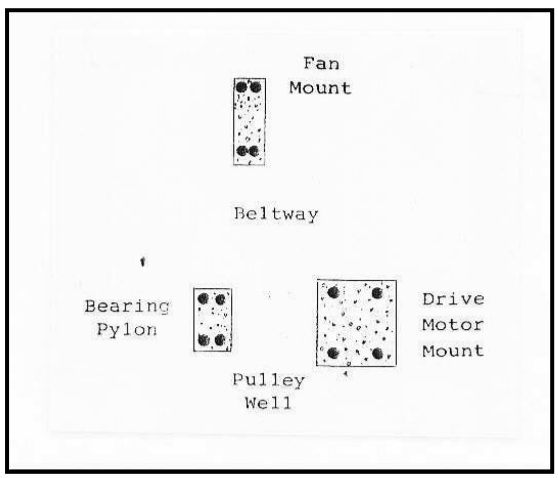


Figure 3.34: At left is a common ventilation blower used to force fresh air underground. Ducting was fastened to the nozzle, and a belt turned the machine. Source: International Text Book Company, 1899, A41:146.

Figure 3.35: The plan view at right depicts a typical concrete foundation for a ventilation blower and its drive motor. Source: Eric Twitty.



Stable: Prior to the 1920s, mining companies relied on draft animals for both underground and surface transportation. The companies erected stables to house the animals, and the buildings were often crude, low, and erected on poorly leveled ground. Distinguishing characteristics include wide doorways, feed mangers, and oat boxes.
Stable Ruin: The collapsed remnants of a stable.
Timber Dressing Station: Timber dressing stations were work areas where miners reduced logs into timbers for underground support. Most stations were outdoors near the mine opening, and they tend to be represented by collections of raw logs and numerous cut wood scraps. Some were within the shaft house or tunnel house.
Timber Stockpile: Mining companies often stockpiled support timbers near the mine opening. Mine timbers are usually 4 to 6 feet long and notched at both ends.
Trestle: A frame structure that supported a mine track, walkway, or pipeline. The most common trestles were short, perched on the shoulder of a waste rock dump, and supported a dead-end rail spur for emptying ore cars. A trestle's structural components included vertical piers or pilings, horizontal stringers, and plank decking.
Trestle Remnant: When dismantled, trestles usually left a series of pilings, individual posts, and stringers. Most were logs.
Tunnel: A tunnel was a horizontal entry underground 3 by 6 feet in-the-clear (interior dimensions) or larger. Collapsed tunnels often manifest as linear areas of subsidence, possibly with pipes or rails projecting outward.
Tunnel House: A tunnel house was a building that enclosed the tunnel portal, a shop, and a ventilation blower. A mine track, and sometimes a trench or flume to divert drainage water, passed through the building. Large tunnel houses may have also encompassed an air compressor and timber dressing station.

Like other mine buildings, tunnel houses were vernacular in design and construction. They had no recognized architectural style, were assembled from available materials, and were built for function. Although each was unique, they were based on a handful of forms conventional to the mining industry. The most basic was a rectangular footprint with a gabled or shed roof. Large tunnel houses may have been L-shaped or possessed several extensions for the shop and machinery. In general, logs were commonly used prior to 1890, and lumber as early as 1880.
Tunnel House Platform: Tunnel houses commonly stood on cut-and-fill platforms graded at the tunnel portal. Large versions often had rock or concrete foundations. The platform or foundation, as well as differences in soil types and consistencies, can reflect the building's footprint. Artifacts and machine foundations can reveal the types of facilities that the building enclosed.
Tunnel House Ruin: The collapsed remains of a tunnel house.
Utility Pole: A pole that supported an electrical or communication line.
Ventilation Blower: Many mining operations employed ventilation blowers to force fresh air underground. They usually located the blower adjacent to the mine opening and an assemblage of ventilation tubes carried the air underground. Two types of blowers proved popular. The *propeller fan* was similar to an enlarged household fan and was encased in a sheet iron shroud with a port for ventilation tubes. The *centrifugal blower*, by far the most popular, can be subdivided into two categories. The first was boxy and featured a ring of vanes in a sheet iron shroud, and the second was curvaceous, thin, and encased in a cast iron shroud. Large blowers had to be anchored to foundations, and as most were belt-driven, they featured an adjacent motor or steam engine.
Ventilation Blower Foundation: Large blowers were anchored to simple foundations usually consisting of timbers embedded in the ground adjacent to the mine opening. The foundations tend to be 3 by 4 feet in area or less and feature four anchor bolts. A motor or small steam engine that powered the blower was usually bolted to an adjacent foundation.

Compressed Air System Feature Types

Air Compressor: An air compressor was a machine that compressed air to power rockdrills underground. Mining companies employed a variety of types that rose and fell in popularity between the 1870s and 1940s. The types are noted below in chronological order. Most compressors predating 1900 were steam-driven, and in later years they were often belted to electric motors or gasoline engines. Nearly all belt-driven compressors featured a motor directly aligned with the flywheel. As a general rule, existing compressors are rare and important engineering features.

Straight-line steam compressors were the earliest and simplest type, and they were introduced during the 1870s and fell out of favor by the 1910s. Most straight-line steam compressors featured a compression cylinder at one end, and a steam cylinder and flywheel at the opposite end. The components were integral with or assembled to a large cast iron body bolted to a foundation. Small units were 2 feet wide and 7 feet long. Large units were up to 5 feet wide and 14 feet long, and often featured an outboard flywheel bearing mounted to a separate pylon.

Duplex steam compressors produced a greater volume of air for large mining operations. Those predating 1900 were basically parallel straight-line units shafted to a common flywheel in between. Some models featured one small and one large compression cylinder that provided compound compression. These machines ranged in size from 7 by 14 feet up to 17 by 35 feet in area. During the late 1890s, manufacturers introduced a compact unit with a flywheel near center and the components bolted to a U-shaped cast iron bedplate. Sizes ranged from 5 by 8 to 17 by 38 feet in area.

Straight-line belt-driven compressors relied on an electric motor for power, transferred via a belt. Models predating 1910 were similar to their steam-driven brethren, except they featured a broad flywheel for the belt. The early units were never popular, but some mining companies with electric power used them. A small model saw heavy use from the 1910s into the 1940s where air needs were limited. These units ranged in size from 2 by 5 feet to 4 by 9 feet in area. Researchers are likely to encounter the small belt-driven compressors at mines active during the 1920s or later.

The *duplex belt-driven compressor* may have been the most widely used model from the 1910s through the 1950s. The machine was U-shaped and featured compression cylinders on the outside and a flywheel near center. A belt passed around the flywheel to a motor anchored at the open end of the U. Machinery manufacturers introduced the model during the late 1890s, and because it required a motor, it saw little use until electricity was available. Most range in size from 5 by 6 feet to 10 by 14 feet in area.

The *petroleum compressor* was introduced during the late 1890s as an alternative to steam models. The type consisted of a straight-line compression cylinder shafted to a petroleum engine. Sizes were similar to the small belt-driven compressors. The machines were popular at remote mines between the 1910s and 1930s because they ran on gasoline, which was easier to haul than a boiler and its fuel.

The *upright compressor* featured two vertical compression cylinders bolted to a subframe. These machines were usually powered either by a gasoline engine or motor, and were rarely larger than several feet in area. Like the petroleum compressors, upright models saw popularity at small, remote mines between the 1910s and 1930s.

The *V-cylinder compressor*, introduced during the 1930s, was based on the mechanics of the automobile engine. V-cylinder compressors featured a crankcase, several cylinders on top, and a radiator to dissipate heat. Small units possessed only several cylinders while large models had up to twelve, and most were belt-driven.

<u>*Air Compressor Foundation:*</u> Because of their great weight and powerful motion, air compressors had to be anchored to solid foundations. Compressors were usually removed when a mine closed, leaving the foundation as the only evidence of the apparatus. Workers often constructed timber foundations for small compressors and used either rock or brick masonry, or concrete, for large models. Based on a foundation's footprint, the researcher can often determine the exact type of compressor.

Straight-line steam compressors were usually anchored to foundations with a rectangular footprint and a flat surface studded with two rows of anchor bolts. In general, workers bolted some machines less than 12 feet long to timber foundations, and otherwise used masonry or concrete. Foundations for large compressors often featured individual blocks for the steam and compression cylinders, and a separate pedestal for an outboard flywheel bearing. Of note, foundations for straight-line compressors can appear similar to those for steam engines, which were heavily employed at concentration mills.

Foundations for *duplex steam compressors* manufactured between the 1870s and 1890s consist of a pair of elongated pads several feet apart. Workers almost always used masonry or concrete, and both pads will feature a symmetrical arrangement of anchor bolts. Foundations for large machines often featured individual stone blocks for the steam and compression cylinders, and the flywheel, which rotated in the gap between. Pipes for the steam and compressed air may project out of the ground adjacent to the foundation. The smaller, compact duplex compressors introduced during the late 1890s were bolted to distinct foundations that are U-shaped, slightly rectangular, and several feet high.

Straight-line belt-driven compressor foundations are similar to those for steam-driven versions but often feature a separate pylon at one end for the flywheel's outboard bearing. A second, rectangular foundation for the drive motor, usually 3 by 3 feet in area or less, should be aligned with the pylon. Compact *duplex belt-driven compressors* were bolted to the same U-shaped foundations as their steam-driven cousins. A small, rectangular foundation for the drive motor should be directly aligned with the open end of the U. Due to severe vibrations, *petroleum compressors* were usually bolted to stout concrete foundations often several feet high. The foundation is almost always rectangular, several feet wide, less than 9 feet long, and features two rows of anchor bolts. *Upright compressors*, small in size, could have been bolted to either timber or concrete foundations rectangular in footprint. A pad for the engine or motor should be adjacent. Foundations for *V-cylinder compressors* tend to be distinct and feature an adjacent mount for a motor or engine. Compressors with several cylinders were bolted to rectangular foundations between 3 by 3 and 4 by 5 feet in area. The foundations for machines with numerous cylinders were several feet wide and up to 10 feet long. Workers often constructed the foundations with a series of closely spaced timbers on an underlying concrete pad or buried timber footers.

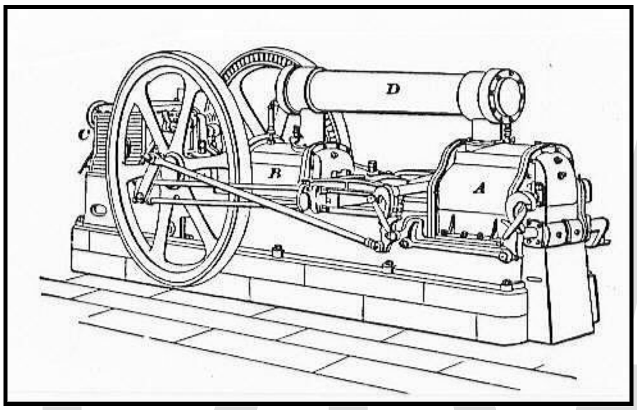


Figure 3.36: The line drawing depicts a straight-line steam compressor that provided two stages of compression. One compression cylinder is at right, another is at center, and the steam drive cylinder is at left. The flywheels imparted momentum to the machine. Source: International Textbook Company, 1899, A20:32.

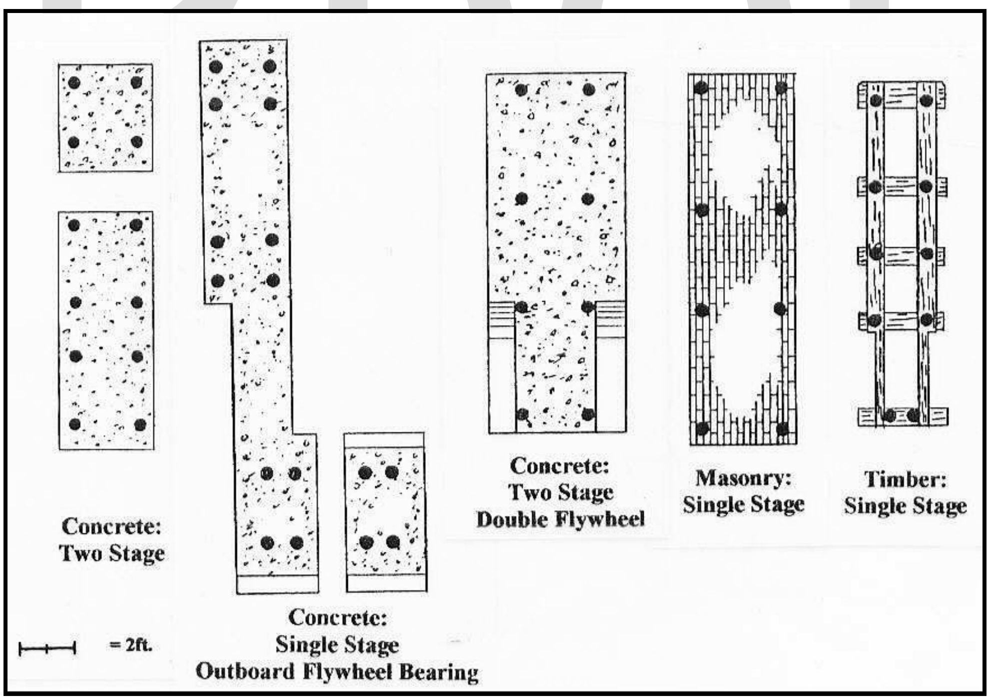


Figure 3.37: The plan view depicts foundations for straight-line compressors. Source: Twitty, 2002:145.

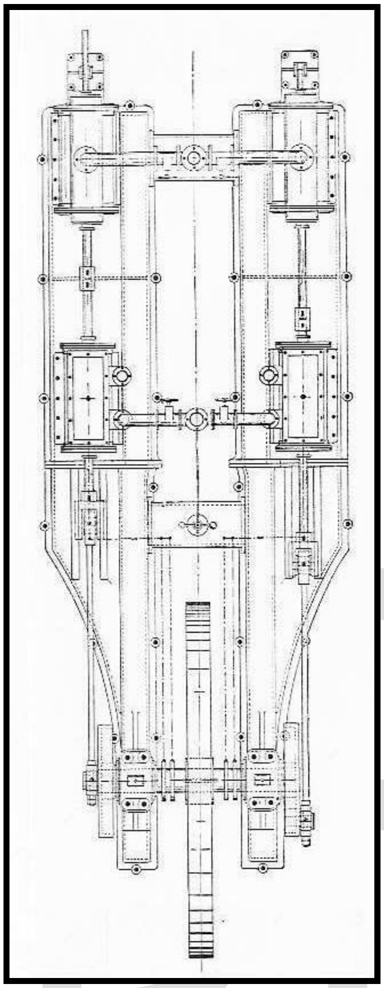
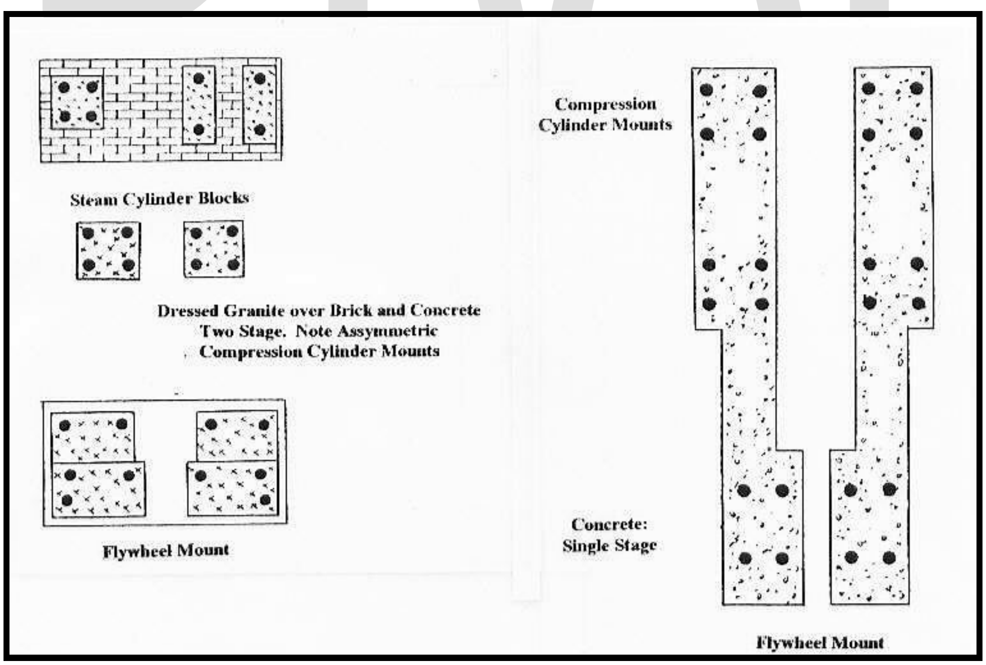


Figure 3.38: The plan view shows a typical pre-1910 duplex steam compressor. The compression cylinders are at top, the steam drive cylinders are at center, and the flywheel is at bottom. Source: Ingersoll Rock Drill Company, 1887:34.

Figure 3.39: The plan view below portrays two common foundations for duplex steam compressors. The foundation at right was for a machine like the one in Figure 3.22, and the foundation at left anchored a compressor with compound action. Source: Twitty, 2002:108.



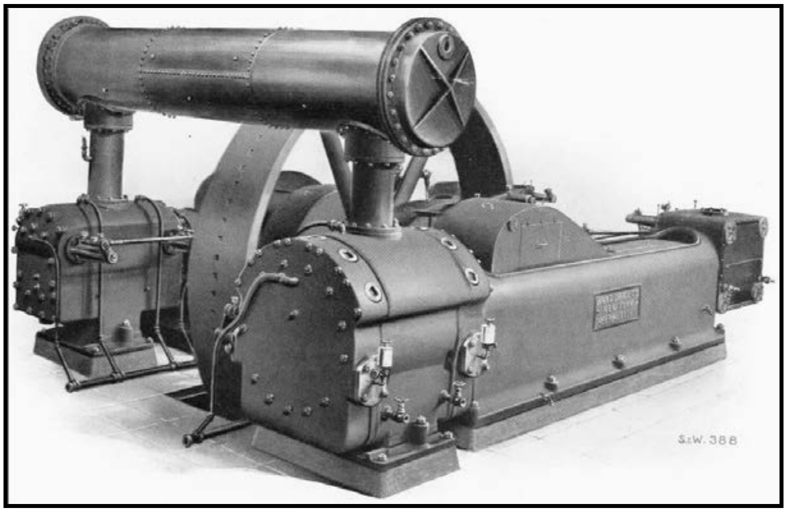


Figure 3.40: During the 1890s, the above form of duplex compressor became popular. Originally, these machines were powered by steam, and by the 1900s, some were also belted to motors where electricity was available. Source: Rand Drill Company, 1904:12.

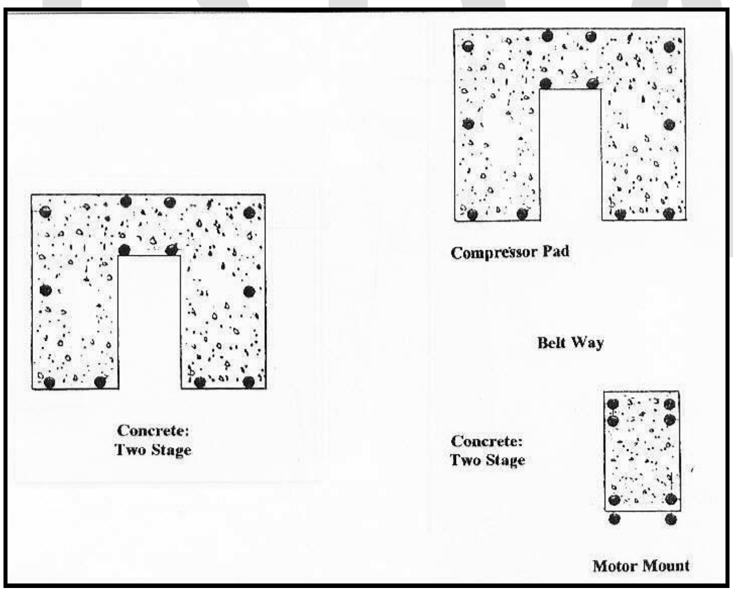


Figure 3.41: Compact duplex compressors were mounted to foundations like those in the above plan view. The foundation at left anchored a steam-powered unit, and the one at right was for a belted version, which became popular by the 1910s. Source: Twitty, 2002:109.

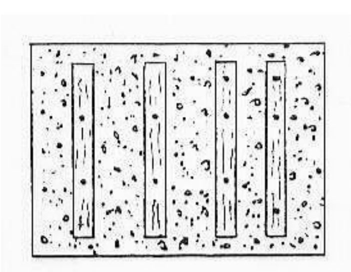


Figure 3.42: The illustration at left is a plan view for a V-cylinder compressor foundation (see Figure 3.35). Timber footers are embedded in a concrete rectangle around 3 by 4 feet in area. Source: Eric Twitty.

Figure 3.43: The V-cylinder compressor, similar to a large engine, became one of the most popular compressor types during the 1930s. Note the foundation. Source: Twitty, 2002:274.

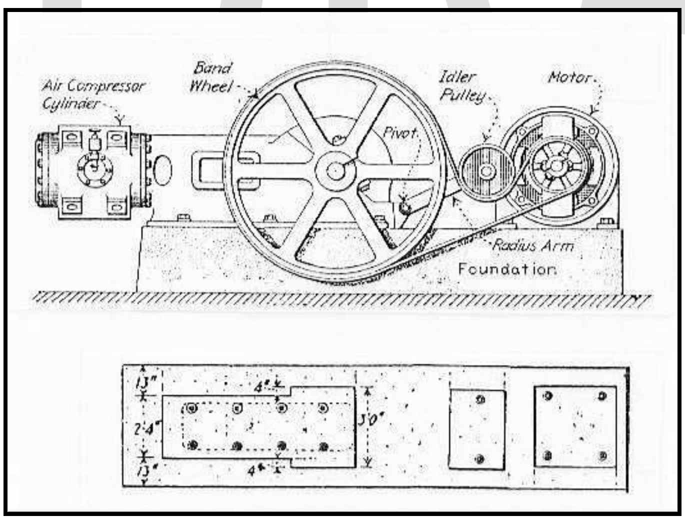


Figure 3.44: The profile illustrates the type of small, belted compressor popular between the 1910s and 1940s. The plan view shows the foundation, which features mounts for the compressor and motor. Source: Eric Twitty.

Compressed Air Main: A pipeline that carried air from a compressor into the underground workings.
Compressor House: Limited primarily to large mines, a compressor house enclosed an air compressor and its receiving tank. If the compressor was steam-driven, then the building also usually enclosed the boiler. The buildings were vernacular in design and appearance.
Compressor House Platform: Compressor houses stood on platforms graded with waste rock or cut-and-fill methods. The platform should feature a compressor foundation, a motor mount or boiler setting ruin, and an artifact assemblage consisting of machine parts and pipe fittings.
Compressor House Ruin: The collapsed remains of a compressor house.

Hoisting System Feature Types

Headframe: Mining operations erected four general types of headframes to meet the needs of ore production. The first is an enlarged version of the two-post gallows discussed above with Prospect Shafts. The second was a *four post derrick* consisting of four posts joined with cross-braces and diagonal beams, all supported by two backbraces. The third is the *six post derrick*, which featured six posts instead of four. The last is a large *A frame*. Production-class headframes were more than 30 feet high and stood on well-built foundations.

Headframe Foundation: Production-class headframes required solid foundations surrounding the shaft. The foundations were usually buried with waste rock ballast for stability and hence were embedded in the ground. Several structures were common. One was a squat timber frame, and the other was carefully leveled log cribbing. Concrete was occasionally used. The headframe was fastened to timber footers extending toward the hoist. The foundation's length usually equaled the headframe's height.

Headframe Ruin: The collapsed remnants of a headframe.

Hoist: Companies almost always employed power hoists at shaft mines to meet the needs of ore production. At small mines, the companies installed the same types and sizes of hoists as discussed above with prospects. However, moderate and large-scale operations sought machines that could raise more tonnages from greater depths.

Single-drum steam models were the most common hoists until the 1910s, when *single-drum electric* units became popular. Production-class models ranged in size from 6 by 6 feet to around 11 by 12 feet in area.

Direct-drive single-drum hoists were installed by some well-capitalized companies because of their superior power and depth capacity. These hoists consisted of two parallel steam cylinders at one end, a large cable drum at the other end, and heavy drive rods to turn the drum. Linkages for a power-assist clutch and brake were in a pit near center. Because of their rarity, few of these hoists survive today.

Double-drum steam hoists were used to operate two hoisting vehicles in balance. These apparatuses can be divided into two classes, both of which were employed for heavy production. The first is a *double-drum geared steam hoist*, which featured a power train similar to the single-drum version described with prospects. By the 1910s, models with separate electric motors became popular, and they were known as *double-drum geared electric hoists*.

The second is the *direct-drive double-drum steam hoist*. These hoists were enormous and complex, and were hallmarks of heavy production. They consisted of two powerful steam cylinders flanking a pair of large cable drums. Heavy drive rods supported by intermediate bearings turned the drums. Due to their great weight, the working components had to be bolted to massive stone blocks. Deep wells between the blocks provided clearance for the drums, as well as cylinders for a power-assist clutch and brakes. When the era of steam ended during the 1910s, these titanic hoists, between 18 by 25 and 30 by 40 feet in area, became obsolete.

Hoist Foundation: Few shaft mines retain their hoists today and instead feature only the foundations. The researcher can often determine a type of hoist based on the foundation footprint.

Foundations for production-class *single-drum steam hoists* and *single-drum electric hoists* tend to be slightly rectangular and flat, feature at least six anchor bolts around the outside, and usually consist of concrete or masonry. Some foundations greater than 8 by 8 feet in area may feature a depressed center for the cable drum.

Direct-drive single-drum hoists were usually bolted to complex foundations that anchored the machines' individual components. The typical foundation usually consists of two parallel masonry footers capped with dressed sandstone or granite blocks. The blocks toward the rear supported the steam cylinders, the blocks toward the front supported the cable drum's bearings, and all feature heavy anchor bolts. The power-assist cylinders for the clutch and brake were anchored to small bolts between the footers. Usually, steam pipes project out of the ground near the foundation's rear. Foundations are rarely larger than 14 by 19 feet in area.[9]

Foundations for *double-drum geared steam hoists* tend to be elongated but oriented 90 degrees to the shaft. They usually consist of concrete or masonry, feature a perimeter of anchor bolts, and wells for the cable drums. Small anchor bolts on the edges of the drum wells often braced brake shoes. *Double-*

[9] Twitty, 2002:240.

drum geared electric hoists were bolted to foundations similar to those for their steam-driven counterparts. The principal difference is a separate mount for the electric motor.

Foundations for *direct-drive double-drum steam hoists* are enlarged versions of those for the single-drum type. The foundation features a broad masonry footing with dual wells for the cable drums, and a depression or platform behind for the power-assist clutch and brake cylinders. Two clusters of dressed sandstone or granite blocks for the drum bearings stand on both sides of the wells and one stands between. Clusters of blocks stand at the foundation's rear, and they supported the steam cylinders. Parallel rows of blocks that supported the drive rods should extend along the foundation's sides.

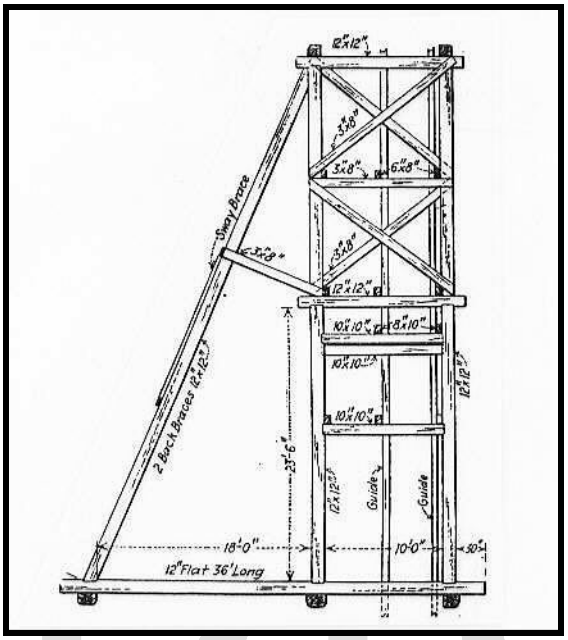


Figure 3.45: The headframe at left is a four-post derrick type. Production-class headframes such as the one illustrated tend to be higher than 25 feet. Source: *Engineering & Mining Journal* 12/28/17 p1216.

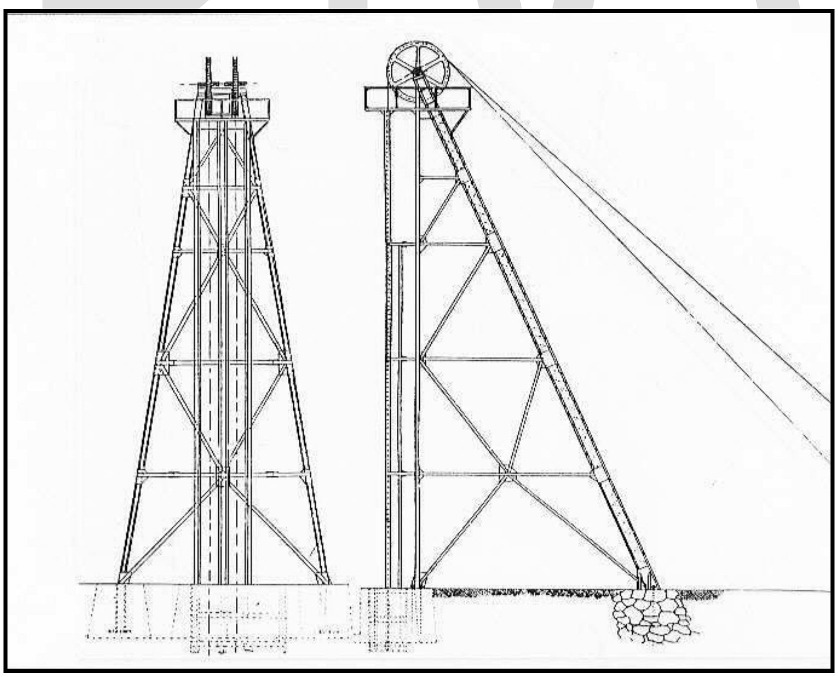


Figure 3.46: The illustrated headframe is a production-class two-post gallows structure known as a Montana type. These headframes were usually tall, well-built, and stood over deep shafts. Source: Twitty, 2002:233.

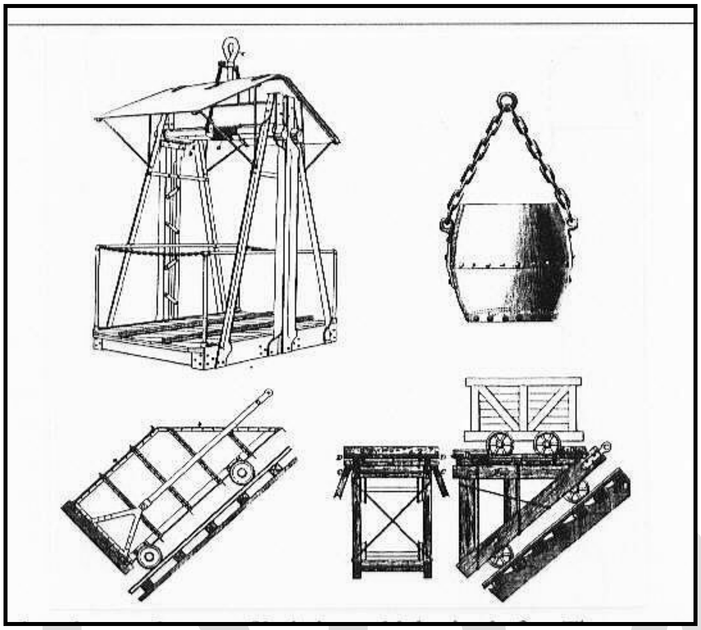


Figure 3.47: Mining companies employed several types of hoisting vehicles in shafts. The cage at upper left, popular from the 1870s through the 1930s, ran on guide rails and carried miners or an ore car. The sinking bucket at upper right required no rails and was common among small operations. The skip at lower left was popular in both vertical and inclined shafts by the 1900s. It ran on rails and required guides in the headframe to empty. At lower right is a vehicle for inclined shafts that became obsolete by the 1900s. Source: Twitty: 2002:151.

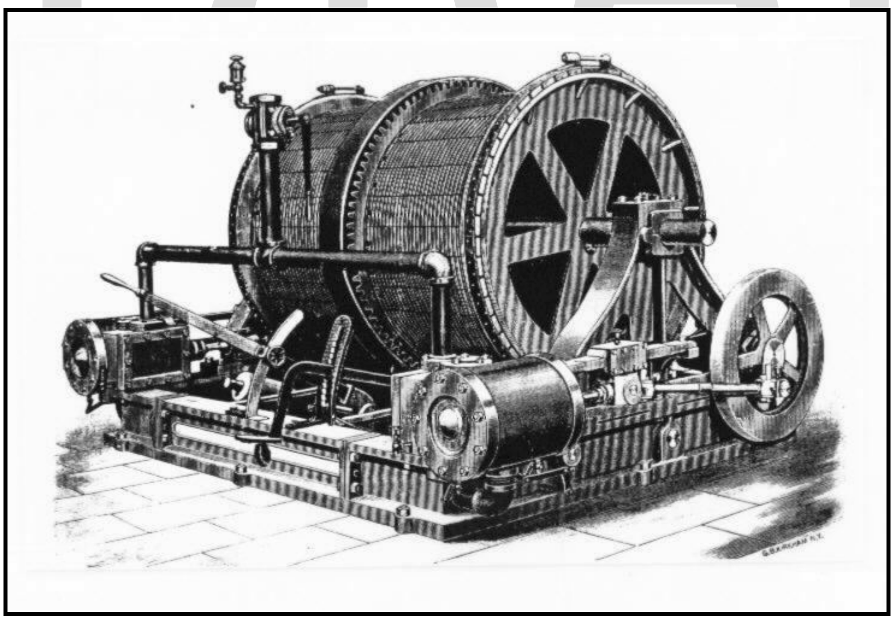


Figure 3.48: Rear quarterview of a geared double-drum steam hoist. Double-drum hoists, hallmarks of significant ore production, achieved balanced hoisting with two vehicles. Source: Ingersoll Rock Drill Company, 1887:65.

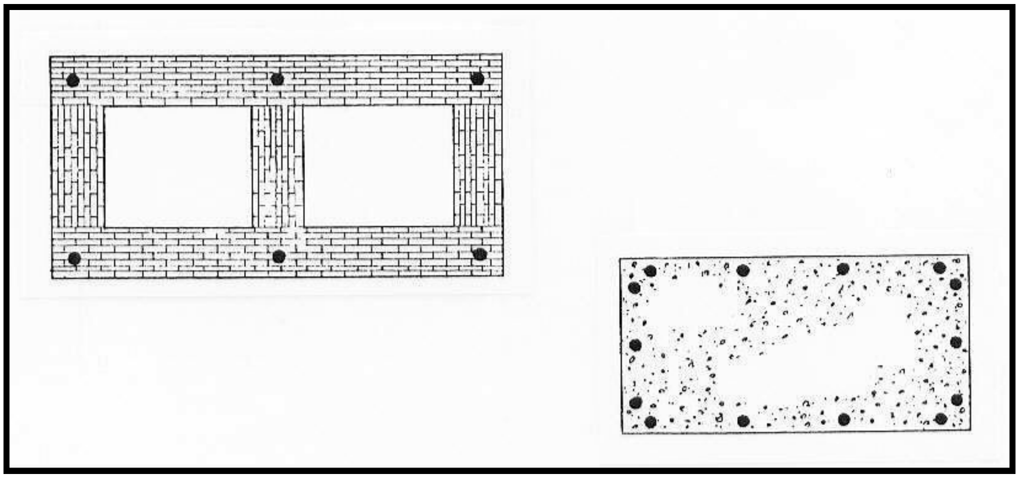


Figure 3.49: The plan views depict foundations for geared double-drum steam hoists. The foundation at left features wells for the hoist's cable drums. Source: Twitty, 2002:242.

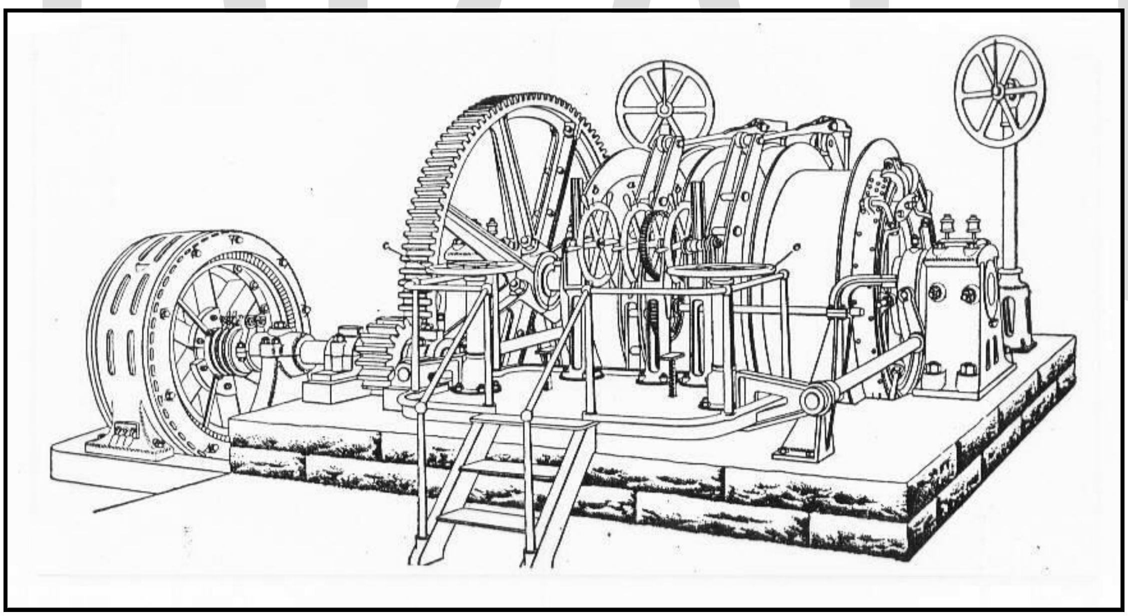


Figure 3.50: Rear quarterview of a double-drum electric hoist. The motor at left drove the dual cable drums via the large bull gear. Such hoists facilitated heavy production, saw use after the 1910s, and were popular among well-capitalized companies by the 1930s. Note the foundation. Source: International Textbook Company, 1906, A50:40.

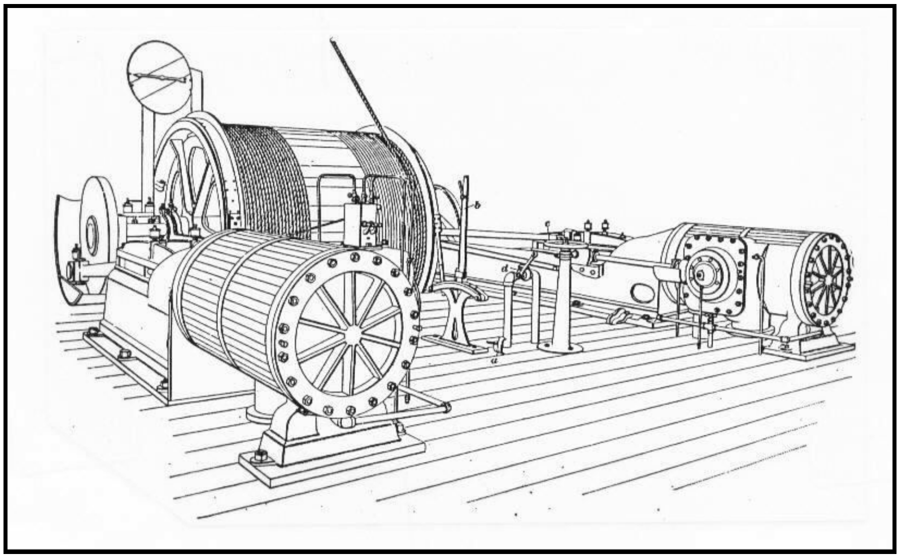


Figure 3.51: Rear quarterview of a direct-drive single-drum steam hoist. Powerful steam cylinders flank the hoist's controls, and the drive-rods are directly coupled to the cable drum. Source: International Text Book Company, 1906, A50:16.

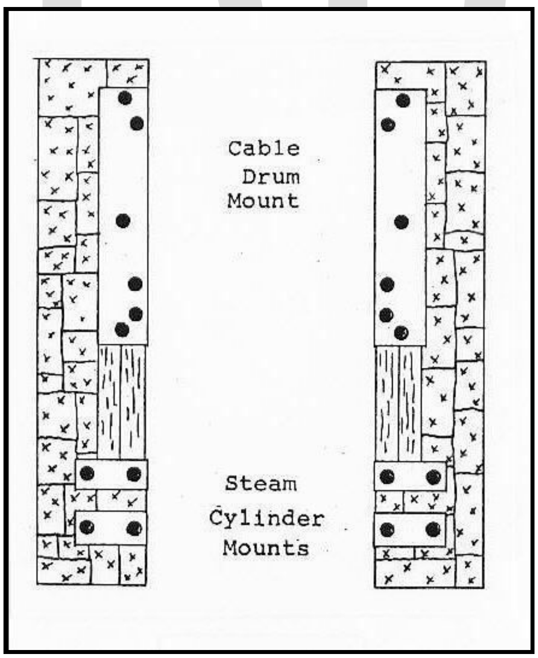


Figure 3.52: The plan view depicts a typical foundation for a direct-drive single-drum steam hoist. Such foundations are usually less than 14 by 17 feet in area. Source: Twitty, 2002:241.

Power System Feature Types

Boiler: From the beginning of mining in South Dakota through the 1910s, most mining machinery was powered by steam. Boilers generated the steam, and mining companies relied on two categories depending on the size and sophistication of the operation. Many small companies employed the same temporary-class portable boilers as the prospect outfits. Their needs were simple, they had little capital to spend, and the machinery was light in duty. The portable boilers are described above with the prospect feature types.

Mining companies wishing for an efficient source of steam installed stationary production-class boilers. The *return-tube boiler* was the universal type and literally powered most forms of industry. In general structure, the return-tube boiler consisted of a riveted plate iron shell over a masonry setting. The shell was horizontal, had numerous flue tubes, and either rested on the masonry setting or stood on posts. The boiler's front featured a cast iron façade that enshrouded a firebox underneath the shell. The façade had a large upper door so workers could swab out the flue tubes, and lower doors to feed the fire and remove ash. A smoke chamber encased in masonry was at the rear of the boiler, and a smokestack was over, but sealed from, the firebox.

The design provided the fire and its flue gases every opportunity to transfer their heat to the shell and covert the water into steam. By adjusting dampers and air ports, the boiler tender brought flames in the firebox to great heat. The flue gases left the firebox, traveled underneath the shell's bottom, rose into the smoke chamber at the rear, returned to the front through the flue tubes in the shell, and then exited the smokestack over the firebox.

Return-tube boilers came in a variety of sizes, and mining companies chose the one that fulfilled their expected demand. Small shells, rarely used, were as little as 2 feet in diameter and 6 feet long, and large shells were 7 feet in diameter and 20 feet long. Common units were around 5 feet in diameter and 16 feet long. The publications listed at the end of this context provide constants regarding boiler size, horsepower, and compatible mining machinery.

When a mine closed, the boiler hardware was usually salvaged for reuse, leaving the masonry setting. For a researcher to record a feature as a return-tube boiler, it must possess the shell and hardware. If only the masonry is left, then it should be recorded as a *Boiler Setting Ruin*. The researcher can determine the size of shell, and hence its horsepower, by measuring the setting. As a general rule, the setting was 3 feet wider and 3 feet longer than the boiler shell.

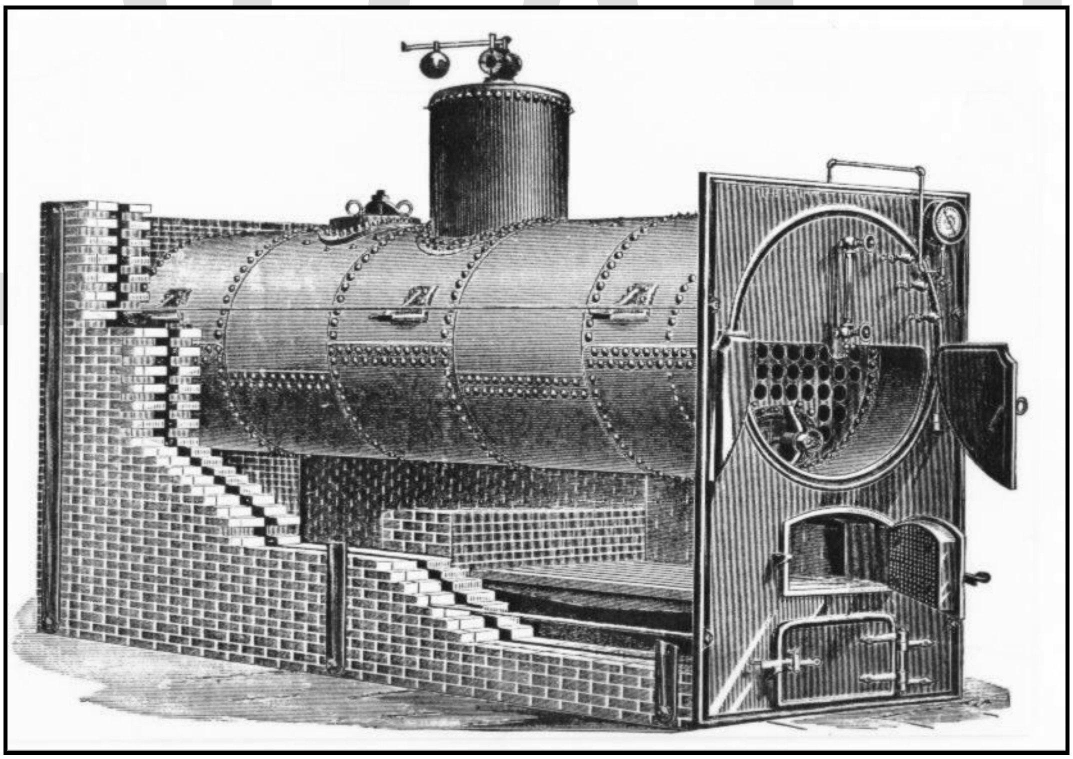


Figure 3.53: The return-tube boiler was the most popular industrial steam generator prior to the widespread embrace of electricity. The unit consisted of an iron shell, a masonry setting, and a cast iron façade. Flue gases traveled from the firebox behind the façade and under the shell. The gases rose into a smoke chamber at rear, reversed direction and returned through the flue tubes perforating the shell, and escaped out a smokestack over the façade. The top doors permitted workers to swab out the flue tubes. Source: Rand Drill Company, 1886:44.

<u>*Boiler Foundation:*</u> Boilers were usually dismantled when a mine closed, and in some cases, the masonry setting was removed as well. Distinct pads and footers may remain, and the type of boiler can be determined from this foundation. Artifacts such as ash, clinker, and scorched rocks and bricks are usually associated with boiler foundations. When portions of the setting remain, the researcher should record them as a *Boiler Setting Ruin*, discussed below.

Portable boilers left the most elementary foundations. Vertical boilers stood on dry-laid brick or stone pads, and workers arranged rock alignments for the skids of locomotive units. Some locomotive boilers lacked skids and instead were supported by simple rock or brick pylons, discussed above under prospects.

Typical return-tube boiler foundations were, flat, rectangular, and around 10 by 22 feet in area. Workers usually used rocks, although well-funded companies substituted bricks. In many cases a foundation may still retain the *bridge-wall*, which was a low row of bricks that forced flue gases against the boiler's belly. When visible, the bridge-wall crosses the foundation near its center.

<u>*Boiler Setting Ruin:*</u> When workers dismantled return-tube boilers, they almost always left the masonry setting. The structure rarely remained intact, however, and collapsed to some degree, becoming a *boiler setting ruin*. Collapsed settings range in appearance from mostly intact walls to mere piles of rubble. With some examination, the researcher may be able to determine the boiler type and location of the firebox. If the walls are intact, a ruin may feature the masonry bolts that anchored the façade, and the posts that supported the boiler shell. Most setting ruins also feature a bridge-wall, which was a low brick divider between the firebox and the smoke chamber. The wall forced flue gases up against the boiler's belly. Most return-tube boiler settings consisted of common bricks or rocks, and they featured cleaning ports near ground-level. Well-capitalized companies often lined fireboxes with fire bricks.

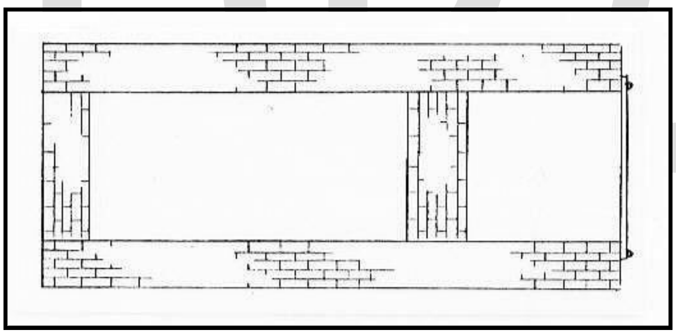


Figure 3.54: Few return-tube boilers currently remain intact and have been reduced to setting remnants and foundations, such as the one in the plan view. Source: Twitty, 2002:145.

<u>*Boiler Clinker Dump:*</u> Sustained operation of a boiler generated burned slate, ash, and clinker, a waste residue of scorious clasts. When workers shoveled the material out of a boiler's firebox, they usually deposited it on the waste rock dump near the boiler.

<u>*Motor:*</u> During the 1910s, mining companies with electric service began to replace steam machinery with motors. The common motor consisted of a cylindrical body, a belt pulley, and electrical wiring. Most motors were less than 4 by 5 feet in area.

<u>*Motor Foundation:*</u> Due to great weight and stresses created by motion, workers anchored motors to stout concrete foundations usually less than 4 by 5 feet in area. Foundations tend to be slightly rectangular, feature four to six anchor bolts, and are aligned with the machine that the motor powered.

<u>*Transformer House:*</u> Companies that employed electricity for lighting and power often erected transformer houses to shelter electrical equipment. They usually located the buildings away from the rest of the surface plant in case of fire. Transformer houses are relatively small, rarely exceeding 30 by 30 feet in area, and usually feature brackets and mounts on posts for the transformers, as well as ports in the walls and numerous insulators for wires. Construction is vernacular, and form may be shed or gabled.

<u>*Transformer House Platform:*</u> Workers usually erected transformer houses on cut-and-fill platforms that possess telltale artifact assemblages of electrical items. Examples include cast iron transformer cases, porcelain or slate switch panel fragments, fuses, porcelain insulators, high-voltage porcelain insulators, glass insulators, and wires.

<u>*Transformer House Ruin:*</u> The collapsed remnants of a transformer house.

Ore Storage and Processing Feature Types

Ore Bin: Mining outfits erected ore bins to store payrock for shipment. Ore bins could be of the sloped-floor variety or open, flat-bottom structures. *Flat-bottom bins* usually consisted of plank walls and a plank floor nailed to joists, all assembled on a flat platform. Large bins often featured a gate through which workers unloaded ore into an adjacent wagon or truck. *Sloped-floor bins* possessed a floor often with a pitch of 45 degrees, and they usually stood on foundations of log cribbing and posts. Large bins may have featured multiple cells for different grades of ore, and chutes projecting out of the front so workers could discharge the contents into wagons or trucks.

Ore Bin Platform or Foundation: A platform or foundation that supported an ore bin. Open, flat-bottom bins usually stood on a platform located on the flank of a waste rock dump so workers could input payrock from an ore car. Sloped-floor bins usually stood on a combination of a platform, which supported the bin's head, and log or timber pilings that supported the remainder.

Ore Bin Ruin: The collapsed or partial remnants of an ore bin.

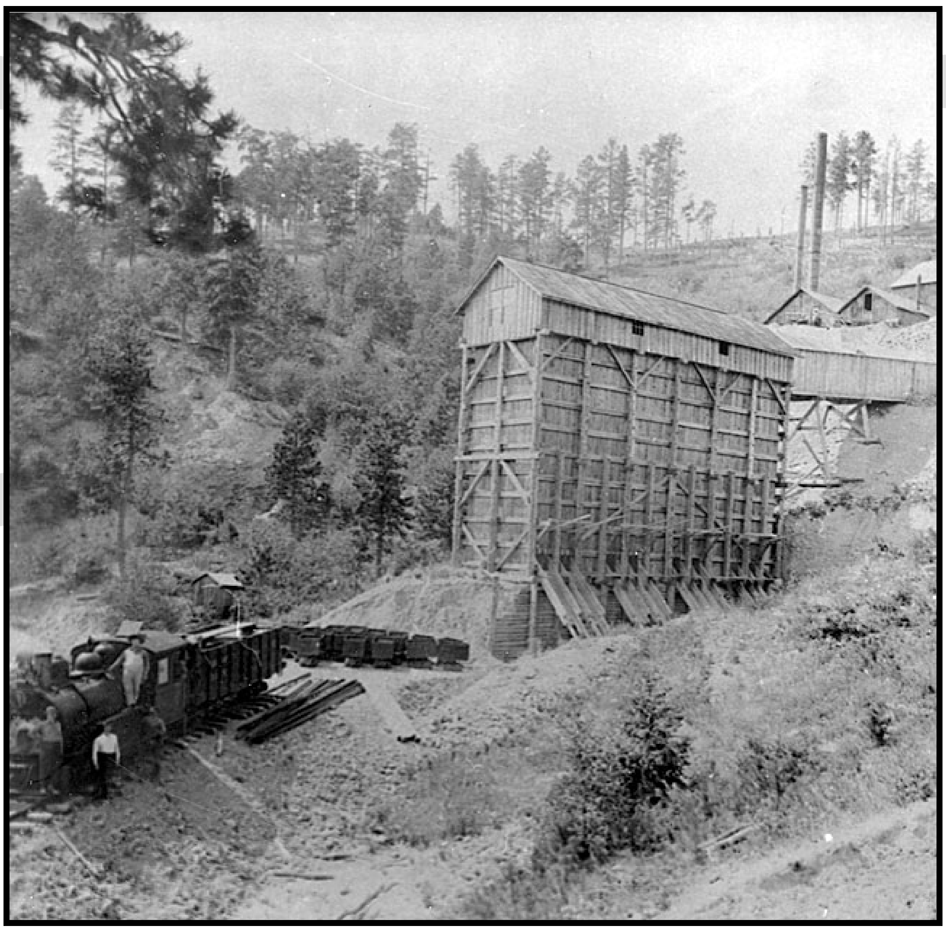


Figure 3.55: The Hoodoo Mine had a sloped floor ore bin characteristic of heavy production. Miners input ore via the covered trestle at top, and freighters extracted the payrock through the chutes at bottom for shipment to a mill. Today, such bins can manifest as log and timber foundations, structural debris, and a platform. Courtesy of the State Archives of South Dakota Historical Society.

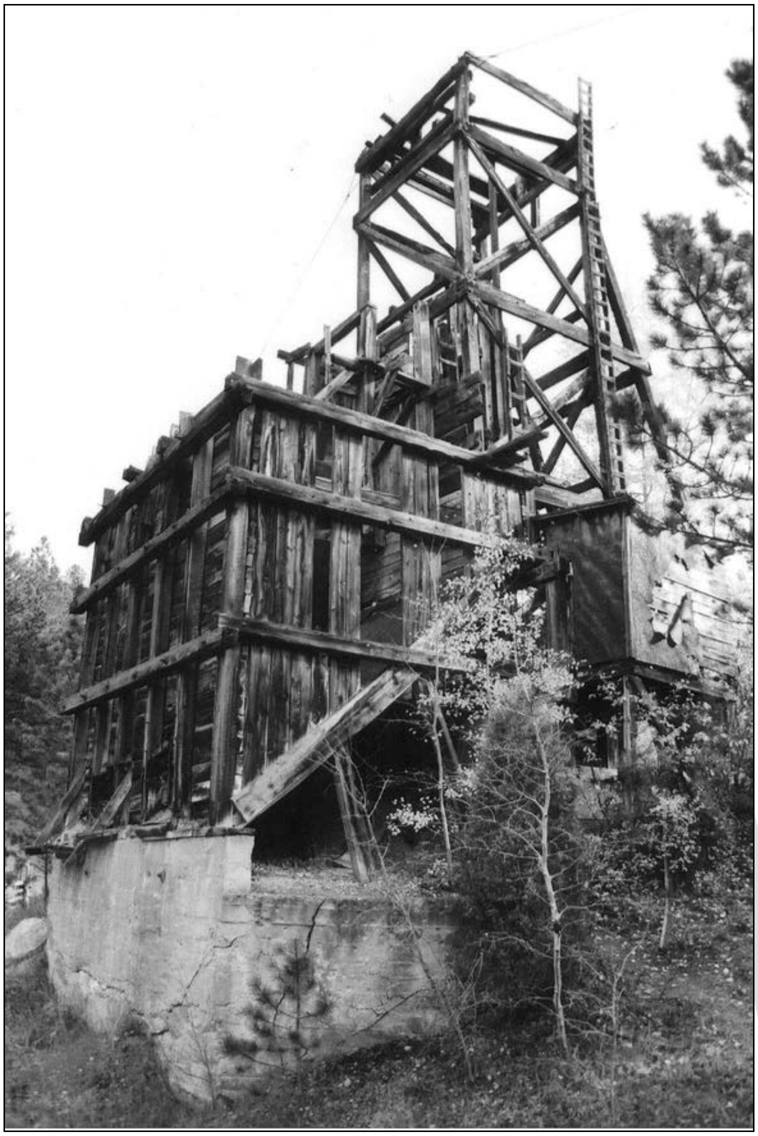


Figure 3.56: Many shaft mines had sloped floor ore bins adjacent to their headframes. Most ore bins stood on the shoulder of a mine's waste rock dump. Source: Eric Twitty.

Ore Chute: A chute that directed payrock into an ore bin or a vehicle.
Ore Chute Remnant: The collapsed remnants of an ore chute.
Ore Sorting House: Ore sorting houses, discussed above, were complex structures with two or three levels. Miners input crude ore into chutes or ports in the top floor, and the material rolled over screens termed grizzlies. The fine, metal-bearing particles dropped through and accumulated in a holding bin on the bottom level. Waste-laden cobbles slid down the screens and stopped at a sorting station, usually on a middle level. Workers sorted the ore at the station, dropped recovered material into the holding bins, and threw separated waste out of the structure, forming piles of cobbles.
Ore Sorting House Platform or Foundation: Platforms and foundations for sorting houses usually appear similar to those for ore bins. The difference can manifest as discrete piles of large waste cobbles flanking the foundation. The piles are often different in appearance from the rest of the mine's common waste rock, and were cast off when workers sorted through low-grade ore.
Ore Sorting House Ruin: The collapsed remnants of a sorting house.

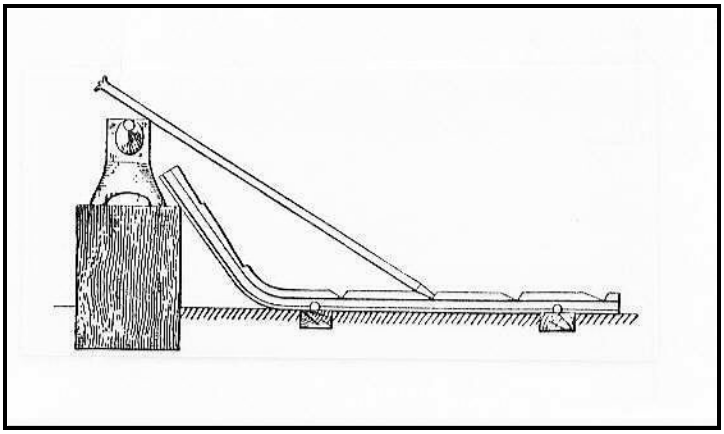


Figure 3.57: The profile illustrates a backing block, the steel bar on the floor that shop workers used to brace hot drill-steels during sharpening. The drill-steel rests in a divot in the bar, and its neck rests against an anvil on a timber stand. Backing blocks were embedded in the shop floor adjacent to the forge. Source: *Engineering & Mining Journal*, 1916:14.

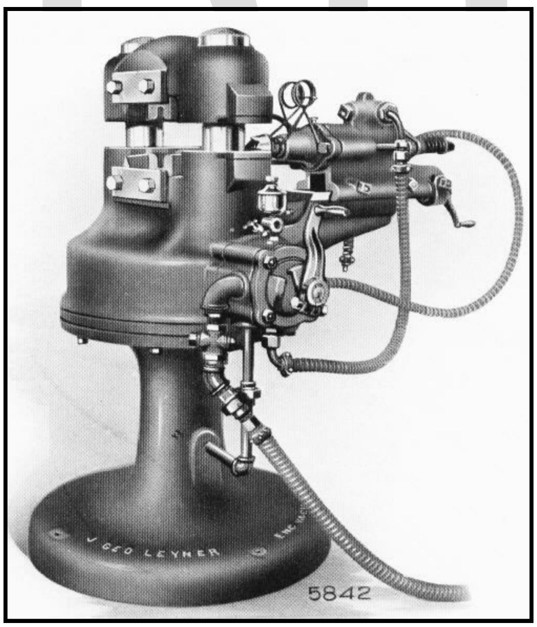


Figure 3.58: Shortly after 1910, leading rockdrill makers introduced a compact drill-steel sharpening machine around 5 feet high. The device, purchased by well-capitalized mining companies, expedited the drill-steel sharpening process. Source: Ingersoll-Rand, 1913:2.

Shop Feature Systems

Backing Block: Some shops featured backing blocks to help workers sharpen the drill-steels used by rockdrills. A backing block consisted of an iron rod 4 by 4 inches or less in cross-section and up to 8 feet long, embedded in the shop floor near the forge. The block's surface featured a series of deep divots where the blacksmith rested the drill-steel's butt, and he leaned the drill-steel's neck against an anvil to brace the item for sharpening. Many mining outfits substituted a railroad rail for the iron rod.

Drill-Steel Sharpening Machine: During the 1910s, well-funded mining companies began adopting compressed air-powered machines to automate the process of sharpening drill-steels. Most sharpeners were upright units 2 by 3 feet in area, 3 to 5 feet high, and featured an assemblage of clamps and power hammers mounted on a cast iron pedestal. Sharpeners were always located in a shop.

Drill-Steel Sharpening Machine Foundation: Because drill-steel sharpening machines destroyed unpadded concrete foundations over time, they were usually bolted to foundations of timber footers or timber pads on concrete. Sharpener foundations are always located in a shop or on a shop platform, are usually 2 by 3 feet in area, and possess four to five anchor bolts.

Forge: Almost every mine shop featured a forge where blacksmiths heated iron. Several types of forges were popular, and most were 3 by 3 feet in area and 2 feet high. The *gravel-filled rock forge* consisted of dry-laid rock walls, the *wood box forge* had plank walls, and both were filled with gravel. The free standing *iron pan forge* featured an iron pan supported by iron legs. Companies that required high volumes of work also installed cylindrical and square iron box forges usually 4 by 4 feet in area.

Forge Remnant: Over time, rock- and wood box forges decayed, leaving mounds of gravel that often feature anthracite coal, clinker, and forge-cut iron scraps.

Lathe Foundation: Some mechanized shops featured a lathe for metal- and woodwork. Lathes were usually bolted to parallel timbers around 2 by 8 feet in area or less.

Power Hammer Foundation: Mechanized mining companies installed power hammers to expedite metalwork. Many power hammers consisted of obsolete rockdrills bolted to timber posts, and they pounded items clamped to underlying tables. When removed, power hammers can be denoted by a heavy timber post up to 6 feet high and an adjacent timber stump where the table was located.

Shop: Nearly every mine had a shop for the manufacture and repair of tools, hardware, and machinery. Shops included blacksmith facilities at the least, some were equipped with power-driven appliances for advanced work, and many were equipped for basic carpentry. To minimize handling of heavy iron, mining companies built their shops near the mine opening.

Shop buildings followed several basic vernacular forms in construction, appearance, and design. Most were custom facilities, built as needed with available materials, and planned according to a company's interpretation of function and efficiency. Prior to the 1890s, shops tended to be simple, rectangular, and had blacksmithing equipment in a major portion and a carpentry area in the rest. Many were of log construction, but mining companies preferred frame construction. During the 1890s, shops increased in size to accommodate more appliances, and by the 1900s, corrugated sheet iron grew in popularly for siding and roofs.

Shop Platform: Shops almost always stood on platforms of leveled earth or waste rock. When the building was removed, a distinct platform usually remained. An artifact assemblage including forge clinker, pieces of hardware, forge-cut iron scraps, cut pipe scraps, and cut wood scraps can help identify a shop platform.

Shop Ruin: The collapsed remains of a shop.

Shop Refuse Dump: A concentration of shop refuse generated by sustained blacksmithing and metalwork. The artifact assemblage is distinct and consists of forge clinker, forge-cut iron scraps, cut pipe scraps, and pieces of hardware. Carpentry shops left an abundance of cut wood scraps, sawdust, and hardware.

Property Type: Open-Pit Mine

The Nature of Open-Pit Mines

In some cases, ore bodies cropped out on ground-surface and were accessible with relatively little work. While unusual, these formations presented mining companies with ideal conditions because much less capital, development, and infrastructure were needed than with underground operations. The company stripped away the overburden, installed basic support facilities, and extracted the ore. Known as both open-pit and open-cut mines, these surface operations ranged in scale from small and labor-intensive to sprawling and mechanized. At small mines, outfits usually worked limited bodies of high-grade metal ore, often gold or silver. At large mines, heavily capitalized companies employed advanced mechanization to produce low-grade ore or coal in economies of scale. Most open-pit operations shared a few basic characteristics such as exposed workings, substantial waste-rock dumps, ore-storage facilities, efficient transportation systems within the workings, and support facilities similar to those at underground mines. Many open-pit mines were parts of greater operations that included underground workings.

Small open-pit mines featured surface workings limited in shape and size to the ore body. Mining outfits preferred to extract only the ore and leave the surrounding rock in place because this was less work. Prior to the 1940s, miners employed many of the same practices used underground. Some drilled by hand, others with rockdrills, they moved rock in ore cars, and supported narrow incisions with timbers. The principal difference was that they worked the ore body in benches. The small outfits also carried over the same basic support facilities. A shop where a blacksmith maintained tools and fabricated hardware stood near the pit entrance, and ore bins were often located nearby. To allow miners to push ore cars to the bin edge, the bin rim had to be concurrent in elevation with the pit floor. Mechanized operations may have included an electric or steam-powered air compressor.

The introduction of earth moving equipment during the 1930s, and its adoption in the 1940s, changed open-pit practices and required a revision of support facilities and ore handling. First, the scale of pits increased because earth moving equipment reduced the costs of production per ton of rock. Common earthmoving equipment included bulldozers, frontend loaders, haul trucks, track drills, and service vehicles. The drill rigs were able to bore deep blast-holes that contained high volumes of explosives, which brought down greater tonnages of rock than with labor-intensive methods. As a result, the headwalls around pits increased in height, and the benches increased in breadth. Second, the loaders scooped the blasted material into trucks, and they required a broad, even floor and the maintenance of wide access avenues. Third, large blasts generated boulders that were unmanageable to transport. In response, many mining companies installed crushing stations over their ore bins to reduce the boulders. Fourth, repair shops had to accommodate the complex equipment, and workers needed to be versed in vehicle mechanics. Last, the reliance on vehicles and heavy equipment depended on well-built roads. Like most mines, large open-pit operations concentrated their facilities together for ease of servicing and coordination.

Open-Pit Mine Eligibility Guidelines

<u>*Resource Eligibility:*</u> In the context of South Dakota mining, open-pit mining was of minor importance because its geographic extent, output, and timeframe were limited. Such operations were significant, however, to specific areas and communities from the 1890s into the 1960s. In the Black Hills, open-pit mines became large enough during the 1890s to employ substantial workforces, support associated communities, and contribute to local economies. Except at Lead, open-pit mining waned after the federally mandated suspension of gold mining in 1942. At Lead, open-pit mining was significant during the 1950s and 1960s. In northwestern South Dakota, coal beds were also mined with open-pit methods during the timeframe.

To be eligible, an open-pit mine must retain physical integrity on a broad scale and possess attributes evocative of its resource subtype. The most important attributes are landscape features typical of surface work, including the pit, its headwall, large waste rock dumps, and a road network. Features representing the support facilities are important contributing elements of a site and strengthen the case for eligibility. Because most infrastructure components suffered decay and the buildings were removed, integrity will probably be archaeological in nature. Infrastructure aspects retain a sufficient level of archaeological integrity when they can be interpreted and their role in the mining operation determined.

Open-pit mines have experienced decay and disturbance in a variety of forms, and the impacts to a site's integrity should be carefully assessed. Natural decay such as heavy erosion, soil creep, collapse of headwalls, and revegetation can alter the necessary attributes. Continued mining has a high potential to erase historic features, which must be present in high proportion. Bulldozing, property development, and environmental remediation also have a high potential to compromise integrity.

NRHP Criterion A: Open-pit mines are often associated with historical trends and patterns important on local levels. Several Areas of Significance may be relevant, and although reviewed below, the Areas are explained in more detail in Chapter 2.

The Area of *Industry* is among the most applicable. Open-pit operations allowed mining to continue in a few areas by working low-grade ore deposits left fallow in the past as unprofitable. These areas were in decline because the rich underground deposits were exhausted, and open-pit methods provided an effective alternative. The open-pit operations became important, if not brief, components of the local mining industries and supported communities in decline.

Open-pit mines participated in the Areas of *Commerce* and *Economics* primarily on a local level. The mining companies fostered local commercial systems by paying wages to workers and consuming high volumes of goods. The productive operations also contributed to local economies through their output, and by attracting investment and disbursing the funds.

Open-pit mining also participated in the Area of *Community Planning and Development*. Through economic contributions and by providing employment, the operations temporarily stabilized some settlements that were otherwise in decline. Those settlements then continued as viable entities, albeit temporarily.

Open-pit mines participated in the Area of *Social History* in several ways. As places of employment, the mines supported populations in areas that Euro-Americans may have otherwise overlooked. In so doing, the mines contributed to the evolution of South Dakota's social geography. In addition, the populations possessed a demography characteristic of Western mining. Individuals were of varying backgrounds, ethnicities, education levels, and socioeconomic status. The boom and bust inherent in the mining industry, including the tunnel operations, required the workers to be mobile, and they spread their traditions as they moved about. The substantial employers also contributed to the development of social classes.

NRHP Criterion B: Open-pit mines have a potential for eligibility under Criterion B if an important person was associated with the site. Some mines, especially large complexes, often can be traced to important individuals such as engineers and managers. If the significance is through the person's presence on-site and direct participation in operations, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The individual's role in the operation must be clearly defined, and a brief biography explaining their significance provided. An important person's investment in a property or involvement with a company is too indirect an association for Criterion B. The individual of note must have been present on-site and played a fundamental and direct role in its physical development.

NRHP Criterion C: Sites may be eligible under Criterion C if they are outstanding examples of open-pit mines. Because most equipment and buildings were removed when a mine was abandoned, integrity is usually on an archaeological level. Substantial portions of the open-pit landscape must be intact, and the local topographic features should include the pit, headwall, and waste rock dumps. Structures and equipment, and subtle characteristics of open-pit methods strengthen a site's eligibility. Important characteristics include intact benches, drill-hole patterns, and evidence of rail and compressed air systems. The *Engineering* Area of Significance may be applicable to open-pit mines when they exemplify design, technology, and engineering specific to the development of ore formations on the surface. If buildings still stand, then the Area of *Architecture* may apply. Buildings represent the adaptation of design, materials, and construction methods to meet the needs of surface work.

Open-pit mines have a high potential to be eligible under Criterion C as contributing elements of a historic mining landscape. Open-pit sites usually present a strong visual impact, and large mines may be landscapes in themselves.

NRHP Criterion D: Open-pit mines may be eligible under *NRHP Criterion D* when they hold a high likelihood of yielding important information upon further study. Buried archaeological deposits may be present and can manifest as privy pits and refuse layers in waste rock dumps. Deposits amid the support facilities may include artifacts capable of enhancing our current understanding of workplace behavior, diet, and substance abuse.

If the surface workings are well-preserved, detailed examination may reveal how mining companies adapted conventional open-pit methods to South Dakota's ore formations. Sizes and shapes of rock benches, and patterns of drill-holes in rock faces, can reflect the practices of drilling, blasting, and breaking ground. Networks of roads and rail lines, and access corridors, represent transportation systems. In general, few formal studies of open-pits have been completed, even though this form of mining was important.

Features Common to Open-Pit Mine Resources

Open-pit mine sites possess assemblages of archaeological and engineering features that represent the operation and its support facilities. To help researchers identify system components and organize their data, the most common Feature Types are listed below. Because open-pit mines relied on the same facilities as underground operations, the researcher should review the feature types described above with hardrock mines. In particular, crossover existed regarding shops, compressed air systems, electricity, and transportation.

Access Road: Open-pit mines featured access roads that allowed light-duty vehicles to drive in and around the workings.
Bench: Companies worked large and deep open-pit mines in benches, which were discrete terraces subjected to drilling and blasting.
Conveyor: Some open-pit mines featured conveyor belts that shuttled ore to a crusher, ore bin, or mill. The apparatus consisted of an endless rubber belt on rollers. A timber frame held the rollers on early versions, while steel was used by the 1920s.
Crushing Station: By the 1950s, many small open-pit mines featured trailer-mounted rock crushers that reduced boulders and large cobbles for handling. At large mines, the crusher was housed in a structure over an ore bin.
Fuel Tank: Heavy equipment and haul trucks required fuel, which was often stored in tanks elevated on steel frames. Some tanks also stood on platforms near the pit entry.
Generator: By the 1950s, some open-pit mines featured generators to provide electricity for lighting and to run machinery. A generator was similar in form to a motor and many models were powered by petroleum engines.
Generator Station: A frame building that enclosed a generator and electrical substation. The buildings were vernacular in construction and appearance, and often consisted of little more than a lumber frame sided with corrugated sheet iron.
Grizzly: A grizzly was a screening structure that separated blasted rock by size. Earth moving equipment dumped crude ore onto the grizzly, which usually consisted of a grill of heavy iron rods. Fine material passed through while boulders rolled off for later reduction.
Headwall: The headwall was a center of activity at open-pit mines, and it was the exposed rock face rising up from the pit floor, or from individual benches. Headwalls were usually the target of drilling and blasting.
Haul Road: Haul roads were principal arteries that allowed dump trucks to carry ore to a bin, or waste rock to a dump. Some roads were broad enough for two-way traffic, while others were segments of one-way circuits.
Loading Area: Two forms of loading areas existed. One was the location on a pit floor where heavy equipment loaded dump trucks with rock. The other was at the toe of an ore bin where trucks or wagons were loaded with ore.
Office: Most open-pit mines featured an office where workers and superintendents administered to operational affairs. Offices were vernacular, built as needed and designed for function rather than appearance. Some featured several rooms, and others included a change area for workers and an assay shop. Nearly all were of frame construction and usually had gabled roofs.
Open-Cut: A relatively small open-pit or a narrow excavation where the surface expression of a vein was removed.
Open-Pit: A broad incision in the ground where ore was removed.

Pit Floor: The floor in an open-pit where workers loaded dump trucks or wagons and maneuvered and parked heavy equipment.
Portable Air Compressor: By the 1940s, portable compressors were popular in open-pit mines because they could be towed to points of work. Portable compressors usually featured an upright compressor, a petroleum drive engine, and an air receiving tank on a four-wheel trailer.

Property Type: Ore Treatment Mill

The Nature of Ore Treatment Facilities

One of the main objectives of mining was to reduce ore to its constituent metals. In general, the process began with crushing and grinding the ore, followed by separating the metalliferous material from waste. Most of the ore produced in the Black Hills was gold, and during the first ten years of mining, it was relatively easy to treat. Known as free-milling and free-gold ore, the material was simple in form and the gold readily amalgamated with mercury. Because of this, companies were able to erect what were categorically known as *amalgamation mills* to recover the gold. Most mills employed a battery of stamps to crush the crude ore into a slurry, which flowed over slanted amalgamation tables at the battery's toe (Figure 3.57 page 185). The amalgamation tables, coated with mercury, recovered the gold. Because of its simplicity and relatively low cost, the amalgamation mill was within economic reach of many mining companies. Independent operators also provided custom treatment for mining companies unable to afford their own mills.

With depth underground, mining companies found that the ore became increasingly complex, presenting great challenges to the mill operators. The gold and the host rock, known as gangue, featured minerals that interfered with amalgamation, and the mills recovered only a small percentage of the gold. Such ore had to be treated in a primary smelter, which crushed the ore, separated out as much waste as possible, and melted the material in a furnace, yielding a blend of metals known as matte. Advanced smelters located in the Midwest, Colorado, and Montana were able to refine the matte into pure metals. For silver and tin, also mined in the Black Hills, smelting was the only effective treatment method.

Few companies were willing to build their own smelters, however, in part due to the great cost, and also because smelters were difficult to design and had high failure rates. Investors sought an alternative in the form of the *concentration mill*, which completed the preliminary crushing and separation steps ordinarily carried out by smelters. Concentration mills relied on combinations of mechanical and sometimes chemical methods to separate the metalliferous material from gangue. The facilities, also known as *reduction mills*, produced concentrates only and no refined metals, and the concentrates were shipped to a smelter for the final treatment steps. The mills saved mining companies costs in two areas. First, the companies did not incur the high transportation costs of shipping waste-laden ore to a distant smelter, and second, they avoided paying the fees charged by smelters for complete treatment. Concentration mills saw increased use during the mid-1880s, and by the 1900s, they replaced most of the simple amalgamation mills.

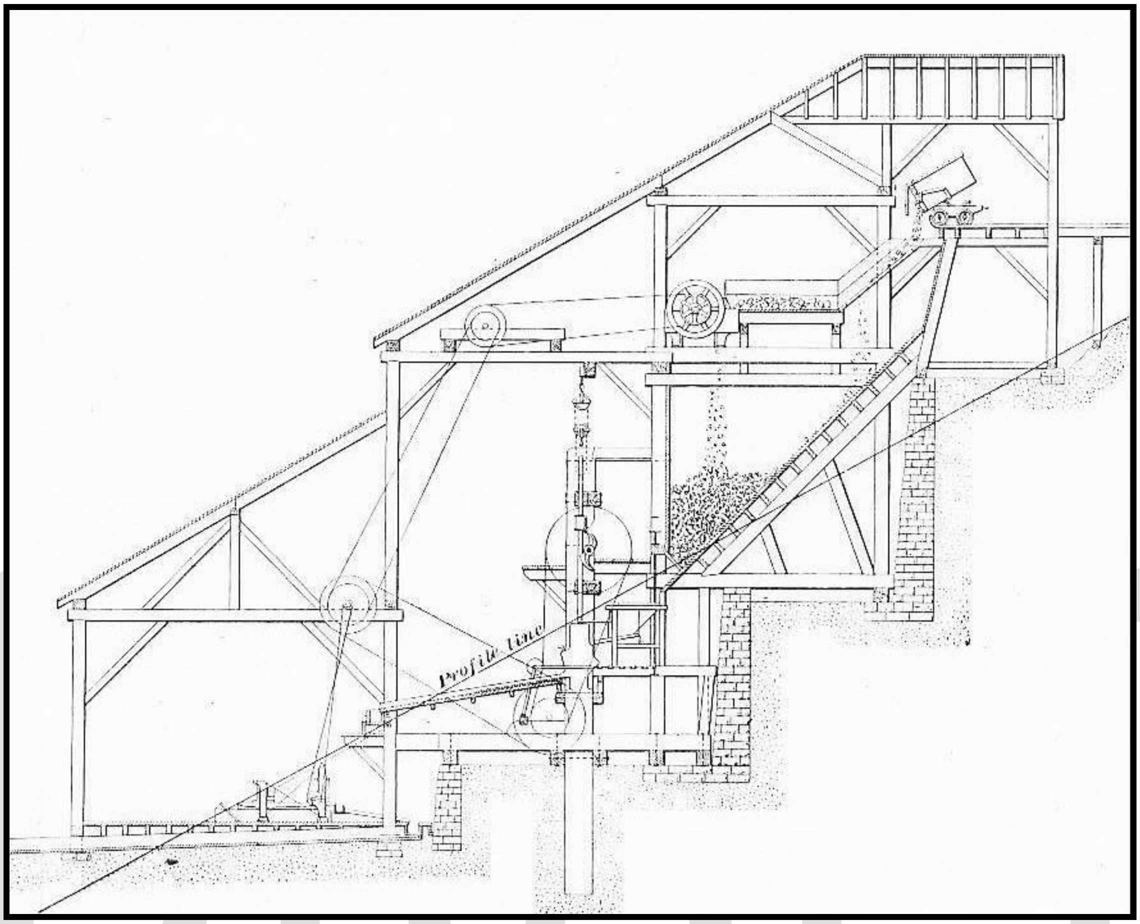


Figure 3.59: The profile illustrates both the stairstep configuration of a typical concentration mill and the process flow path. Workers dumped ore onto a screen at top, and fine material passed through while course cobbles were diverted into a crusher. A stamp battery at center then pulverized the ore into a slurry, which passed over amalgamating tables that extracted free-gold and silver. The slurry then descended to concentration machinery on the lower platform. That machinery separated out the gold and silver that refused to amalgamate. Source: International Textbook Company, 1899, A43:214.

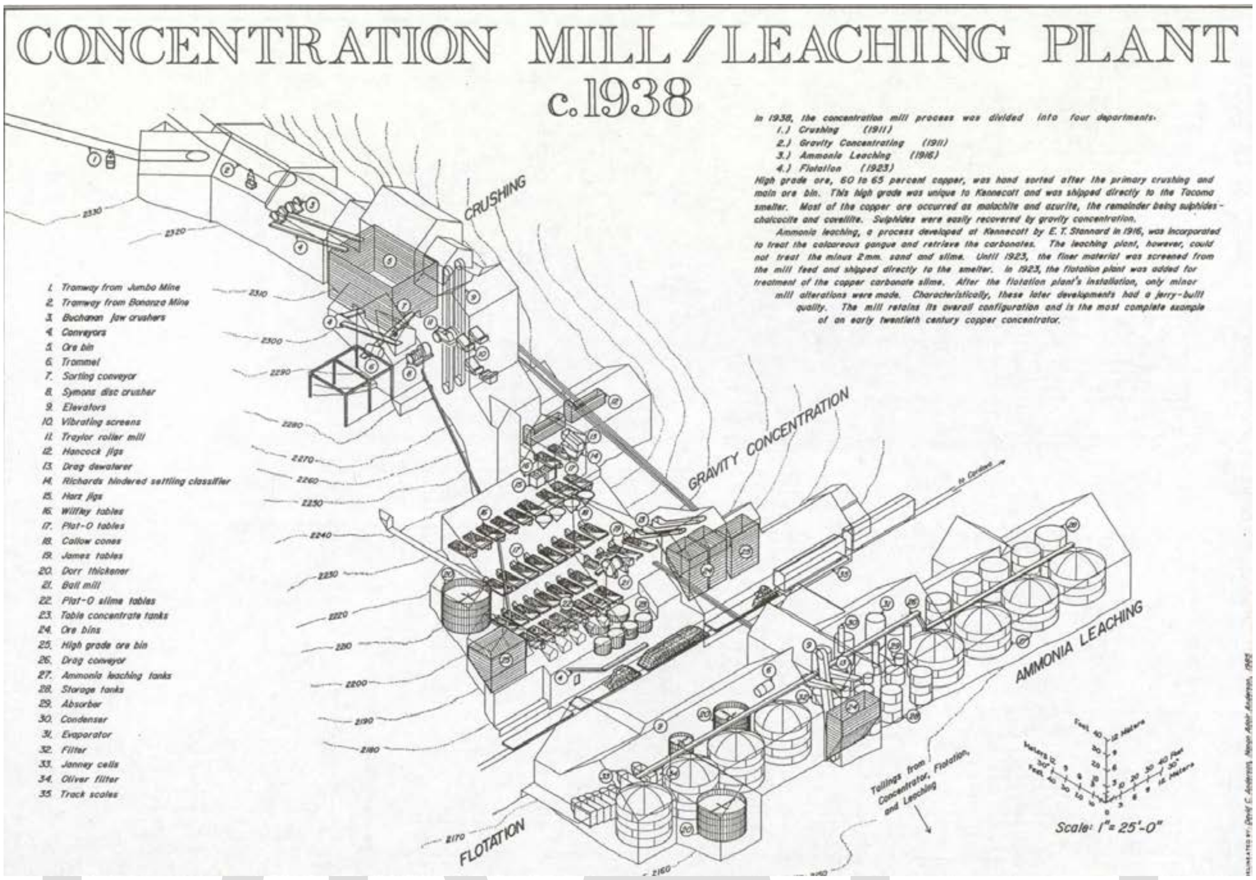


Figure 3.60: Concentration Mill/Leaching Plant diagram.

Ore Treatment Mill Property Subtypes and Eligibility Guidelines

Property Subtype: Amalgamation Stamp Mill

Resource Description: The amalgamation stamp mill was a Black Hills institution, and it recovered gold from crushed ore with mercury. The ore was crushed to a slurry and subjected to mercury, which captured the gold and left spent tailings. Because common amalgamation mills traditionally crushed the ore with batteries of stamps, they became popularly known as *stamp mills*. This term is slightly misleading in that some amalgamation mills relied on other apparatuses to crush and amalgamate the ore. Concentration mills, discussed below, also employed batteries of stamps for crushing, but were not stamp mills in themselves. When associated with a concentration mill, the term stamp mill applies only to the stamp battery and not the entire facility.

Amalgamation mills were only effective on relatively simple, easily crushed gold ore. In traditional stamp mills, a jaw crusher (Figure 3.55 page 134) completed the primary crushing and reduced the ore to sand and gravel, and the stamp battery pounded the material into a slurry. A stamp battery consisted of a timber gallows frame with guides for heavy iron rods fitted with cylindrical iron shoes. A camshaft, powered by a large belt, lifted the rods in sequence and let them drop. The shoes pulverized the ore in cast iron battery boxes bolted to timber pedestals. After screening, the slurry washed over amalgamating tables at the battery's toe. A mercury coating on the tables

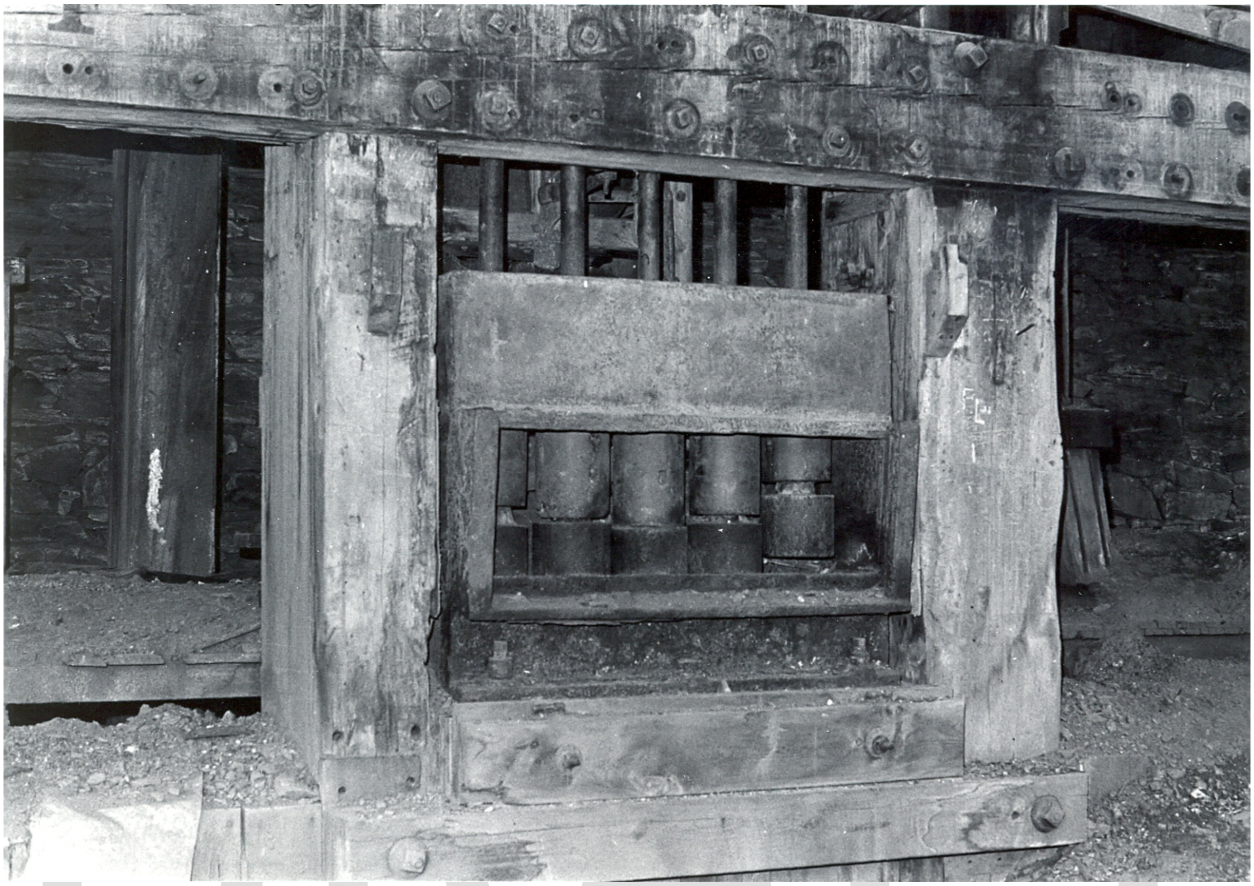


Figure 3.61: Stamp Mill at Standby Mine near Rochford. Courtesy South Dakota State Historical Society.

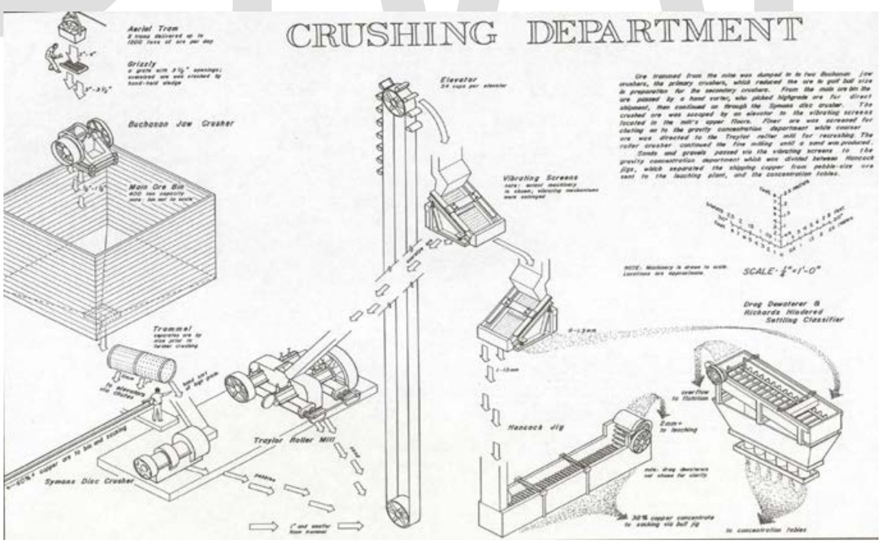


Figure 3.62: Crushing diagram.

amalgamated with the gold, and the spent tailings flowed into a trough and continued out of the mill. Workers periodically scraped off the amalgam and heated the mass in a retort, which volatized the mercury and left impure gold that had to be refined.

Because traditional amalgamation stamp mills (Figure 351 page 118) treated ore in only several stages, they tended to be simple. In keeping with conventional metallurgical engineering, they relied on gravity to draw the ore through crushing and metals recovery. Hence, metallurgists usually erected the facilities over three or four terraces cut out of a slope. A receiving bin was at the mill's head and fed crude ore into the primary crusher on a terrace below. The stamp battery stood on another terrace, and the amalgamation tables were on yet a third level. The lowest platform featured other facilities and the power source, which was often a horizontal steam engine and boiler. The retort, an assay office, and administrative office were often in a separate building.

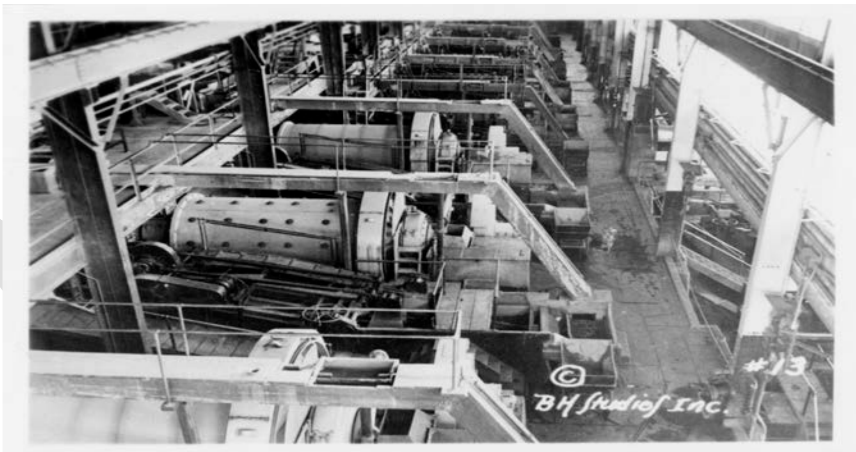


Figure 3.63: Homestake Rod Mill. Courtesy South Dakota State Historical Society.

Because stamp batteries were costly to erect and consumed power, metallurgists occasionally used Huntington mills (Figure 3.60 page 136) and ball mills (Figure 3.62 page 137) as an alternative. A Huntington mill consisted of a deep iron pan 4 to 8 feet in diameter with steel rollers on the bottom. The rollers rotated around the pan floor and ground the ore into a slurry. A ball mill, similar to today's cement mixer, was little more than a tapered steel vessel that slowly spun on heavy bearings. Inside, steel balls tumbled and wore the ore down. In both cases, a worker periodically introduced mercury to achieve amalgamation. Mills equipped with Huntington or ball mills instead of stamps were true amalgamation facilities, but rare.

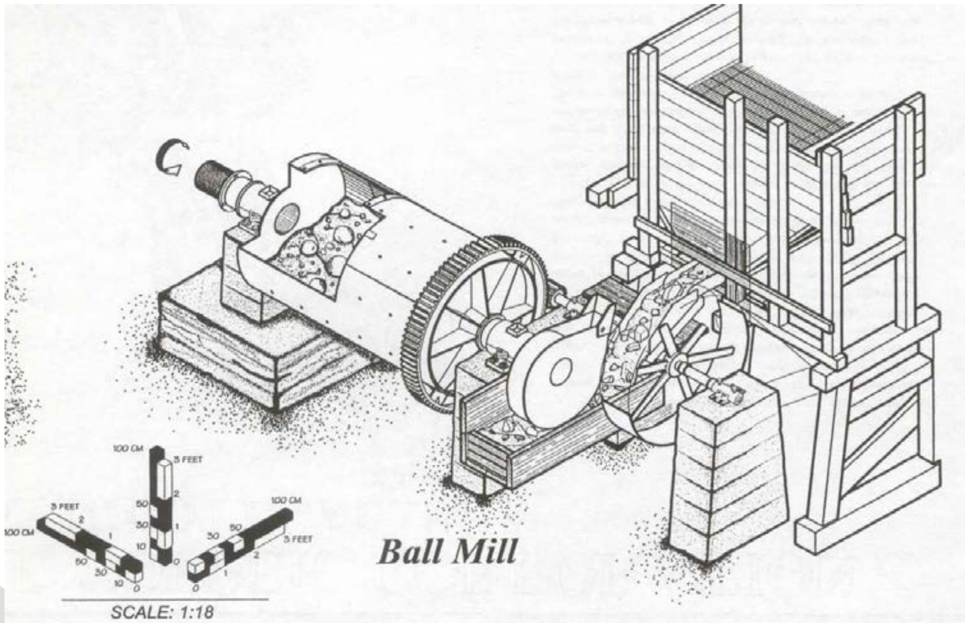


Figure 3.64: Ball mill.

Often, metallurgists added the two types of apparatuses as a supplement to traditional stamp mills to extract more gold when only one amalgamation stage proved insufficient. As can be expected, the additional machinery required more terraces in the mill building. Usually, each terrace was dedicated to a specific stage of ore treatment and had its own dedicated bank of appliances.

Resource Eligibility: Amalgamation stamp mills were important on a statewide level during two time periods. The first spanned from 1876 to around 1920, and the second from 1933 until 1942.

Amalgamation mills played a fundamental role in the blossoming and then on-going success of the mining industry. When hardrock mining began during the late 1870s, amalgamation mills were the only local means of recovering gold from ore. The mills made gold mining profitable where it otherwise would not have been. By the mid-1880s, concentration mills began to supersede amalgamation in many regions because the payrock grew increasingly complex with depth underground. However, amalgamation mills remained relevant until around 1920 because mining companies continued to produce enough free-gold ore to justify the process. After 1920, mining declined in importance, and few amalgamation mills were in service after this time.

Mining resumed its broad significance as an industry in 1933 when President Franklin Delano Roosevelt increased the prices of gold and silver to levels that interested both investors and local individuals. The Depression-era revival lasted until 1942 when mobilization for World War II drew off materials and labor, and the Federal government outlawed gold mining. The revival was extremely important to South Dakota, and amalgamation mills were a contributing factor. Some of the ore available during the 1930s was treatable with amalgamation, and the mills were preferred because of their simplicity and low cost.

Although most productive mining districts featured at least several amalgamation mills, sites remaining today may be perceived as uncommon. Further, few of the sites have escaped deterioration, and those with physical integrity are rare. When the mills closed, they became prime targets for the salvage of structural materials and machinery. Afterward, erosion and revegetation impacted most level surfaces such as terraces and platforms. In recent decades, some of the sites were also the subject of environmental remediation projects and land development. Given the above, few mill sites possess intact buildings, structures, or machinery, and their integrity will probably be on an archaeological level. The absence of structures and machinery should in no way be equated with poor integrity. Rather, integrity refers to a site's ability to clearly represent the historic milling operation, as well as the overall resource type. For archaeological remains to constitute integrity, the material evidence should represent the mill building, other facilities, and general infrastructure, but approximate the specific crushing and amalgamation equipment.

Intact buildings, structures, or machinery strengthen a site's eligibility because these are rare and important examples. If a mill site possesses the above but has been otherwise disturbed, it may still be eligible because surviving architecture and engineered aspects are significant. The buildings and engineered aspects must, however, be in their place of use, and the site complete enough to provide physical context.

In many cases, mills were periodically modified or enlarged. Each successive improvement left its own imprint on a site, erasing aspects of earlier designs and machinery. Assessing integrity and timeframe can be difficult in such cases. If a site retains a majority of its original aspects, even when on an archaeological level, then the site retains integrity relative to its original timeframe. If a subsequent operator expanded the mill, changed the machinery, and left an otherwise heavy imprint, then the site retains integrity relative to that operation.

NRHP Criterion A: Amalgamation mills are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although reviewed below, they are explained in more detail in Chapter 2.

Amalgamation mills that date between 1875 and 1885 participated in the Area of *Exploration/Settlement*. The mills directly fostered hardrock mining, and that industry was a principal reason behind the exploration, settlement, and development of the Black Hills.

In the Area of *Industry*, amalgamation mills brought hardrock mining into its initial boom and helped it remain profitable afterward. Between the late 1870s and the mid-1880s, amalgamation mills were the only local ore treatment facilities of significance, and they converted crude ore into gold bullion. That gold electrified investors and industrialists, who provided the capital necessary for mining in the Black Hills to become an industry of force. After the mid-1880s, the ore became increasingly complex with depth underground and resisted amalgamation. Although concentration processes provided an answer for the complex material, amalgamation remained important. Many mining companies continued to produce simple ore and preferred amalgamation mills because of their low cost.

Engineering is another relevant Area of Significance. Between the late 1870s and mid-1880s, metallurgists adapted known amalgamation technology to the ore and environmental conditions specific to the Black Hills. Afterward, metallurgists experimented with process variations such as Huntington mills and ball mills, contributing to the general development of amalgamation. The mills also participated in a movement away from simple and labor-intensive methods to advanced and highly mechanized processes, which made lower grades of ore profitable to produce.

Amalgamation mills participated in the Areas of *Commerce* and *Economics* primarily on a local level. The milling companies fostered local commercial systems by paying wages to workers, securing sources of ore from mining companies, and consuming high volumes of goods. The successful facilities also contributed to local economies through their output, and by attracting investment and disbursing the funds.

Amalgamation mills participated in the Area of *Social History* in several ways. The mills employed a workforce that possessed a demography characteristic of Western mining. Individuals were of varying backgrounds, ethnicities, education levels, and socioeconomic status. The boom and bust inherent in the mining industry required the workers to be mobile, and they spread their traditions as they moved about. As major employers, the large mills also contributed to the development of social classes.

NRHP Criterion B: Amalgamation mills have a potential for eligibility under Criterion B when an important person was associated with the site. Some mills, especially large complexes, often can be traced to important individuals such as engineers and metallurgists. If the significance is through the person's presence on-site and direct participation in operations, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The individual's role in the operation must be clearly defined, and a brief biography explaining their significance provided. An important person's investment in a property or involvement with a company is too indirect an association for Criterion B. The individual of note must have been present on-site and played a fundamental and direct role in its physical development.

NRHP Criterion C: Sites may be eligible under Criterion C if they clearly exemplify an amalgamation mill. Because most equipment and buildings were removed when a mill was abandoned, integrity is usually on an archaeological level. The mill footprint, terraces, aspects of infrastructure, and support facilities should be represented by features and artifacts. The general stages of crushing and amalgamation should be identifiable, but the specifics can be approximated. Intact structures and equipment, a high degree of integrity, or character defining engineering or architectural features strengthen a site's potential eligibility. Important engineering and architectural features include intact buildings, structures, and machinery. The *Engineering* Area of Significance is usually relevant to mill sites because they often exemplify the adaptation of metallurgical design, technology, and engineering to the Black Hills ore. If characteristic buildings still stand, then the Area of *Architecture* may apply. Buildings represent the adaptation of design, materials, and construction methods typical of the mining industry, and to meet the needs of ore treatment.

Amalgamation mill sites may be eligible under Criterion C if they are contributing elements of a historic mining landscape. Even when a mill site is poorly preserved, it may provide context or belong to a greater body of resources representing an area's history. Large mill sites may constitute small landscapes in themselves, especially when tailings dumps are present.

NRHP Criterion D: Amalgamation mill sites may be eligible under *NRHP Criterion D* when they hold a high likelihood of yielding important information upon further study. Mill sites can contribute in three general ways. The first is buried archaeological deposits such as privy pits, thick boiler clinker dumps, and refuse layers in tailings dumps. The deposits may include artifacts capable of enhancing our current understanding of workplace behavior, diet, and substance abuse. If the workers lived on-site, residential deposits may illuminate the currently dim portrait of mill workers and their lifestyle.

Second is a good assemblage of structures, foundations, or machinery for the crushing and amalgamation stages. Detailed examination may reveal how metallurgists adapted amalgamation processes to Black Hills ore, and the machinery they chose. The third is a well-represented infrastructure. Documentation may demonstrate how engineers designed water, power, ore input, and tailings disposal systems.

In general, large and complex mill sites tend to possess at least one of the information sources noted above and will qualify under Criterion D. Small mill sites, on the other hand, are usually simple, lack buried deposits of substance, and no longer have sufficient assemblages of features and artifacts.

Property Subtype: Concentration Mill

Resource Description: A concentration mill was a facility that employed primarily mechanical and occasionally chemical means to separate the metalliferous content of ore from waste. Concentration mills ranged in scale from small facilities to sprawling industrial complexes, and they were usually built over a series of terraces incised into a hillslope so gravity could draw the ore through the various processing stages. Small mills usually provided several stages of crushing and concentration in a single, linear path.

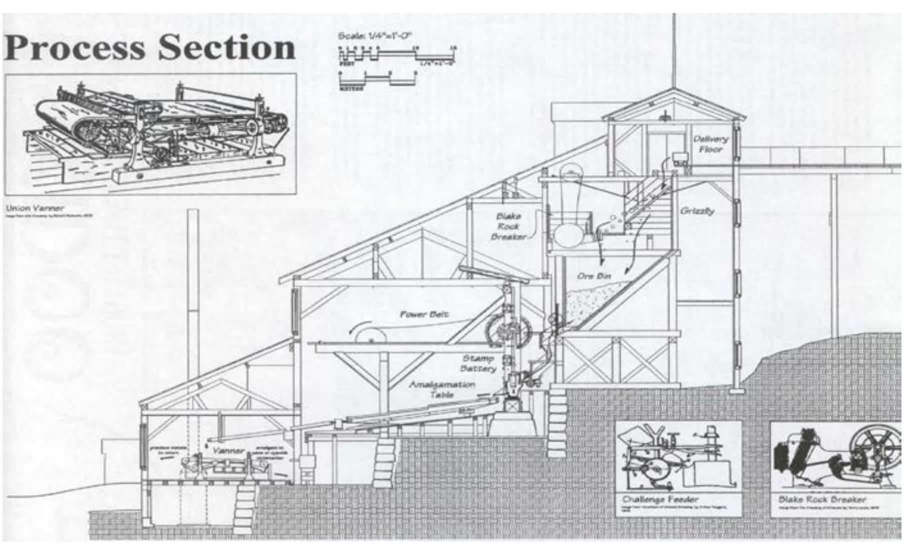
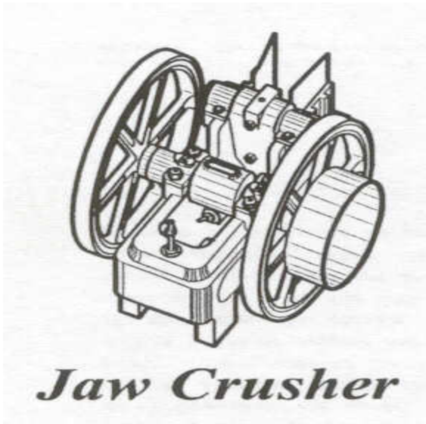


Figure 3.65: Processing cross section.

Large mills were heavily equipped to process both high volumes of ore, and complex ore that resisted simple treatment. To do so, they often provided primary, secondary, and even tertiary stages of crushing and concentration, and may have featured several parallel sequences.

Engineers tended to follow a general pattern when designing concentration mills. An ore bin stood at the mill's head and it fed crude ore into a primary crusher, usually located on the mill's top platform. The resultant gravel descended to a secondary crusher located on the platform below, then through a screening system. Oversized cobbles returned for secondary crushing, and material that passed the screen went on for concentration at small mills, or tertiary crushing at large mills.

Machinery manufacturers offered a wide array of crushers and grinders, which metallurgists selected according to the ore's characteristics. Because no two source mines featured the same ore and no two metallurgists were alike, each mill was a custom affair. However, metallurgists followed some patterns regarding the application of crushing machinery. Jaw crushers, also known as Blake crushers, provided primary crushing. Batteries of stamps were commonly employed for secondary crushing. Crushing rolls (Figure 3.55 and 3.56 page 134), also known as Cornish rolls, often carried out secondary and tertiary crushing, and they consisted of a pair of heavy iron rollers similar to wheels in a stout timber frame. A narrow gap between the rollers drew in clasts of sand and gravel, which the rollers fragmented. Grinding pans and Huntington mills were used for tertiary crushing, and both featured a heavy cast iron pan and iron shoes or rollers that dragged across the floor, grinding the ore. The end products of crushing and grinding were *fines* and *slurry*.



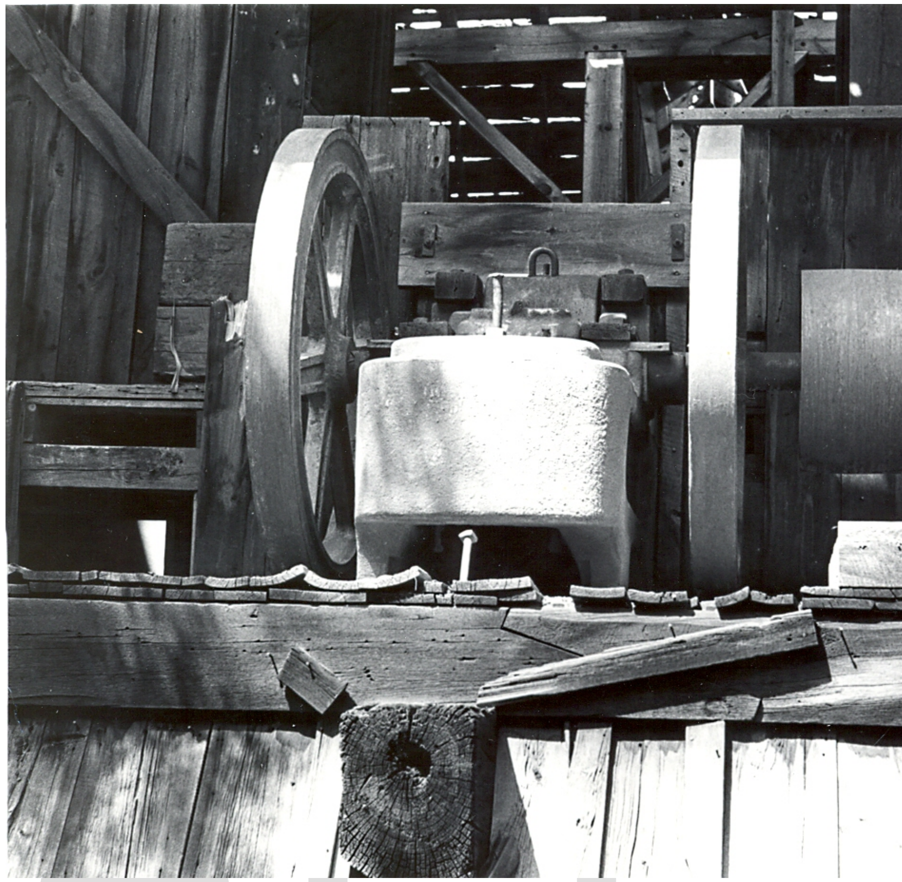


Figure 3.66: Jaw Crusher diagram at left and at Standby Mine near Rochford. Courtesy South Dakota State Historical Society.

Following another screening, the slurry descended to subsequent mill platforms for concentration. In the Black Hills, mills employed four general processes, usually in combination. The first was mechanical concentration, where various appliances used water currents and vibration to separate the heavy metalliferous material from the lighter waste. The second was an amalgamation stage where the slurry was subjected to mercury, often in grinding appliances. The third and fourth treatment processes were chlorination and cyanidation. Both chlorine and cyanide had an affinity for gold like mercury, but were able to extract the metal from complex gangue. Following are brief outlines of the four processes.

<u>Mechanical Concentration</u>

Mechanical concentration, the most elementary process, was equally relevant for silver, tin, and complex gold ore. After the ore was reduced to a slurry, apparatuses separated the metalliferous material from waste, and the resultant concentrates were either shipped to a smelter as a product, or subjected to the gold recovery methods noted above. All the appliances acted on the principal that the metalliferous material was heavier than the relatively light waste. Several devices proved relatively popular, and many metallurgists assembled a concentration sequence involving more than one appliance.

The *jig* (Figure 3.66 page 140), common from the 1860s through the 1910s, relied on water currents and agitation to classify particles by size and weight. The jig consisted of a wooden trough, often 4 by 9 feet in plan and 4 feet high, divided into cells that opened onto a V-shaped floor featuring valves and drains. Plungers agitated the slurry of ground ore in the cells, causing the heavy or large fines to settle while a gentle current of water washed the waste away. *Vanners* (Figure 3.67 page 141)were popular from the 1870s through the 1890s. A vanner featured a rubber belt, often 5 feet wide and 15 feet long, on rollers that vibrated. The belt was kept wet and as the machine vibrated, the heavy metalliferous material settled against and stuck to the rubber while a jet of water washed off the waste. As the belt wrapped down around one of the rollers, the metalliferous material dropped into a flume and proceeded for further concentration. *Vibrating tables* (Figure 3.69 page 142)became one of the most popular concentration appliances after introduction during the late 1890s. A vibrating table featured a tabletop, often 5 by 15 feet in area, clad with rubber or linoleum held down with fine riffles. The tabletop was mounted at a slant on a mobile iron frame that rapidly oscillated, and the vigorous action caused heavy metalliferous material to settle against the higher riffles while the waste worked its way downward. Water playing across the tabletop washed the waste away.

By the 1910s, *flotation cells* were proving their worth and operated according to principles that seemed to defy traditional concentration technology. A flotation machine consisted of a large rectangular tank divided into cells filled with water and slurry. Oils or detergent were introduced, which compressed air or agitators worked into a froth. In contrast to the above mechanical devices, the froth carried the metalliferous material upward while waste settled to the bottom of the cells. Revolving paddles then swept the metalliferous material into flumes for a drying stage.

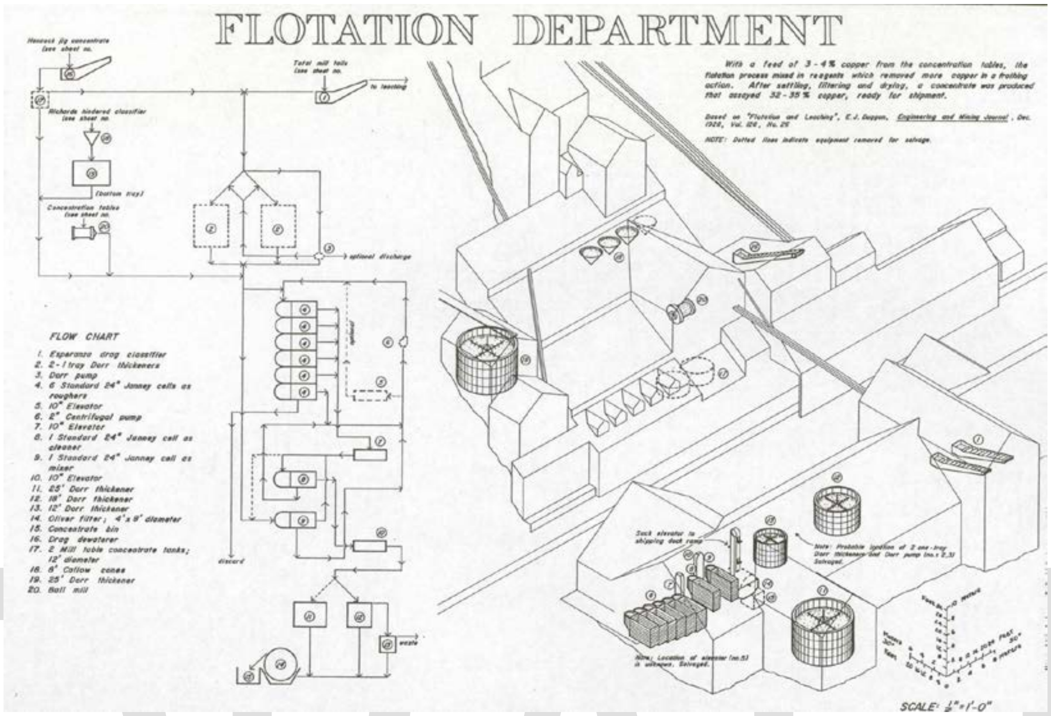


Figure 3.67: Flotation sketch.

Amalgamation

Concentration mills often included an amalgamation process because even when the ore was complex, mercury was able to recover some of the gold during fine grinding. *Huntington mills* and *grinding pans* were used for tertiary grinding from the 1880s through the 1910s, and the metallurgist introduced mercury into the pan to amalgamate with the gold. Metallurgists began to favor *ball mills* and *rod mills* during the 1900s for the same purpose. A ball mill, similar to today's cement mixer, consisted of a tapered steel chamber filled with iron balls. As the chamber slowly rotated, the balls tumbled and ground the ore into a fine slurry. The metallurgist periodically introduced mercury, which became thoroughly blended with the mass. Rod mills acted on a like principal but featured a cylindrical vessel filled with iron bars. The mercury recovered the available free-gold, and the material that did not amalgamate then went on to other concentration stages.

Chlorination and Cyanidation

During the late 1890s, some companies experimented with *chlorination*, and by 1905, *cyanidation* to recover gold from low-grade ore. Chlorination fell out of favor during the 1900s, replaced by superior cyanidation. Both processes were rarely used alone and instead were the end phases of concentration. After concentration, workers diverted the slurry into chlorination or cyanidation tanks, where dilute chlorine or cyanide solutions leached out the gold. The tanks, large wood or steel vats, featured agitators that stirred the slurry and mixed it with the solution. The chlorine or cyanide bonded with the gold, and the solution was tapped into *precipitating boxes*. A worker added zinc, which chlorine and cyanide preferred over gold, causing the precious metal to precipitate out. Mills could have featured one or a series of tanks, depending on the purity and volume of ore.

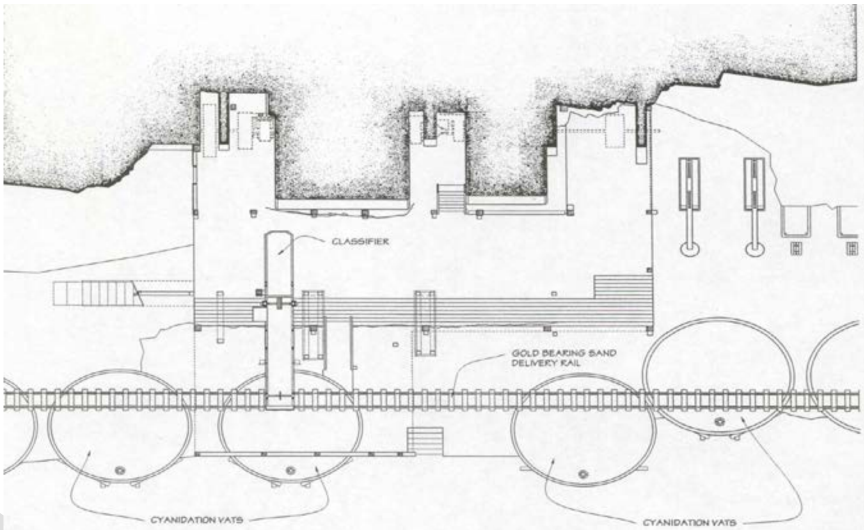


Figure 3.68: Cyanidation diagram

Concentration mills were powered by the same general technology as employed at mines. Most mills relied on steam until the 1910s when electricity was locally available, and motors provided power afterward. Both were usually anchored to a solid foundation on one of the mill's lowest terraces and drove the mill appliances through a system of overhead driveshafts and belts. A main belt transferred motion from the motor or engine to a principal driveshaft, which rotated in bearings bolted to the mill's support frame. Additional belts distributed the power from pulleys to the appliances, or to more driveshafts if the mill was large. Steam mills commonly relied on horizontal engines, and small upright units powered additional appliances at large mills.

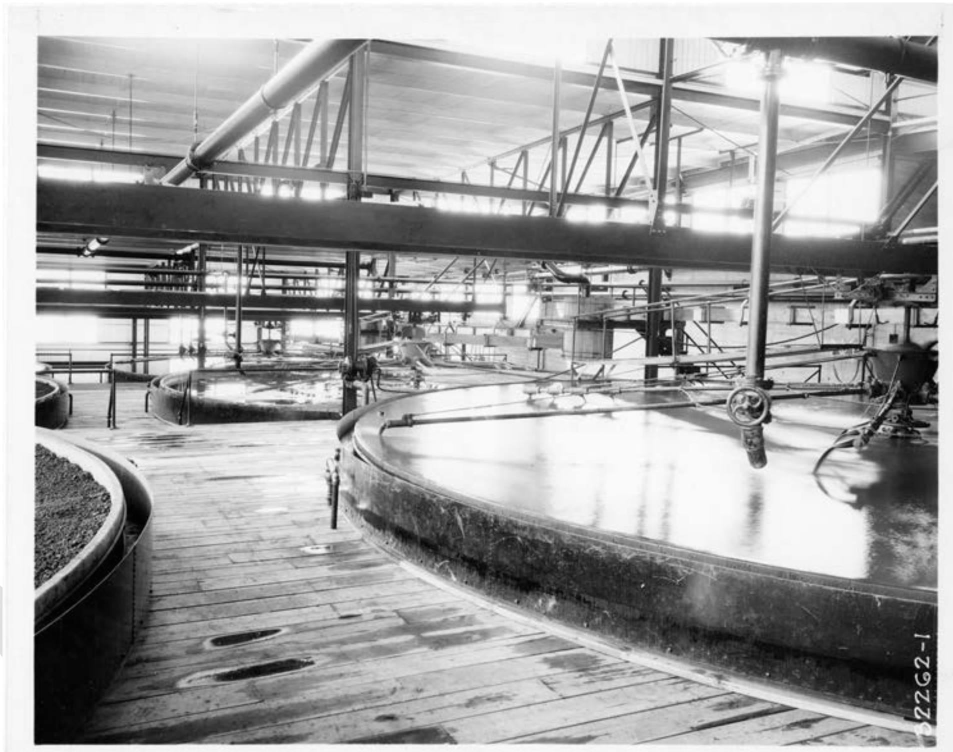


Figure 3.69: Homestake Sand Vats for Leaching. Courtesy South Dakota State Historical Society.

As can be surmised, concentration mills were substantial industrial structures that descended hillslopes in a series of terraces. A metallurgist designed a specific flow path equipped with a variety of crushing and concentration appliances for the type and volume of ore being treated. When a mill was abandoned, the structures and machinery were usually removed, leaving stair-step platforms, machine foundations, and hardware. Tailings left from ore processing were usually flumed to an area downslope and can manifest today as substantial deposits of finely ground sand and rock flour.

Figure 3.70: Galena Slime Tanks. Courtesy South Dakota State Historical Society.

Resource Eligibility: Concentration mills were important on a statewide level during two time periods spanning 1885 to around 1920, and from 1933 until 1942. They were also important in specific regions during other times, depending on ore type and local history.

In a broad sense, concentration mills played a fundamental role in the success of the mining industry. In particular, the mills allowed the industry to remain a significant force after mining companies exhausted the easily treated free-gold by the mid-1880s. The companies found that the free-gold ore gave way to complex payrock the deeper they went underground, and the complex material resisted traditional amalgamation treatment. Concentration mills provided an effective alternative that allowed the mining industry to profit heavily from the complex ore. As a result, mining as a statewide industry remained viable until around 1920, and some areas such as Lead, continued to thrive afterward.

Mining resumed its broad significance as an industry in 1933 when President Franklin Delano Roosevelt increased the prices of gold and silver to levels that interested both investors and local individuals. The Depression-era revival lasted until 1942 when mobilization for World War II drew off materials and labor, and the Federal government outlawed gold mining. The revival was extremely important to the South Dakota, and concentration mills were a major factor. A large proportion of the ore available in 1933 was low-grade, complex material that required concentration to be economically viable.

Although most productive mining districts featured at least several concentration mills, sites remaining today may be perceived as uncommon. Further, few of the sites have escaped deterioration, and those with physical integrity are rare. When the mills closed, they became prime targets for the salvage of structural materials and machinery. Afterward, erosion and revegetation impacted most level surfaces. In recent decades, some of the sites were also the subject of environmental remediation projects and land development. Given the above, few mill sites possess intact buildings, structures, or machinery, and their integrity will probably be on an archaeological level. The absence of structures and machinery should in no way be equated with poor integrity. Rather, integrity refers to a site's ability to clearly represent the historic milling operation, as well as the overall resource type. For archaeological remains to constitute integrity, the material evidence should represent the mill building, other facilities, and general infrastructure, but approximate the specific crushing and concentration processes.

Intact buildings, structures, or machinery strengthen a site's eligibility because these are rare and important examples. If a mill site possesses the above but has been otherwise disturbed, it may still be eligible because surviving architecture and engineered aspects are significant. The buildings and engineered aspects must, however, be in their place of use, and the site complete enough to provide physical context.

In many cases, mills were periodically modified or enlarged. Each successive improvement left its own imprint on a site, erasing aspects of earlier designs and processes. Assessing integrity and timeframe can be difficult in such cases. If a site retains a majority of its original aspects, even on an archaeological level, then the site retains integrity relative to its original timeframe. If a subsequent operator expanded the mill, changed the machinery, and left an otherwise heavy imprint, then the site retains integrity relative to that operation.

NRHP Criterion A: Concentration mills are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although reviewed below, the Areas are explained in more detail in Chapter 2.

In the Area of *Industry*, concentration mills were a foundation of the mining industry and helped it remain profitable. Prior to the mid-1880s, most of the gold ore came from shallow depths, and it was simple and easily treated with traditional amalgamation methods. Afterward, the ore became increasingly complex with depth underground and resisted amalgamation. Concentration provided an answer and allowed the mining industry to continue. Some milling outfits concentrated the ore with mechanical methods and then shipped it to smelters for final treatment. Others concentrated the ore and recovered gold on-site with chlorination or cyanidation. Concentration was the main reason why silver and tin mining were viable. Because of concentration mills, South Dakota's mining industry was a significant force that shaped history on local, statewide, and national levels. The industry was a major employer, fostered commerce on a broad scale, was a magnet for Euro-American settlement, and influenced politics and government.

Engineering is one of the most pronounced and fundamental Areas of Significance. The complex ores of the Black Hills defied conventional amalgamation practices and those methods proven to be effective for metals in other regions. To render the complex ores economically viable, metallurgists combined their experience with calculation and devised processes that prevailed. Concentration in the Black Hills also participated in a movement away from simple and labor-intensive methods to advanced and highly mechanized processes, which permitted the separation of multiple metals in economies of scale. This involved the coordination of testing and treatment methods, complex mechanical systems, and hundreds of workers in massive facilities that featured multiple buildings.

Concentration mills participated in the Areas of *Commerce* and *Economics* primarily on a local level. The milling companies fostered local commercial systems by paying wages to workers, securing sources of ore from mining companies, and consuming high volumes of goods. The successful facilities also contributed to local economies through their output, and by attracting investment and disbursing the funds.

Concentration mills participated in the Area of *Social History* in several ways. The mills employed a workforce that possessed a demography characteristic of Western mining. Individuals were of varying backgrounds, ethnicities, education levels, and socioeconomic status. The boom and bust inherent in the mining industry required the workers to be mobile, and they spread their traditions as they moved about. As major employers, the large mills also contributed to the development of social classes.

NRHP Criterion B: Concentration mills have a potential for eligibility under Criterion B when an important person was associated with the site. Some mills, especially large complexes, often can be traced to important individuals such as engineers and metallurgists. If the significance is through the person's presence on-site and direct participation in operations, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The individual's role in the operation must be clearly defined, and a brief biography explaining their significance provided. An important person's investment in a property or involvement with a company is too indirect an association for Criterion B. The individual of note must have been present on-site and directly participated in the milling operation.

NRHP Criterion C: Sites may be eligible under Criterion C if they clearly exemplify a concentration mill. Because most equipment and buildings were removed when a mill was abandoned, integrity is usually on an archaeological level. The mill footprint, terraces, aspects of infrastructure, and support facilities should be represented by features and artifacts. The general ore treatment process should be identifiable, but its specifics can be approximated. Intact structures and equipment, a high degree of integrity, or character defining engineering or architectural features strengthen a site's potential eligibility. Important engineering and architectural features include intact buildings, structures, and machinery. The *Engineering* Area of Significance is usually relevant to mill sites because they often exemplify the adaptation of metallurgical design, technology, and engineering to Black Hills ore. If characteristic buildings still stand, then the Area of *Architecture* may apply. Buildings represent the adaptation of design, materials, and construction methods typical of the mining industry, and to meet the needs of ore treatment.

Concentration mill sites may be eligible under Criterion C if they are contributing elements of a historic mining landscape. Even when a mill site is poorly preserved, it may provide context or belong to a greater body of resources representing an area's history. Large mill sites may constitute small landscapes in themselves, especially when tailings dumps are present.

NRHP Criterion D: Concentration mill sites may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. Mill sites can contribute in three general ways. The first is buried archaeological deposits such as privy pits, thick boiler clinker dumps, and refuse layers in tailings dumps. The deposits may include artifacts capable of enhancing our current understanding of workplace behavior, diet, and substance abuse. If the workers lived on-site, residential deposits may illuminate the currently dim portrait of mill workers and their lifestyle.

Second is a good assemblage of structures, foundations, or machinery for the ore treatment process. Detailed examination may reveal how metallurgists designed concentration processes for Black Hills ore, and chose machinery accordingly. The third is a well-represented infrastructure. Documentation may demonstrate how engineers designed water, power, ore input, and tailings disposal systems.

In general, large and complex mill sites tend to possess at least one of the information sources noted above and will qualify under Criterion D. Small mill sites, on the other hand, are usually simple, lack buried deposits of substance, and no longer have sufficient assemblages of features and artifacts.

Property Subtype: Arrastra

Resource Description: An arrastra was a simple, inexpensive, labor-intensive, and inefficient means of recovering gold from ore. Arrastras were primarily employed during the first years of hardrock mining to treat simple ores. A few capital-starved outfits in remote locations continued to employ the technology during the Depression-era revival of the 1930s. However, the availability of amalgamation mills rendered these primitive treatment facilities largely obsolete by the early 1880s.

An arrastra consisted of a circular stone floor usually less than 30 feet in diameter, low sidewalls encircling the floor, and a capstan at center. A harness beam swiveled on the capstan, and it pulled drag-stones around the floor as it rotated. A draft animal walking a path that encircled the floor provided motive power, and some outfits substituted waterpower for the draft animals. As the stones ground the ore, the arrastra operator sprinkled mercury and water, and the mercury amalgamated with the gold as it became exposed. After a prescribed amount of time, the operator drained the arrastra, shoveled out the tailings, and scraped the precious amalgam off the floor.

The simplicity of the arrastra made it an ideal facility for extracting gold from ore on the remote frontier. The miner only needed to possess three basic resources: hardware, tools, and skill. The hardware was minimal and included brackets, timber bolts, a swivel, hooks, and tack. The miner could harvest local materials for the capstan, floor, and sidewalls, but had to exercise caution in their assembly. The floor had to be perfectly smooth with minimal crevices, and the joints between the floor and sidewalls as narrow as possible. The miner graded a level platform for the floor, sealed it with clay, and anchored the capstan and sidewalls firmly in the ground. He stuffed more clay into the crevices and joints to retain the mercury and amalgam, and was ready for operation.

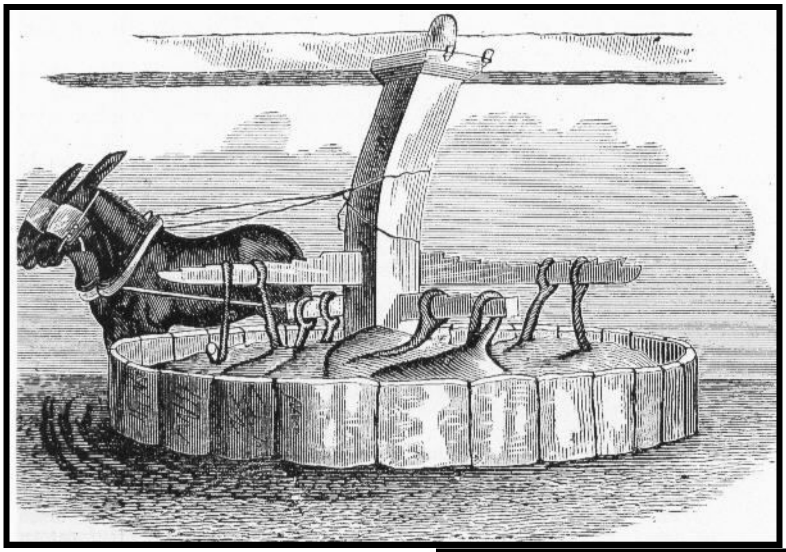


Figure 3.71: The ages-old arrastra was the most primitive ore treatment facility in the Rocky Mountain west. The operator shoveled gold ore into the interior, added mercury, and waited for the rotating muller stones to grind the material into sand and slurry. As the ore fractured, mercury amalgamated with the gold. Because arrastras were simple and inexpensive, they were used by prospectors on the frontier. Source: *Mining & Scientific Press* 5/26/83.

Figure 3.72: Some arrastras were driven by waterwheels or steam engines for increased capacity. Such arrastras had drive-trains fitted with gearing and a belt pulley, such as the version at the Death Valley Museum, California. Although the support structures were substantial, they usually leave little evidence. Source: Eric Twitty.

Resource Eligibility: Today, arrastras are very rare and important as historic resources. Although arrastras saw general use for only a brief period of time and were relatively few in number, they were instrumental to the success of early hardrock mining. Arrastras were the first type of ore treatment facility built in the Black Hills when the region was remote and undeveloped. Given this, arrastras were significant on a statewide level from 1875 into the early 1880s, when they were superseded by amalgamation mills. Arrastras may also be significant during the first years of specific mining districts opened slightly later in time.

The geographic extent of arrastras in the Black Hills is uncertain, although it seems likely that they were built in most mining districts during the late 1870s. Few, however, have survived in any form. Most were destroyed when individuals disassembled the floors in search of leftover gold, or when the land was developed by later mining activity. Arrastras that still exist today will probably possess integrity on an archaeological level. Usually, only the circular floor, the capstan stump, and possibly a thin veneer of tailings remain. If the sidewalls and capstan are mostly intact, then an arrastra can be described as complete. The absence of these aspects, however, should in no way be equated with poor integrity. An intact floor is a sufficient level of archaeological integrity to represent the arrastra, but the floor must be in its original place of construction. Because few arrastras exist in any state of preservation, features in addition to the floor strengthen a site's eligibility.

Determining whether an arrastra dates to the period of significance noted above can be difficult. Historically, miners did not document their arrastras, and so few will appear in archival sources. Further, the operation of an arrastra generated few clearly dateable artifacts visible on ground-surface. Archaeological testing and excavation may be the only sure means of assigning a timeframe. An arrastra can be assumed to date to the period of significance if archival research proves that the immediate area was developed early in Black Hills history.

NRHP Criterion A: Arrastras are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although reviewed below, the Areas are explained in more detail in Chapter 2.

As the earliest ore treatment facilities in the Black Hills, arrastras participated in the Area of *Exploration/Settlement* in several ways. First, miners used arrastras to test ore for its gold content, and then to recover the metal when rich enough. In both cases, arrastras successfully demonstrated the presence of gold, directly contributing to the Black Hills rush. Second, most mining districts lacked amalgamation mills in their first years, and shipping crude ore to distant facilities was prohibitively expensive. Arrastras were the only local means of treating the ore, and they were a first stage of profitable mining. Overall, the apparatuses allowed the mining industry to gain footing while the Black Hills were a remote frontier. The industry then brought political, economic, and social systems.

The role of arrastras in the Area of *Industry* is similar. Arrastras were the first step in recovering gold from ore, and as such, fostered hardrock mining. Because arrastras were slow and inefficient, their net yield was insignificant. But, they proved that the Black Hills gold ore could be treated with amalgamation. Investors, mining companies, and amalgamation mills followed, and they assumed industrial proportions by the early 1880s.

NRHP Criterion B: Arrastras can be eligible under Criterion B if an important person was associated with the site. Because few arrastras were documented in archival sources and most were built by transient miners, it is very difficult to attribute them to significant individuals. If an important person can be identified, Criterion B applies if that individual built or ran the arrastra. In some cases, important people were involved with companies that built arrastras or owned the underlying properties. Such an association is too indirect for Criterion B. The individual of note must have been present on-site and played a fundamental and direct role in its physical development.

NRHP Criterion C: Arrastras may be eligible under Criterion C if distinguishing characteristics or features currently remain at the site. Few if any complete arrastras exist, and integrity will most likely be on an archaeological level. The circular stone floor must be present and in its place of use. Archaeological features representing the sidewalls, capstan, mechanized power source, or support facilities strengthen a site's potential eligibility. The *Engineering* Area of Significance is usually relevant to arrastras because they exemplify the earliest type of ore treatment facility in a mining district, as well as a type of technology unique to the mining frontier.

NRHP Criterion D: Arrastras have a high potential for eligibility under *NRHP Criterion D* because of their likelihood of yielding important information upon further study. In general, relatively few arrastras have been documented and little is currently understood about how miners actually constructed and operated the facilities. The surface features and artifacts may enhance the currently knowledge, and even when only the floor is visible, arrastras can possess buried archaeological deposits and features that may contribute important details.

Features Common to Ore Treatment Mills

Mill sites can consist of combinations of archaeological, engineering, and architectural features. Aspects of engineering such as machinery and structures may remain from the crushing, ore concentration, power, and infrastructure systems. Aspects of architecture can include the frame shell of the mill, as well as associated buildings. When the above are no longer intact, they may be represented by archaeological features. Listed below are the Feature Types common to mill sites. To help researchers understand their relationship to a site, the features are grouped according to the general stages of ore treatment.

Figure 3.73: Standby Mill near Rochford. Courtesy South Dakota State Historical Society.

General Feature Types

Assay Shop: Mills usually featured assay shops to track the efficiency of metals recovery and concentration. A metallurgist periodically tested samples of unprocessed crude ore and compared the results with tests on tailings and concentrates. If he found that the metals recovered by the mill approximated the amount in the crude ore, the metallurgist knew the mill functioned efficiently. The assay shop may have been within the overall mill building at small facilities, or provided with its own building at large plants. The shops had distinct appliances such as a free-standing or masonry assay furnace, a blower, a coal bin, and stout workbenches.

Assay shop buildings were usually constructed with the same materials and workmanship as the associated mill. Most were based on lumber frames, had ample windows, a chimney for the furnace, and a heavy subframe or foundation for crushing machinery. The shops were vernacular in that they had no recognized architectural style and were custom-designed for function and economy. A tall brick chimney, machine foundations, and an artifact assemblage of assay debris are distinguishing characteristics.

Assay Shop Foundation/Platform: Assay shops often stood on earthen platforms or foundations of concrete and rock masonry. Distinct characteristics can define a platform as that for an assay shop. Foundations or other remnants of an assay furnace, its blower, and small crushers may remain. Artifact assemblages typically include furnace clinker, fire-bricks, broken assay crucibles, mineral samples, and laboratory artifacts.

Assay Shop Ruin: The collapsed remnants of an assay shop.

Conveyor: Mills relied on gravity to draw ore through a sequence of crushing and concentration machinery installed on terraces. Many designs used conveyors to return the ore to the upper terraces for reprocessing, or from one treatment stage to another. Early conveyors consisted of a bucket-line or spiral feed, and later conveyors consisted of belts on rollers. A timber or steel frame was the chassis for the assembly.

Conveyor Remnant: A partially disassembled conveyor.

Machine Foundation: A foundation that anchored an unknown mill machine.

Mill Building: Mill buildings were distinct edifices in the mining landscape. Most enclosed the ore treatment machinery, power source, and other facilities under one roof. The buildings tended to be large, sloped in profile to conform to stairstep terraces or foundations, and irregular in plan.

Each mill was unique in design and incorporated elements of both architecture and engineering. Most were based on a custom-designed frame that not only supported the walls and roof, but also appliances, bins, and the system of driveshafts and belts that ran the machinery. Given this function, most frames varied in design and construction within the mill, and were made of heavy timbers. The foundations for small mills consisted of log or timber footers on earth, and stone or concrete sufficed at large plants. Well designed mill buildings stood independently from interior structures such as bins and stamp batteries, allowing for replacement of the components. Most, however, were tied into the interior structures for economy of materials.

The exterior appearance was a mining industry variety of vernacular. Prior to the 1910s, board-and-batten siding or walls of mere planks were common, and corrugated sheet iron and tarpaper dominated afterward.

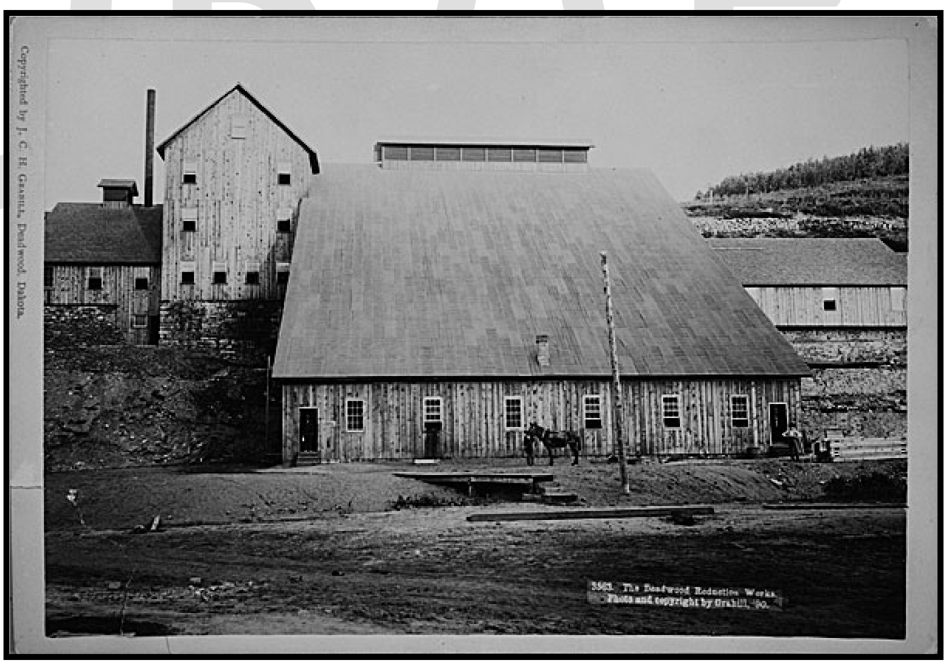


Figure 3.74: The building for the Deadwood Reduction Works, pictured in 1890, is typical of amalgamation and concentration mills. The floorplan is complex with ore bins at the top, engine and boiler rooms at upper left, and the sloped portion covering a series of terraces and platforms, each with machinery for crushing and metals recovery. A heavy and well-designed frame supports the roof, walls, and interior structures and equipment. Courtesy of the State Archives of South Dakota Historical Society.

Mill Building Foundation: Mills stood on stout foundations that not only supported the building, but also machinery and structures within. The foundations had footers around the circumference for the walls, and additional footers on the terraces for the frame and machinery. At small mills, the foundations were timbers and logs embedded in earth. At large mills, the foundations consisted of concrete or masonry, and were often integrated with walls retaining the terraces.
Mill Building Ruin: A collapsed mill building.
Mill Platform/Terrace: Because mills relied on gravity to draw the ore through crushing and concentration, they were built over a series of terraces cut out of a slope. Often, the terraces are the principal features representing a mill. Each terrace supported a stage of treatment. When recorded, platforms should be numbered from the top down and described according to function.
Receiving Bin: Nearly all mills featured an ore bin at the head to receive crude ore for processing. The bins typically had sloped floors and discharge chutes in the front, which directed the ore into a stamp battery or primary crusher. The walls consisted of a timber frame sided on the interior by heavy planks.
Receiving Bin Platform or Foundation: Receiving bins stood on foundations and platforms similar to those for ore bins at mine sites. Timber or log footers embedded in the ground supported the frame, and cribbing or masonry may have supported the head and toe.
Receiving Bin Ruin: The collapsed remnants of a receiving bin, usually jumbled frame elements, plank siding, and foundation footers.
Utility Pole: Utility poles carried electrical or telephone lines. Poles erected by power companies often feature date nails.

Crushing System Feature Types

Jaw Crusher: A jaw crusher reduced crude ore from the receiving bin into gravel, completing the first stage of physical reduction. The heavy machine, also known as a Blake crusher, was located on the mill’s upper terrace. Crushers usually featured jaws and dual flywheels powered by a belt. Small units were around 2 by 4 feet in area and large units were up to 4 by 8 feet in area.
Crusher Foundation: Due to severe vibrations, crushers were anchored to stout timber or masonry foundations. Small piles of crushed gravel often underlie crusher foundations.
Stamp Battery: Early mills relied on stamp batteries for primary crushing. After the mid-1880s, batteries often provided secondary crushing, reducing the gravel produced by a jaw crusher. A stamp battery consisted of a heavy timber gallows frame, heavy iron stamps that dropped into a battery box, and a cam shaft that raised and let the stamps fall. The cam rotated in the top of the frame, and it was fitted with a large bullwheel turned by a belt. The stamp shoes were fixed to steel rods that slid in guides. Batteries usually featured stamps in groups of five. The timber frame for a single group tended to be 7 feet wide, up to 15 feet high, and stood over a cast iron battery box bolted to a timber pedestal. Initially, workers shoveled ore into the battery box for crushing, and by the 1890s, automatic feeders introduced the ore.
Stamp Battery Frame: In many cases salvage efforts dismantled the iron hardware from a stamp battery, leaving the timber frame. Bolts for the cam shaft and semi-circular guides for the stamp rods are usually evident.
Stamp Battery Pedestal: Often, stamp mills were dismantled for use elsewhere, leaving the pedestal as the principal representation today. Stamp battery pedestals were rectangular, often 2 by 5 feet in area and 2 feet high, and consisted of timbers set on-end. The pedestal anchored a cast iron battery box in which the stamps crushed the ore.
Screening Station: Successful concentration and amalgamation required the crushed ore to be absolutely uniform in particle size after crushing. Screens in between each crushing stage allowed fine material to proceed while returning coarse particles for reprocessing. Trommels were preferred because they screened ore in a continuous flow. A trommel consisted of wire mesh cylinders nested together and bolted to a steel frame. As they rotated, fine material passed through while coarse particles rolled out and were returned.
Crushing Rolls: A crushing rolls was an apparatus that provided secondary or tertiary crushing for ore already reduced to gravel. The apparatus featured a pair of large iron rollers set slightly apart in a cast iron or heavy timber frame. As they rotated, the rollers drew gravel into the gap and fractured it. Small units were around 4 by 4 feet in area while common units were 6 by 6 feet in area. Crushing rolls were usually located on an upper mill terrace, but below the primary crusher.

Crushing Rolls Foundation: A crushing rolls was often anchored to a rectangular timber foundation consisting of heavy horizontal beams bolted to posts that leaned slightly inward.

Huntington Mill: A Huntington mill was an apparatus that ground previously crushed ore into a fine slurry. The machine was based on a cast iron pan approximately 6 feet in diameter and 3 to 4 feet deep ringed with a channel. A set of heavy iron rollers rotated across the pan floor and ground the ore. Fine particles passed through screens breaching the walls and left via the channel. In amalgamation mills, workers introduced mercury, which captured the gold during grinding. A canvas belt powered the device via a pulley and geared shaft.

Huntington Mill Foundation: Huntington mill foundations were factory-made and the timbers often feature beveled edges. The foundation usually consisted of a rectangular timber footer 6 by 9 feet in area. The machine stood on heavy posts forming a 6 by 6 foot cube at one end, and the other end featured a raised block with a brace for the drive shaft.

Ball Mill: A ball mill was a steel vessel similar to today's cement mixer. The vessel tapered at one or both ends, rotated in heavy bearings, and was powered by a canvas belt and shaft. As the vessel rotated, steel balls inside tumbled and pulverized the ore into a fine slurry. Small units were 4 feet in diameter and 6 feet long. Balls mills were used for tertiary crushing in concentration mills, and to recover gold with mercury in amalgamation plants.

Ball Mill Foundation: Ball mills were anchored to heavy concrete foundations distinct in footprint. The foundation featured three parallel pylons, usually 1 foot thick. Two pylons supported the vessel's ends. The one for the narrow end was usually 2 feet long and 4 feet high, and the pylon for the broad end was 3 feet long and slightly lower. The third pylon, often square, stood away and anchored the driveshaft.

Rod Mill: A rod mill operated according to same principals as a ball mill, and saw like applications. The vessel, however, was cylindrical, and steel rods inside ground the ore.

Rod Mill Foundation: Rod mill foundations were similar to those for ball mills. Parallel pylons, usually 1 foot thick, 3 feet long, and as high, supported the vessel, and another pylon smaller in size anchored the driveshaft.

Figure 3.75: Wheel and cam on a stamp at Standby Mine near Rochford. Courtesy South Dakota State Historical Society.

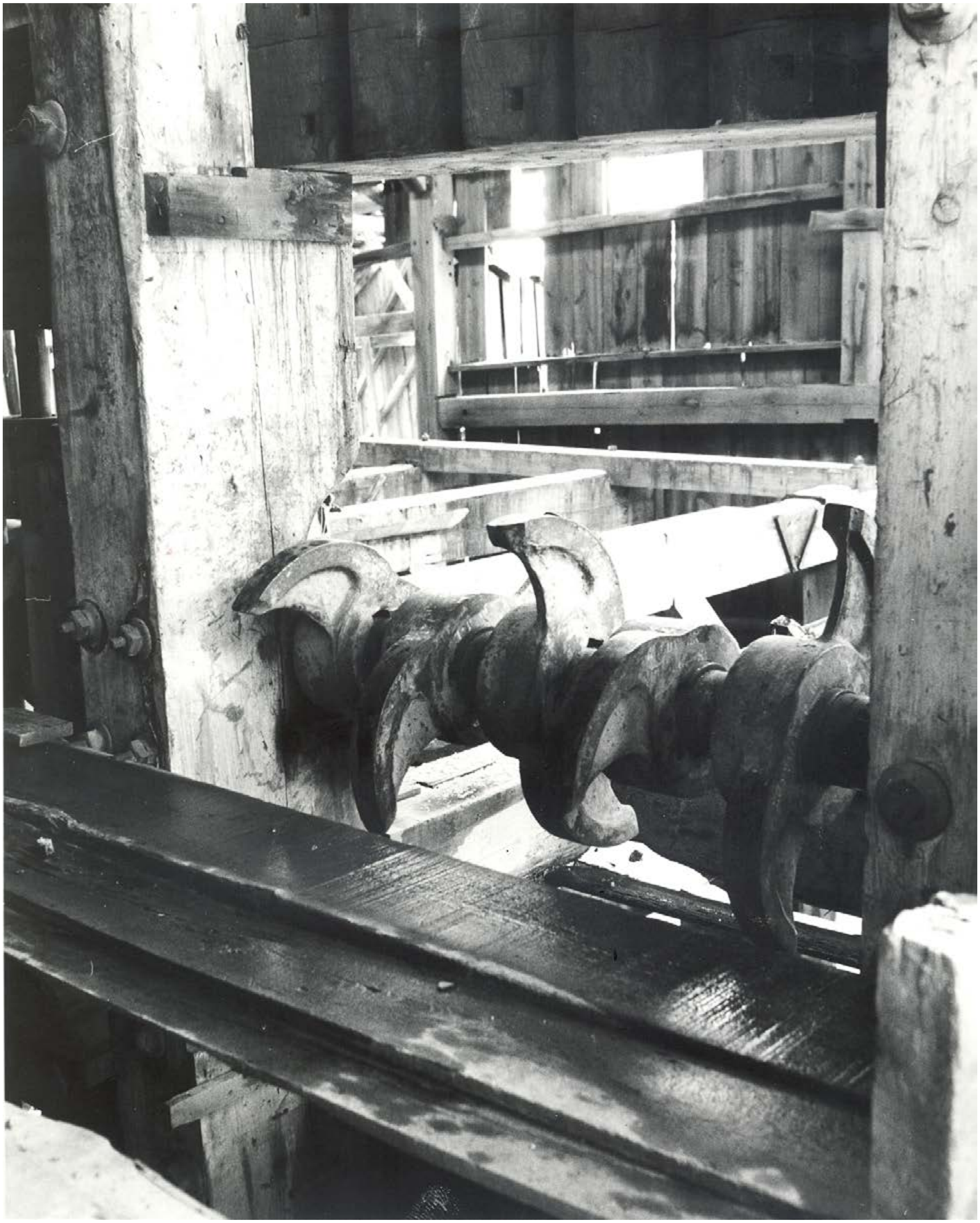


Figure 3.76: Close up of cam at Standby Mine in Rochford. Courtesy South Dakota State Historical Society.

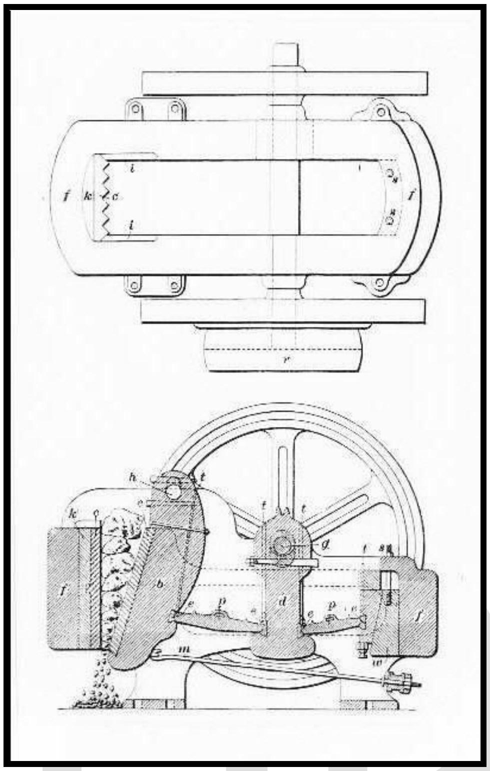


Figure 3.77: The plan view, top, and profile, bottom, illustrate a jaw crusher, which provided initial crushing at most mills. Source: International Textbook Company, 1899, A43:2.

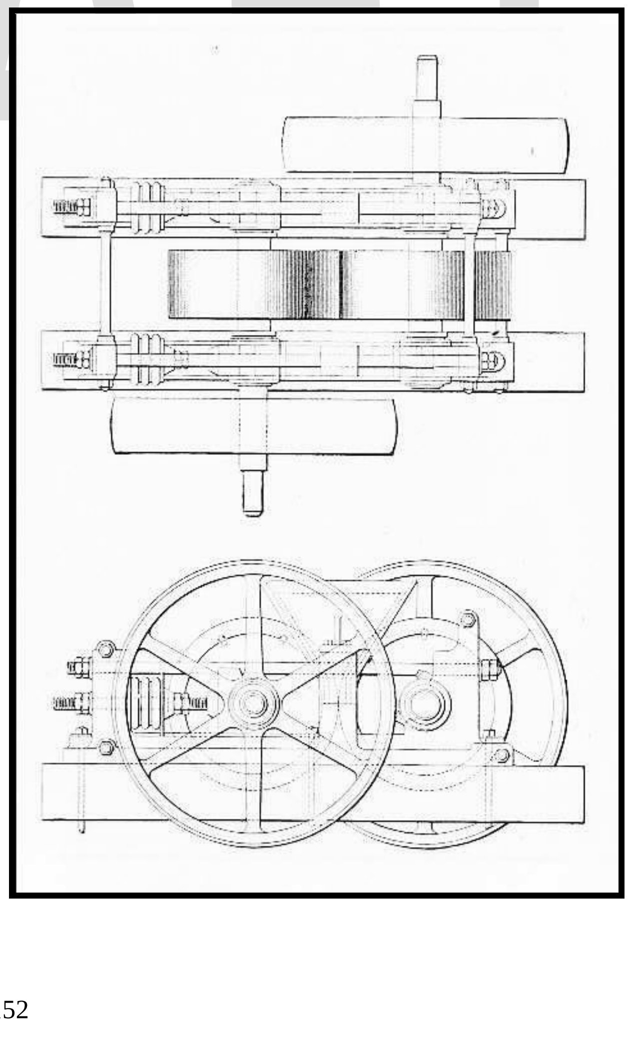


Figure 3.78: The plan view, top, and profile, bottom, illustrate a device known as a crushing rolls, which was popular for secondary and tertiary crushing. Source: International Textbook Company, 1899, A43:12.

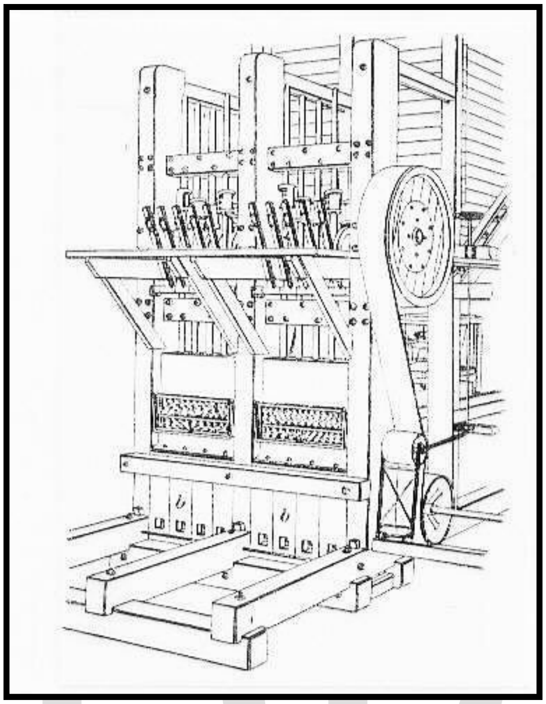


Figure 3.79: The quarterview illustrates the front of a stamp battery, which provided secondary crushing at some mills. Stamp rods are visible between the timber posts, and their heavy iron shoes pounded ore in the battery boxes below. The battery boxes are bolted to pedestals of upright timbers, which are often the only remnants of stamp batteries today. Source: International Textbook Company, 1899, A43:27.

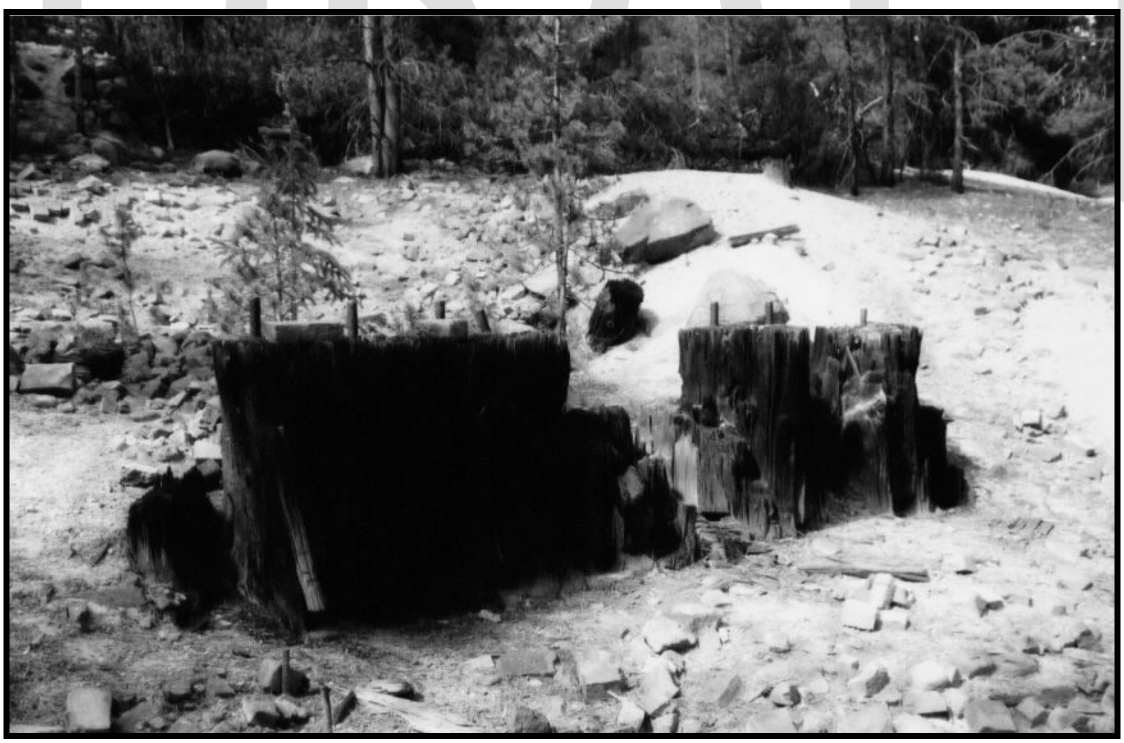


Figure 3.80: When a stamp battery was dismantled, the pedestals for the cast iron battery boxes were often left in place. The pedestals consist of timbers on-end and feature anchor bolts on top, and each is around 2 feet wide, 3 feet high, and 5 feet long. Source: Eric Twitty.

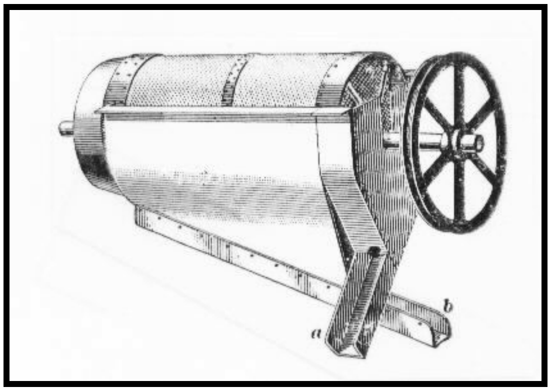


Figure 3.81: Most mills relied on trommel screens to sort crushed rock between processing stages. Source: International Textbook Company, 1899, A43:12.

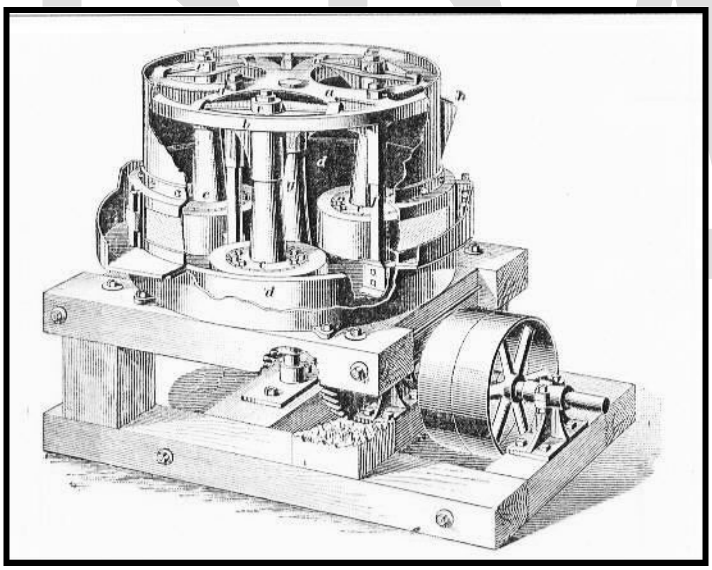


Figure 3.82: The device known as the Huntington mill saw two applications. At concentration facilities, it provided secondary and tertiary crushing, and at amalgamation mills, the device simultaneously ground and amalgamated gold and silver ores. The driveshaft at right turned a capstan in the mill's pan, which caused the rollers to grind screened ore against the pan's cast iron walls. Note the foundation. Source: International Textbook Company, 1899, Z43:47.

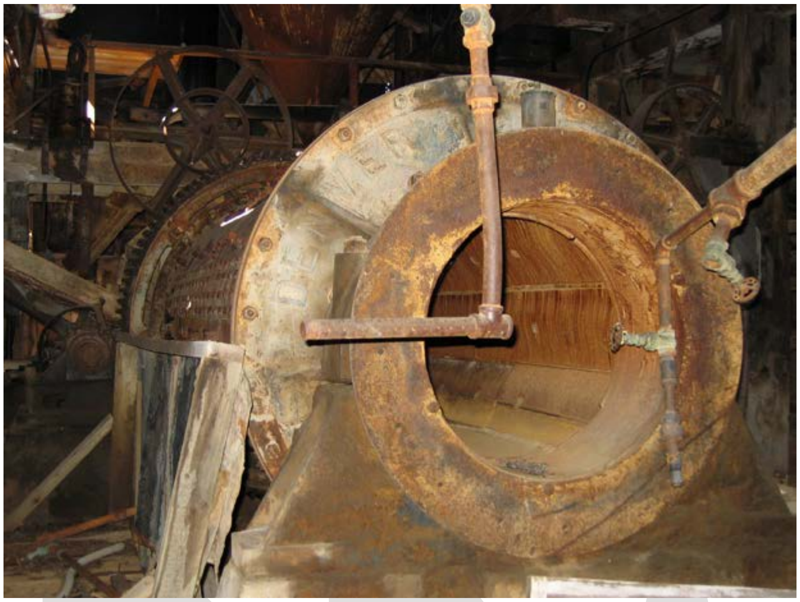


Figure 3.83: Rod mills became popular for fine grinding by the 1910s. As the entire cylinder slowly rotated, tumbling steel rods in the chamber ground screened ore into a slurry. A hatch covered the opening. Source: Carol Beam, Boulder County Parks and Open Space, Boulder, Colorado.

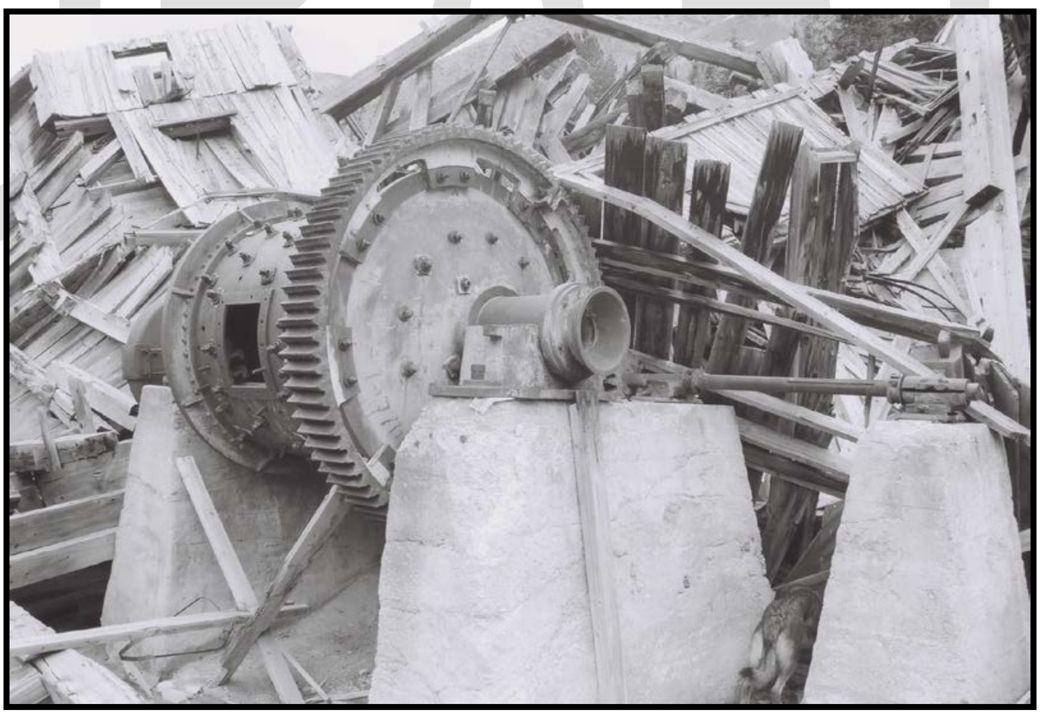


Figure 3.84: The ball mill performed similar to the rod mill above. The difference was that steel balls tumbled in the chamber and ground ore to a slurry. Note the concrete foundation, distinct in footprint. Source: Eric Twitty.

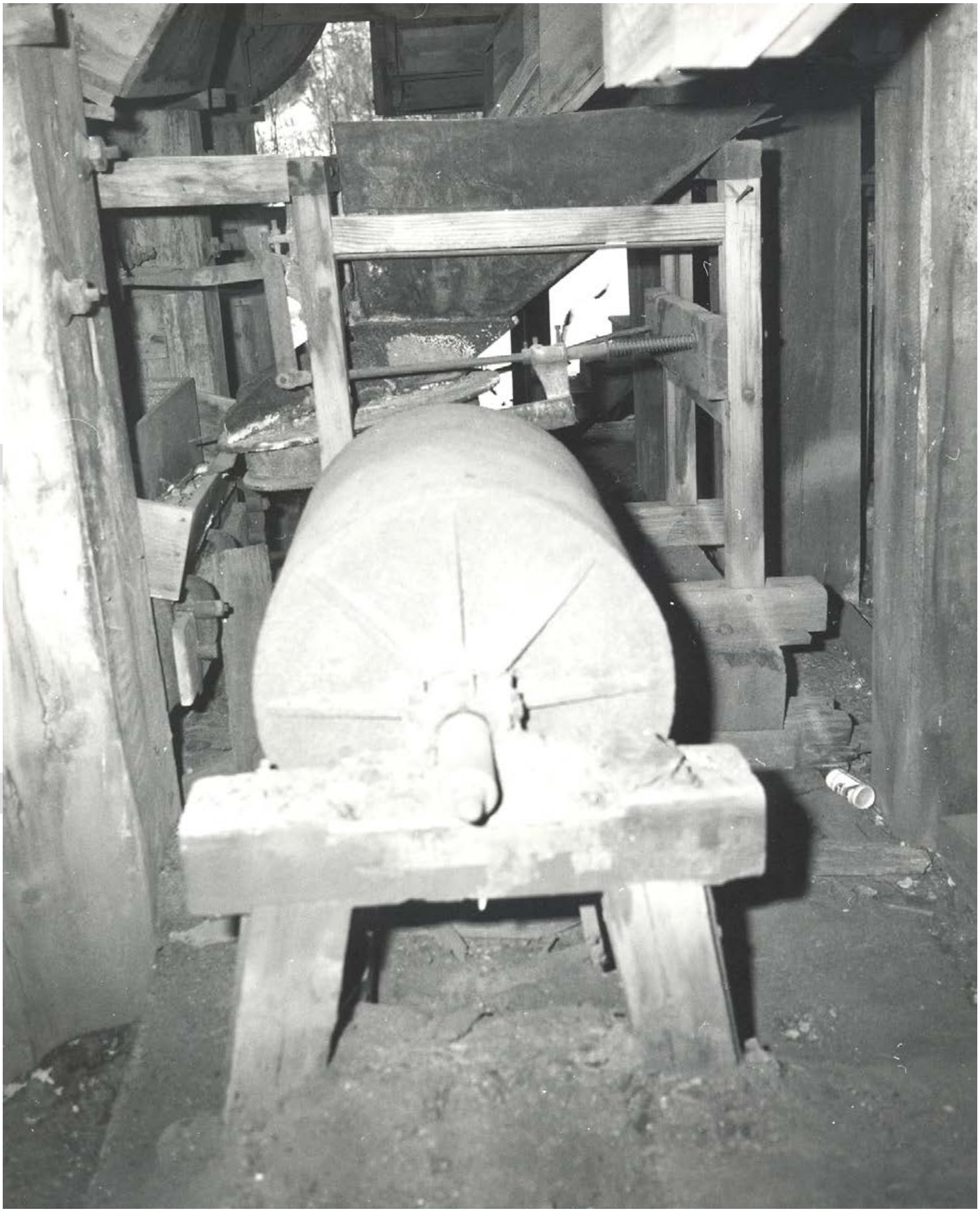


Figure 3.85: Ball Mill from the Standby Mine near Rochford. Courtesy South Dakota State Historical Society.

Concentration System Feature Types (Figures on following pages)

Amalgamation Table: Amalgamation tables were only used in amalgamation stamp mills. The tables stood on heavy timber frames and sloped away from the toe of a stamp battery. The tabletops were usually copper, coated with mercury, and around 6 by 12 feet in area. The slurry of pulverized ore produced by the stamp battery trickled over the copper plate, and the mercury caught the gold. In early mills, a flume diverted the spent slurry out of the mill as tailings. Later, the flume delivered the slurry to other amalgamation appliances such as Huntington mills.

Amalgamation Table Frame: Amalgamation tables were usually removed from mills when the facilities were abandoned, leaving a heavy timber frame around 6 by 12 feet in area and at least 4 feet high.

Jig: A jig was a concentration appliance that enhanced the separation of metalliferous particles from waste. Common jigs consisted of a wood body with a V-shaped bottom that featured drain ports, and wood walls dividing the interior into cells. A frame over the cells supported a cam shaft powered by a canvas belt. The shaft gently moved plungers up and down, agitating the slurry in the cells. The action kept light waste in suspension while allowing heavy metalliferous material to drop out and settle in the V floor. A water current flushed the waste away. Most jigs were around 4 by 9 feet in area and 4 feet high.

Vanner: A vanner was a concentration apparatus between 4 by 8 and 6 by 13 feet in area. The machine featured a broad rubber belt that passed around rollers at both ends of a mobile iron frame. An eccentric cam imparted a vibrating motion that caused heavy metalliferous particles to settle on the belt. The lighter waste remained on the surface and was washed into a flume by a jet of water. The waste may have flowed out of the mill as tailings, or continued to another set of concentration appliances. Scrapers removed the metalliferous material into another flume for recovery.

Vanner Foundation: Vanners were usually bolted to timber foundations that featured cross-members at both ends, stringers linking the cross-members, and braces for the frame. A flume for the waste slurry usually passed by the vanner's toe.

Vibrating Table: The vibrating table, introduced during the late 1890s, was one of the most successful and widely employed concentration apparatuses. Vibrating tables featured a slanted tabletop, often 5 by 15 feet in area, clad with rubber and narrow wooden riffles. The tabletops were often mounted at a slant on a mobile iron frame oscillated by an eccentric cam. The motion caused heavy metalliferous material to settle against the riffles while a current of water washed the light waste into an adjacent flume.

Vibrating Table Foundation: Vibrating table foundations featured anchor bolts projecting out of three timber cross-members. Two cross-members were at the ends, and a third was parallel and near one of the ends. The foundations are typically around 12 to 15 feet in length.

Flotation Cells: Introduced during the early 1910s, flotation was a highly successful stage of concentration for complex ore. Flotation cells were based on a large rectangular wooden tank divided into compartments. Paddles agitated a slurry solution in each cell and swept a froth of metalliferous material over the cell's sides. The froth either flowed into a flume or into a second set of cells for additional concentration. A plank walkway often extended along the tank, and the assemblage stood on timbers on one of the mill's lower terraces.

Cyanide Tank: Cyanidation was an alterative to amalgamation for recovering gold from complex ore. Finely ground slurry was introduced into cyanidation tanks, where a dilute cyanide solution leached out the gold. Slowly rotating agitation arms on the tank floor ensured a constant blend. Similar to a water tank, the vessels were usually located on a mill's lowest terrace and provided a last stage of ore treatment.

Chlorination Tank: Chlorination was a process similar to, but predating cyanidation. The equipment was largely the same.

Settling Tank: Some concentration mills featured settling tanks on the lowest platform where heavy metalliferous fines gravitated out of spent slurry. Settling tanks were similar to wooden water tanks and often featured a revolving arm at center to exacerbate the settling process.

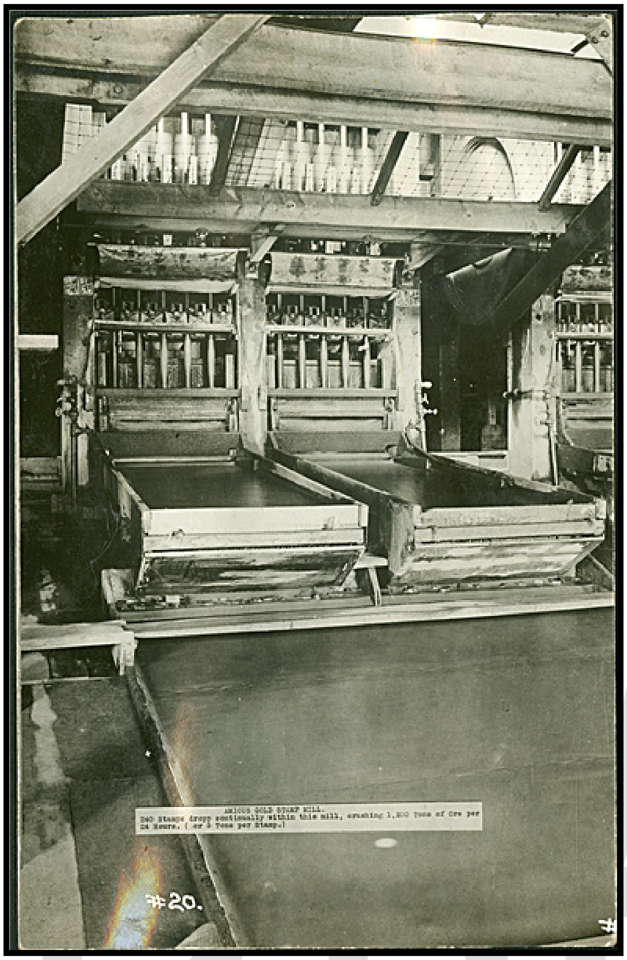
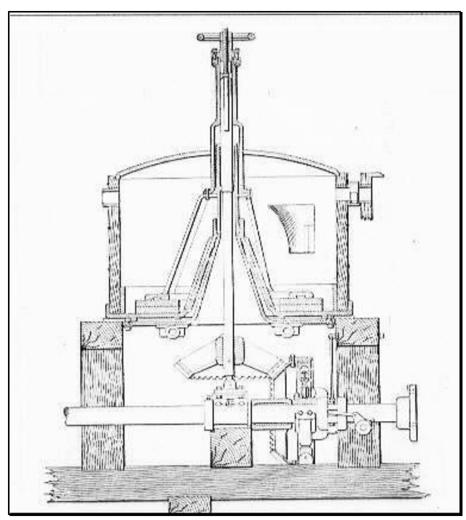


Figure 3.86: The undated photo illustrates amalgamation tables at the Amicus Mill in Lead. The tables, large copper plates coated with mercury, extend outward from the base of stamp batteries. Slurry produced by the stamps flowed over the tables, and the mercury amalgamated with the gold. Courtesy of the State Archives of South Dakota Historical Society.

Figure 3.87: The profile depicts a grinding pan, which provided tertiary crushing. Some mills also used the pans to amalgamate gold ore. A belt drove the pan, which featured heavy shoes that rotated around the cast iron floor. Source: International Textbook Company, 1899, A43:172.



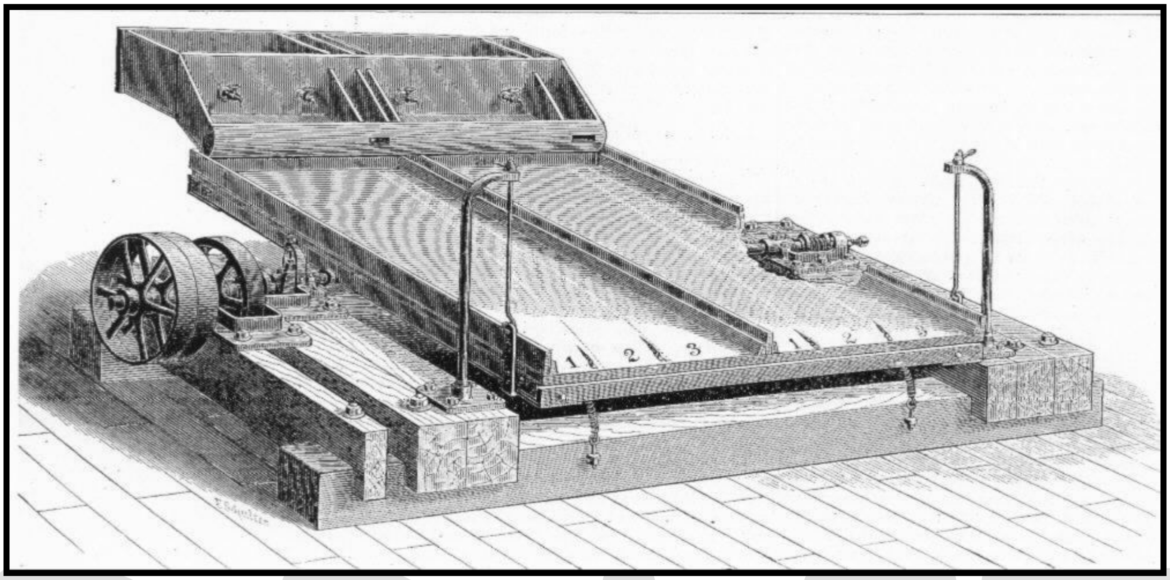


Figure 3.88: Known as both a percussion table and a bumping table, this 1880s apparatus used vibratory action to concentrate finely ground gold and silver ores. Source: *Mining & Scientific Press* 8/9/90, p83.

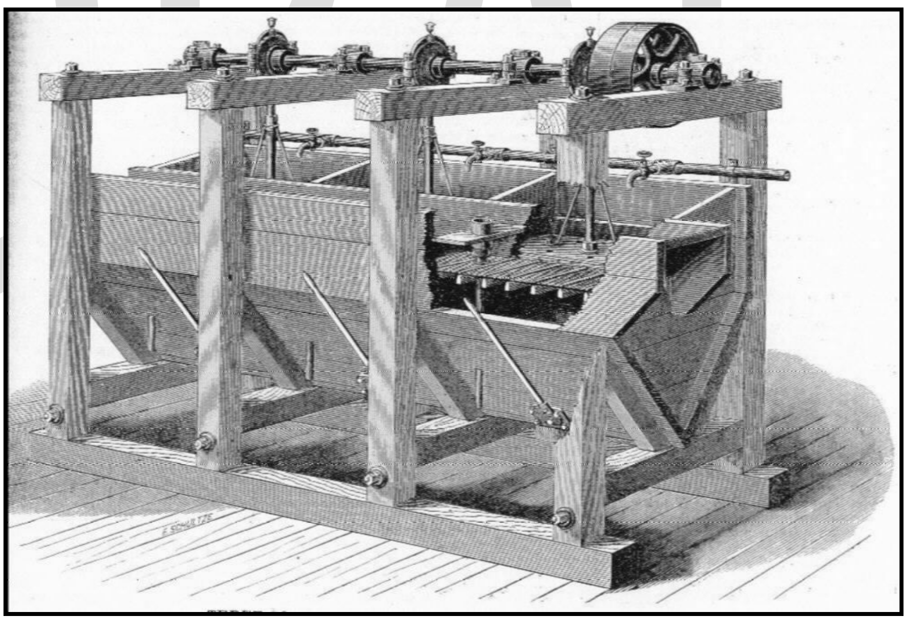


Figure 3.89: The jig was an effective concentration device popular from the 1860s through the 1910s. The crank at top moved three screen plungers up and down in the water-filled cells, illustrated by the cut-away view. The agitating action classified crushed ore particles by size or weight, depending on the application. Source: *Mining & Scientific Press* 8/9/90, p83.

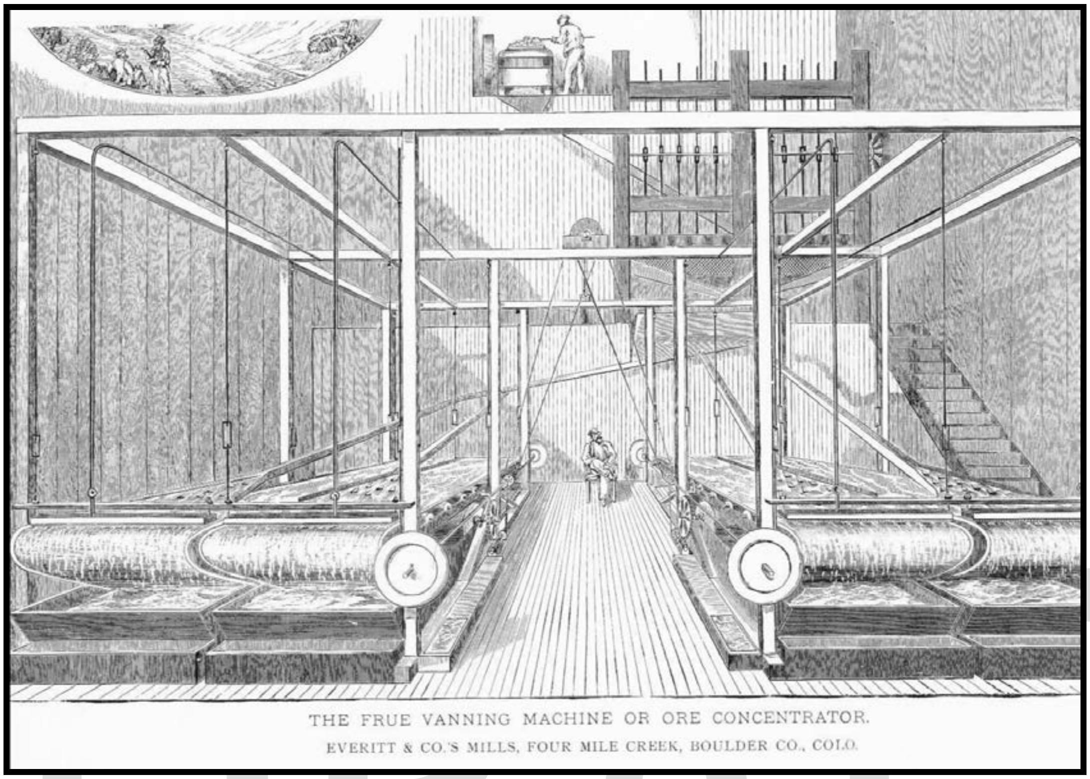


Figure 3.90: The Everett Mill, which operated in Colorado during the late 1870s, employed several Frue vanners to concentrate gold ore. As the vanner vibrated, finely ground ore settled against the broad rubber belt while water jets and a scraper removed light waste material. Note the stamp battery at upper right. Source: *Engineering & Mining Journal* 11/24/77, p387.

Figure 3.91: Vibrating tables like the one in Figure 3.69 below were anchored to foundations of three concrete or timber footers, often 5 feet wide and 15 feet long. Source: Eric Twitty.

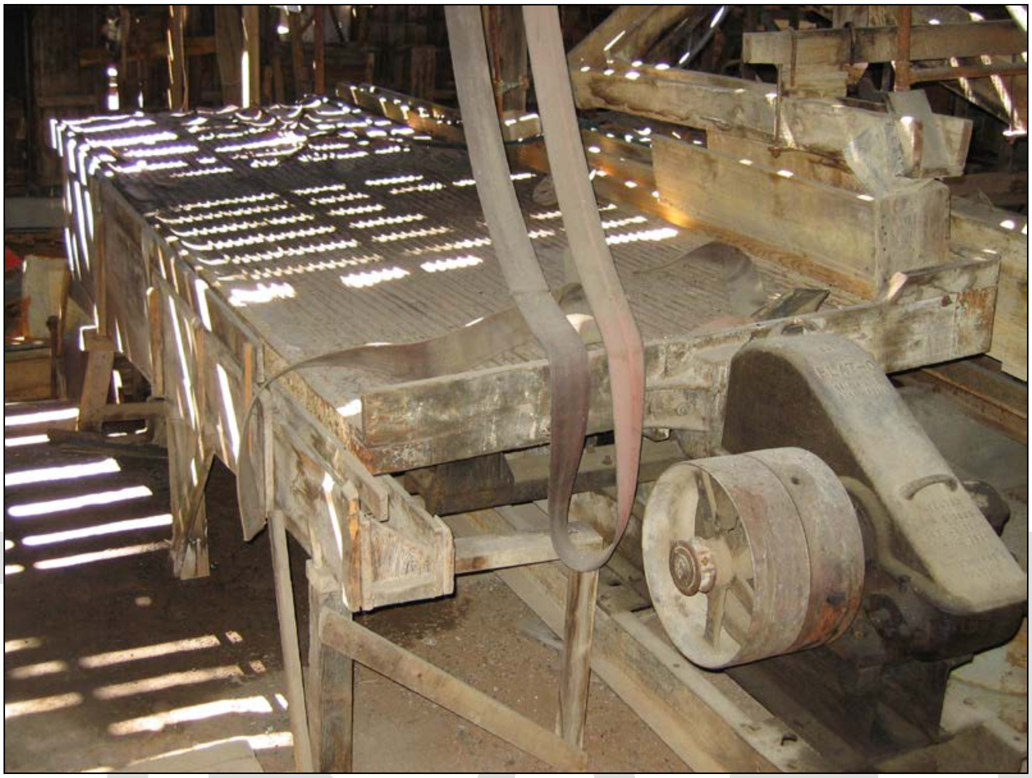


Figure 3.92: Following its introduction around 1898, the vibrating table was one of the most popular and effective concentration appliances throughout the Rocky Mountain west. An eccentric cam under the guard at right imparted a vibrating motion to the tabletop, and the vigorous action caused heavy metalliferous material to settle against the riffles. Water currents washed the light waste off. Source: Carol Beam, Boulder County Parks and Open Space.

Power System Feature Types

Boiler: Prior to the 1910s, most mills were powered by steam engines. Return-tube boilers usually generated the steam. See Hardrock Mine Feature Types for a description of boilers.
Boiler Foundation: See Hardrock Mine Feature Types.
Boiler Setting Ruin: See Hardrock Mine Feature Types.
Boiler Clinker Dump: See Hardrock Mine Feature Types.
Motor: By the 1910s, mills were increasingly electrified, and motors powered the machinery. See Hardrock Mine Feature Types for a description of motors.
Motor Foundation: See Hardrock Mine Feature Types.
Overhead Driveshaft: Few mill appliances had their own independent power sources, and most were driven by a central engine or motor. Sets of overhead driveshafts and canvas belts transferred motion from the engine or motor to the appliances. Overhead driveshafts, also known as line-shafts, featured belt pulleys over each mill appliance and rotated in bearings bolted to the mill building's frame.
Steam Engine: Prior to the 1910s, steam engines were the most common source of power for mills. Usually located on the mill's lowest terrace, the engine transferred motion to a system of overhead driveshafts via a canvas belt. Most engines were horizontal units between 2 and 3 feet in width and 8 to 12 feet long. A steam engine required a boiler.
Steam Engine Foundation: Steam engine foundations are often rectangular, studded with anchor bolts, and between 2 and 3 feet in width and 8 to 12 feet long. Workers built engine foundations with heavy timbers, brick or rock masonry, or concrete. The foundations often featured a pylon for the outboard flywheel bearing.

Transformer Station: Those mills with electric power required transformer stations to convert and distribute the current. See Hardrock Mine Feature Types for a description.
Transformer Station Platform: See Hardrock Mine Feature Types.
Transformer Station Ruin: See Hardrock Mine Feature Types.

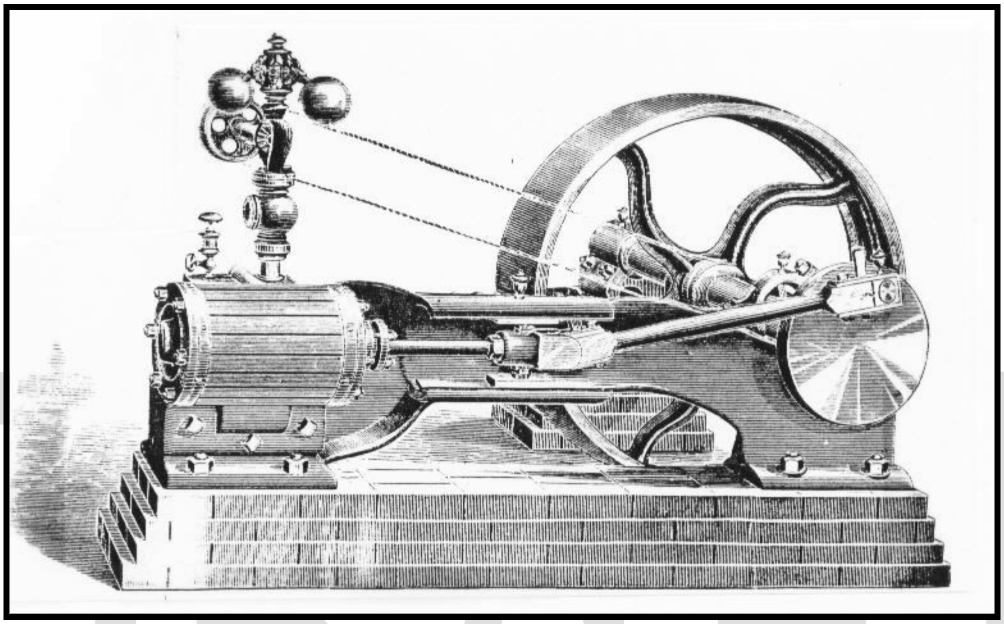


Figure 3.93: Until electricity became available during the 1910s, horizontal steam engines powered nearly all concentration mills. A drive belt passed around the flywheel to a mill's system of driveshafts. Note the masonry foundation. Source: Ingersoll Rockdrill Company, 1887:53.

Figure 3.94: By the 1910s, mining companies increasingly used electric motors to power their mills, provided electricity was available. Source: Carol Beam, Boulder County Parks and Open Space, Colorado.

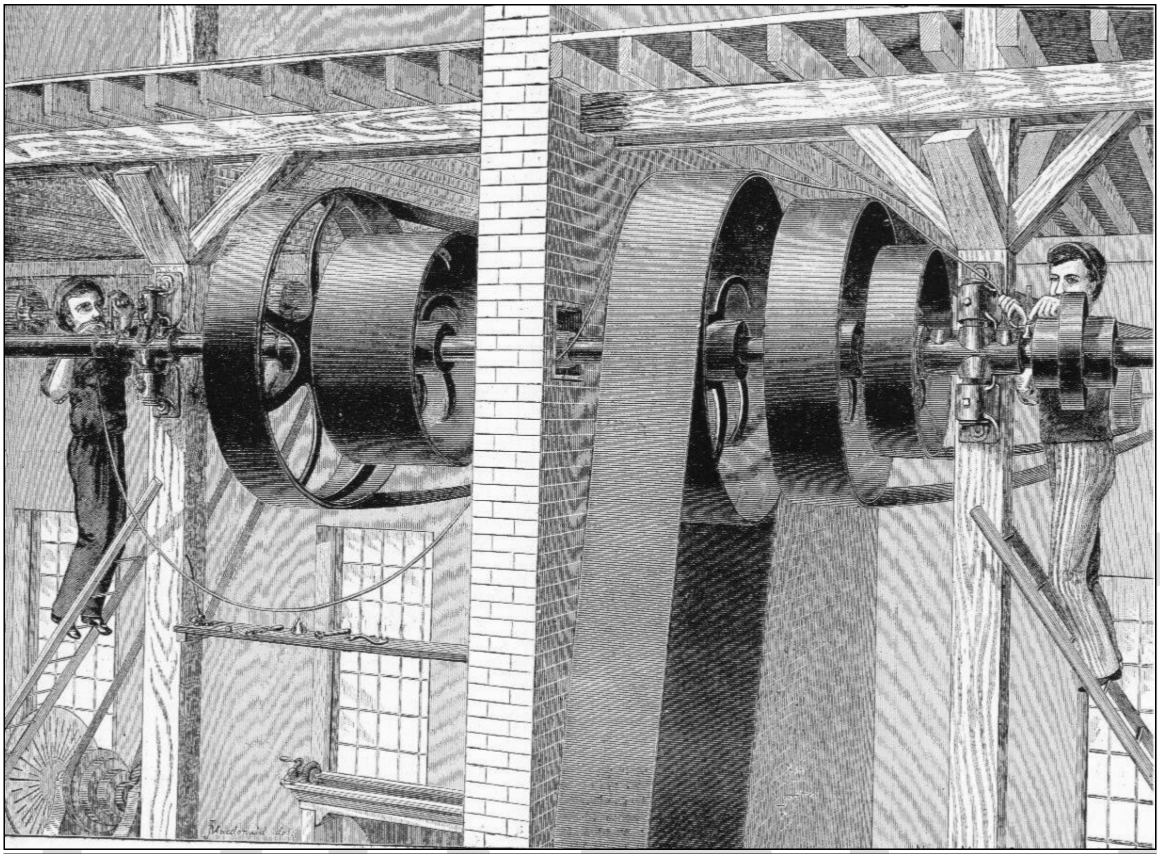


Figure 3.95: A system of overhead driveshafts and belts was the most common means of transferring motion from a mill's engine to its various appliances. Source: *Mining & Scientific Press* 9/1/83, p129.

Water and Waste Feature Types

Cistern: Both concentration and amalgamation processes depended on reliable sources of water. As insurance against supply interruption, many mills had cisterns, which were concrete, masonry, or timber chambers countersunk into the ground. Because mills usually relied on gravity to pressurize plumbing, cisterns tended to be located upslope from a mill.

Ditch: A ditch was an excavation that carried water to a mill, or its cistern or reservoir.

Flume: A flume was a wooden structure usually constructed with plank walls and a plank floor. Outside of the mill, flumes delivered water or carried tailings away. Inside the mill, flumes transferred slurry from one process to another.

Flume Remnant: The collapsed or buried remnants of a flume.

Mill Tailings Dump: A deposit of finely ground rock flour and sand usually downslope or downstream from a mill.

Pipeline: An assembly of pipes that carried water from a place of storage to a point of use.

Pipeline Remnant: The evidence left by a disassembled pipeline.

Privy: Most mill complexes included a privy for the crew's personal use. Privies were vernacular buildings, small in area, and had a bench as the toilet seat. They stood on logs, timbers, or rocks over a pit.

Privy Pit: A privy pit was the waste receptacle underneath a privy building. When a pit was full, workers relocated the building, sometimes threw refuse into the depression, and covered it with a cap of earth. Pits tend to manifest today as depressions less than 5 feet in diameter, often with artifacts and other materials in their walls and bottoms.

Pump Foundation: Large mills relied on pumps to elevate fresh water or shunt slurry from one concentration process to another. The pumps were often anchored to rectangular foundations less than 2 by 4 feet in area and made of concrete or timber footers. Pipe connections usually are associated.
Refuse Dump: A collection of hardware, structural materials, and other cast-off items.
Reservoir: To ensure a constant source of water, some milling operations dammed nearby drainages, creating small reservoirs. To pressurize the plumbing system, the reservoir was usually upslope.
Water Tank: Mills often featured a tank made of staves or sheet iron for water. To pressurize the plumbing system, the tank was usually located near the head of a mill.
Water Tank Platform: Water tanks stood on circular or semi-circular platforms. The floor may feature timber bolsters for the tank and an outlet pipe.

Arrastra Feature Types

Arrastra: An arrastra consisted of a circular stone floor ringed with low sidewalls, and a capstan at center. The floor was between 4 and 30 feet in diameter. The simplest arrastras had a harness beam bolted to the capstan. A draft animal tethered to the beam walked around the floor, dragging stones chained to the beam. Mechanized arrastras substituted a drive-wheel and gearing.
Arrastra Floor: This feature type refers to an arrastra's circular stone floor.
Arrastra Remnant: An arrastra remnant consists of portions of the floor, sidewalls, and capstan.
Power Transfer Frame Foundation: Mechanized arrastras relied on external power sources such as waterwheels or steam engines. A timber or log frame around the arrastra braced the belt pulleys and gearing that transferred the power. Most frames were anchored to foundations of timber footers or rocks, which may still be evident at a site.

Property Type: Smelter

The Nature of Smelters

Although relatively few smelters operated in South Dakota, they were important facilities for the on-going production of complex gold and silver ore. Smelters were the final recipients for the complex ore and concentrates generated by mines and mills, and they converted the material into refined bullion. The smelting industry began in the Black Hills during the 1880s to process silver and tin ore, but the initial smelters were inefficient and failed. In response, mining companies shipped their ore to functional plants out-of-state. By the early 1900s, investors renewed their interest in smelters to treat the complex gold ore that resisted amalgamation, and over the course of ten years, erected several new plants in and around the northern Black Hills. Not all facilities, however, proved to be successful, and smelters in Nebraska, Colorado, and Montana continued to receive most of the complex ore.

To produce metals, smelters incorporated mechanical, chemical, and roasting processes that a metallurgist had to tailor to a region's specific ore. Basic smelting began when wagons or the railroad delivered crude ore to the facility, and workers dumped the material into receiving bins at the smelter's head. The ore had to be broken into consistently sized cobbles either by hand or with a mechanical crusher, and then loaded into the smelting furnace. If the ore contained high proportions of waste, then it was concentrated with mechanical methods prior to smelting.

The furnace was at the heart of a smelter facility, and two general types were popular. The earliest was a masonry structure with a chamber for ore, ducts to direct hot gases through the ore, and fireboxes with forced-air ventilation to enhance fuel combustion. Troughs collected molten liquid as it ran off the ore and segregated the metal from slag according to specific gravity. These early smelters were based on designs that worked on soft lead ore, but nearly all shared the problem of ineffectiveness when treating resilient payrock like that in the Black Hills.

The most successful smelting furnaces, universal in the West by the 1870s, were cylindrical steel vessels 4 to 12 feet in diameter and lined with fire bricks. They stood on stout rock or brick masonry foundations and featured tap spouts and tuyeres, which were ports that admitted air blasts, at graduated intervals. At center was a columnar charge of fuel, and workers dumped crude ore around the column until the ore chamber was full. They usually admitted lead bullion, or lead or iron ore, because the soft metal served as a flux, which, when molten, helped the rest of the ore to liquefy. After workers arranged layers of ore, sealed the spouts, and added more fuel, they started a blower that fed air to the smoldering fuel, bringing it to great heat.[10]

As the lead or iron ore melted and the temperature increased, these liquid metals came in contact with harder metals and minerals, causing them to soften, melt, and trickle down into the base of the furnace. Over time, the lot of ore became molten and the heaviest material, usually the metals, settled to the bottom while the lighter waste floated on top. At this point, workers opened the upper slag spouts and tapped the liquid waste into slag carts, then did likewise for intermediate slag spouts. After they drew the waste off, the workers added more ore and fuel until the pool of liquid metal rose to the height of a lower slag spout. At this time, workers opened the lowest spout at the furnace base and tapped the molten metal into pots or molds until

[10] Bailey, 2002:80; Meyerriecks, 2001:173.

liquid slag made an appearance, indicating an end to the metal. Workers then repeated the process, keeping the furnace in continuous operation for days or weeks.[11]

Because metallurgists used gravity to draw ore through the processing stages, they usually sited smelters on a slope. Smelting facilities required flat space, a source of abundant water, and well-graded roads. In addition to the furnace, smelters often featured ore bins, large fuel bins, water tanks, storage, an assay office, and a vault. Successful smelters in productive mining districts usually had more than one furnace to process batches of ore simultaneously if the material was simple, or in stages if the ore was complex. Large smelters also featured roasters and mechanized concentration mills to prepare the ore and enhance separation prior to smelting.

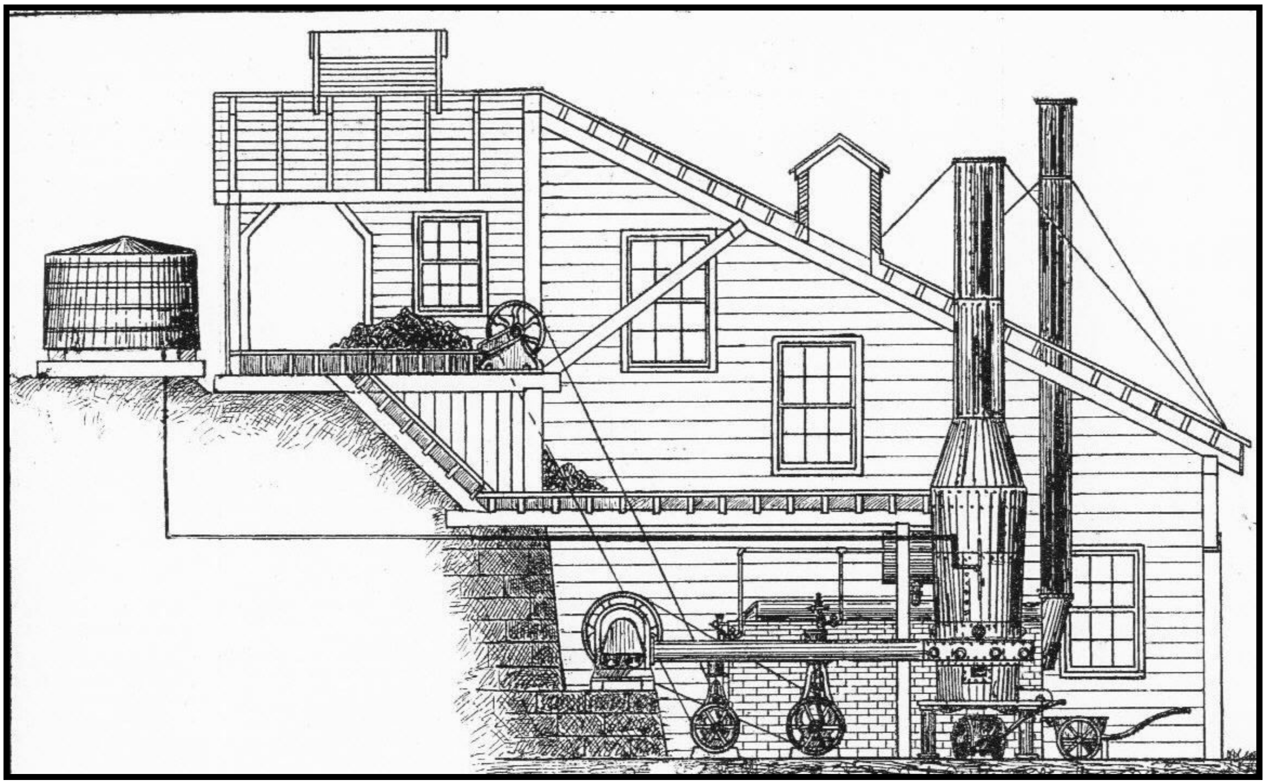


Figure 3.96: The profile illustrates a small and simple smelter. Workers sorted crude ore at top left and then fed the material into a crusher marked by the upper wheel, which is a belt pulley. The resultant cobbles and gravel accumulated on the floor at center, and workers periodically fed the material into the furnace at lower right. The type of furnace, free-standing and pre-fabricated, was common by the 1870s. Note the blower system in front of the brickwork at bottom, which forced air into the furnace for great heat. In many cases, smelters also had concentration machinery to process complex ore in advance. Source: *Mining & Scientific Press* 4/28/83, p281.

[11] Bailey, 2002:82-83; Meyerriecks, 2001:174.

Smelter Property Type and Eligibility Guidelines

Few if any smelters currently remain standing in South Dakota, and most sites have suffered various impacts after the smelter was removed. As a result, most identifiable sites will possess physical integrity on an archaeological level at best. Commonly, stairstep terraces or platforms represent the building and general stages of ore preparation and smelting. Unfired crude ore, bin foundations, and a foundation for a jaw crusher should be evident on the highest terrace. The lowest terrace will offer evidence of the furnaces and blowers. Masonry foundations, brick rubble, and slag flows mark the locations of the furnaces, and machine foundations might remain from the blowers. Features reflecting screening and concentration machinery may lie on intermediate terraces. Smelters almost always had assay shops, and a shop platform should be present on or near the lowest terrace. Aspects of water and power systems are likely, as well. High volumes of slag and clinker from furnace fuel are telltale characteristics of smelter sites.

Resource Eligibility: As a subset of the mining industry, smelting was of limited importance in South Dakota. Overall, few smelters were successful prior to the early 1900s, and most mining companies shipped their ore and mill concentrates to plants outside of the state. By the early 1900s, investors finally erected several efficient smelters, but these niche facilities were designed for gold ores of specific compositions. Complex ore not suitable for the niche smelters still had to be sent outside the state, and mining companies produced an abundance of such material. Regardless, the niche smelters played an important role in the continuation of the mining industry after 1900. The smelters allowed mining companies to produce grades of ore that resisted amalgamation and cyanidation, and were previously unprofitable. In so doing, the smelters prolonged mining and helped the industry to remain a significant force until around 1920.

Eligible smelter sites must retain physical integrity at least on an archaeological level. A site should possess characteristics typical of smelters, as well as convey the operation's history. The features and artifacts should represent the smelter building, support facilities, and general infrastructure, but approximate the specific crushing and smelting stages. Although smelter sites are not expected to have intact buildings, structures, or machinery, any that might be present strengthen a site's eligibility because these are rare and important examples. If a site possesses the above but has been otherwise disturbed, it may still be eligible because surviving architecture and engineered aspects are significant. The buildings and engineered aspects must, however, be in their place of use, and the site complete enough to provide physical context.

South Dakota's smelters may have been modified or enlarged over time. Each successive improvement left its own imprint on a site, erasing aspects of earlier designs and processes. Assessing integrity and timeframe can be difficult in such cases. If a site retains a majority of its original aspects, even on an archaeological level, then the site retains integrity relative to its original timeframe. If a company added facilities, changed the machinery, and left an otherwise heavy imprint, then the site retains integrity relative to that timeframe.

NRHP Criterion A: Smelters are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although reviewed below, the Areas are explained in more detail in Chapter 2.

In the Area of *Industry*, smelters helped the mining industry remain profitable after 1900. Prior to this time, some mining companies encountered complex ore that not only resisted amalgamation and cyanidation, but also was difficult to treat in concentration mills. Although such ore required smelting, it was too low in grade to be shipped to distant smelters. As a result, the mining companies were forced to leave the ore in the ground. The niche smelters rendered the ore profitable to produce, and at a time when the other grades of ore were becoming exhausted. As a result, the smelters prolonged the life of many mines and contributed to the viability of the industry until around 1920.

The smelters had some importance in the *Engineering* Area of Significance. Metallurgists adapted conventional smelting practices and technology to the complex ores of the Black Hills, contributing to the field of ore treatment.

Smelters participated in the Areas of *Commerce* and *Economics* on both state and local levels. The operators fostered local commercial systems by paying wages to workers, securing sources of ore from mining companies, and consuming high volumes of fuel. The successful facilities also contributed to the state's economy through their output, and by attracting investment and disbursing the funds.

Smelters participated in the Area of *Social History* in several ways. The plants employed a workforce that possessed a demography characteristic of Western mining. Individuals were of varying backgrounds, ethnicities, education levels, and socioeconomic status. The boom and bust inherent in the mining industry required the workers to be mobile, and they spread their traditions as they moved about. As major employers, the smelters also contributed to the development of social classes.

NRHP Criterion B: Smelter sites have a potential for eligibility under Criterion B because they can be traced to important individuals such as engineers and metallurgists. If the significance is through the person's presence on-site and direct participation in operations, then Criterion B applies. If the association is through design and engineering, then Criterion C applies. The individual's role in the operation must be clearly defined, and a brief biography explaining their significance provided. An important person's investment in a smelter or involvement with a company is too indirect an association for Criterion B. The individual of note must have been present on-site and played a fundamental and direct role in the operation.

NRHP Criterion C: Sites may be eligible under Criterion C if they clearly exemplify a smelter. Because equipment and buildings were removed when a smelter was abandoned, integrity can be expected on an archaeological level. The smelter footprint, terraces, aspects of infrastructure, and support facilities should be represented by features and artifacts. The general flow path for the ore from input to furnace should be identifiable, but the process specifics can be approximated. Intact structures and equipment, a high degree of integrity, or engineering or architectural features strengthen a site's potential eligibility. A site retains high integrity when its features clearly represent each stage of ore treatment, as well as individual machines and appliances. Important engineering and architectural features include intact buildings, structures, and machinery. The *Engineering* Area of Significance is usually relevant to smelter sites because they often exemplify the adaptation of smelter design, technology, and engineering to the conditions of the Black Hills. If characteristic buildings still stand, then the Area of *Architecture* may apply. Buildings represent variations of design, materials, and construction methods typical of smelters.

Smelter sites may be eligible under Criterion C if they are contributing elements of a historic landscape. Even when a smelter site is poorly preserved, it may provide context or belong to a greater body of resources representing an area's history. Extensive sites may constitute small landscapes in themselves, especially when slag dumps are present.

NRHP Criterion D: Smelter sites may be eligible under *NRHP Criterion D* if they hold a high likelihood of yielding important information upon further study. Smelter sites can contribute in three general ways. The first is buried archaeological deposits such as privy pits, thick clinker dumps, and refuse layers in tailings dumps. The deposits may include artifacts capable of enhancing our current understanding of workplace behavior, diet, and substance abuse. If the workers lived on-site, residential deposits may illuminate the currently dim portrait of smelter workers and their lifestyle.

Second is a good assemblage of structures, foundations, or machinery for the smelting process. Detailed examination may reveal how metallurgists adapted the smelting process to Black Hills ore, and designed facilities accordingly. The third is a well-represented infrastructure. Documentation may demonstrate how engineers designed water, power, transportation, and slag disposal systems.

In general, sites with physical integrity tend to possess at least one of the information sources noted above and will qualify under Criterion D. Sites with poorly represented features or a lack of buried deposits will not qualify.

Features Common to Smelter Resources

The features below are an abbreviated list of those expected at smelter sites. Most smelters relied on the same water and power systems as ore treatment mills, and included preliminary stages of crushing, screening, and concentration. The researcher should review Ore Treatment Mill Feature Types for descriptions.

Blower: Smelters relied on blowers to force an air blast into a furnace. A typical blower featured a ring of vanes encased in a wood or sheet iron shroud with a port for the outflow. A motor or steam engine powered the blower, and it often stood nearby. Blowers ranged from 3 to 8 feet in diameter.

Blower Foundation: A foundation that anchored a blower. Foundations were usually rectangular, less than 6 by 8 feet in area, and consisted of masonry, concrete, or timbers.

Coal Bin: Because smelters consumed high volumes of fuel, they almost always featured substantial bins for coal or coke. The bins were usually sloped-floor structures that facilitated a gravity-drawn flow of fuel from the structure. The walls typically consisted of a timber frame sided on the interior with planks.

Coal Bin Ruin: The collapsed remnants of a coal bin.

Coal Bin Foundation: Due to their great weight, coal bins usually stood on masonry or timber foundations. Scatters of coal or coke strongly suggest that a given foundation supported a coal bin.

Furnace: The small smelters relied on two general types of furnaces. The earliest and least efficient was a brick or rock masonry structure with multiple chambers. Combustion in lower chambers created superheated gases that melted ore in upper chambers. The interior was lined with fire bricks or sandstone blocks. The masonry should feature evidence of intense heat and slag.

The type of furnace most popular by the late 1870s was a free-standing, cylindrical steel vessel lined with fire bricks. These furnaces tended to be from 6 to 12 feet in diameter and as high, crowned with a steel smokestack. Workers input crushed ore through hatches in the top and drew out molten material through ports in the bottom.

Furnace Ruin: The collapsed remnant of a masonry furnace.

Furnace Foundation: The early masonry furnaces stood on rectangular foundations of brick or rock integral with the chamber walls. The free-standing furnaces stood on brick or rock pads larger in footprint than the steel vessel. A foundation for a blower is usually nearby. Furnace foundations almost always feature slag and evidence of heat.

Furnace Platform/Terrace: Furnaces usually stood on dedicated platforms or terraces within the smelter building. Because the furnace provided one of the last stages of ore treatment, the platform was among the lowest at a smelter. Evidence of a furnace, such as slag flows or a foundation, should remain. Free-standing steel furnaces often left little more than the foundation surrounded by slag flows, while masonry types may have left structural ruins.

Slag Dump: Slag is a vitreous waste left after ore was melted and the metal content drawn off. Smelting companies disposed of their slag in dumps downslope from the smelting complex.

Slag Flow: Uncontrolled releases of slag from a furnace created flows on the furnace platform. The flows appear similar to lava or smooth concrete.

Smelter Building: Smelter buildings were similar to those for ore treatment mills. Where possible, they were built over a series of platforms or terraces so gravity could draw the ore through the stages of preparation and smelting. Each terrace was usually dedicated to a specific treatment stage. For a description of the general constitution of the building, see Ore Treatment Mills above.

Smelter Building Foundation: The foundations for smelters were similar to ore treatment mills.

Smelter Ruin: The collapsed remnants of a smelter building.

CHAPTER 4

MINING SETTLEMENT PROPERTY TYPES AND THEIR ELIGIBILITY GUIDELINES

Property Type: Mining Settlement and Residence

Between 1874 and around 1920, prospectors, miners, and industry participants examined nearly every, if not all, the canyons, gulches, hills, and mountains in the Black Hills. In those locations where industry participants spent appreciable amounts of time, they usually established residences. Every mining district featured at least isolated prospectors' camps and collections of residences, and where the mines and prospects were numerous and closely spaced, the accumulation of residences formed what can be referred to as settlements. Many settlements such as Deerfield and Tigerville never progressed beyond an informal status, but when a local mining industry showed signs of permanency and the population grew large enough, some of the settlements matured into formally organized towns.

As places of inhabitation, the residences common to the mining industry fall into several broad categories. In ascending order of complexity and population, the categories are: prospector's camp, workers' housing, unincorporated settlement, and townsite. Their descriptions and eligibility guidelines are provided below.

Mining Settlement Resource Subtypes and Eligibility Guidelines

Property Subtype: Prospector's Camp

Resource Description: When examining an area or developing a claim, prospectors usually established camps that they intended to be impermanent. The camps were simple, often lacked formal buildings, and were abandoned after brief occupation. A typical camp included a wall tent or log cabin, a privy for sanitation, an open area for domestic activities, and possibly a fire ring for outdoor cooking. Prospectors also built corrals with stumps, brush, and natural obstacles as fencing. In the camp, the prospectors chopped firewood, may have conducted blacksmithing, and threw refuse downslope.

Because the camps were intended to be impermanent and were occupied briefly, only the barest of material evidence remains today. Camps inhabited by individual and pairs of prospectors tend to be represented by a single tent platform, a sparse scatter of food cans, and little else. In some cases, groups of prospectors established camps of several tents or a log cabin as a more permanent base of operations. For an assemblage of residential features to qualify as a prospector's camp, it must be directly associated with prospect workings or be in an area that was subjected to prospecting. If a site features evidence of substantial buildings and lengthy occupation, it may be one of the resource types described below such as Workers' Housing. Prospectors' camps often lie within larger complexes such as groups of excavations or placer workings, for example. In such cases, the resource is a component of that larger site and should be recorded as such.

Figure 4.1: Although this mid-1870s prospectors' camp is in Colorado, it typifies those in South Dakota. Archaeological features represent such sites today. Earthen platforms might represent the tents, the fire ring at right could be evident and overgrown, and a scatter of cans often extends downslope. Courtesy of U.S. Geological Survey, Jackson, W.H. 566.

Resource Eligibility: Prospectors' camps were a function of the search for both placer and hardrock deposits. Given this, the camps were important during the same timeframes and for many of the same reasons as the prospect sites discussed in Chapter 3. As manifestations of the frontier prospecting movement, the camps were important on a statewide level from 1874 to 1885. During this time, prospectors defined the extent and distribution of the state's placer and hardrock riches, and the results became the foundation for the state's principal mining industry and associated settlement pattern. Afterward, prospecting contracted in importance to local areas. Continued ore discoveries allowed the mining industry in some areas to remain viable after the early and principal mines declined in production.

Because prospectors' camps were occupied briefly and were ephemeral, relatively few retain physical integrity today and many cannot be clearly identified. Resources that can be confirmed as prospectors' camps are important and may be eligible provided their material remains date to the Period of Significance noted above, or a specific area's mineral discovery era. Unless a site features an intact cabin, physical integrity is expected to be on an archaeological level. For archaeological remains to constitute sufficient integrity, the material evidence should permit the virtual reconstruction of the camp. The tent or cabin platform should be present, the artifact assemblage characteristic of brief occupation, and the general area prospected. We can consider prospectors' camps with integrity to be uncommon resources.

NRHP Criterion A: Prospect camps are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and although mentioned below, they are explained in more detail in Chapter 2. A camp's timeframe must be established so relevant trends and patterns can be determined. Timeframe is, however, difficult to define for prospect camps because most lack sufficient assemblages of dateable artifacts and were not clearly described in archival sources. Without a firm timeframe, a site cannot be identified with trends and patterns. A camp can be assumed to date to the period of significance if archival research or other information proves that the immediate area was prospected early in Black Hills history.

Between 1874 and 1885, prospectors' camps were an institution on the Black Hills mining frontier, and as such, participated in the Area of *Exploration/Settlement*. As temporary places of residence, the camps served as bases of operations for the prospectors who characterized the region's geology, proved the presence of gold and silver, and conducted general exploration.

Within the Area of *Industry*, some sites that date after 1885 may be important on a local level for their role in the continuation of prospecting. After 1885, the boom declined in the Black Hills, although later prospecting was significant because it provided additional ore that allowed an area's mining industry to remain viable. The camps supported the prospectors who found the post-boom ore deposits.

Camps inhabited by groups of prospectors can be important under the *Social History* Area of Significance. Such camps served as frontier meeting and communication centers where individuals exchanged information and news. The camps also served as primitive social centers for a segment of the mining industry that often went without human contact for long periods of time. Further, those individuals were highly mobile, independent, diverse in background, and left an imprint on the culture of the American West that persists today.

NRHP Criterion B: Prospect camps may be eligible under *NRHP Criterion B* under certain circumstances. First, an important person must have lived in the camp. Second, the site must retain physical integrity relative to that person's timeframe. Few camps will be eligible under Criterion B because archival information is usually insufficient to prove the presence of an important person.

NRHP Criterion C: Prospectors' camps hold the highest likelihood of being eligible under *NRHP Criterion C* because they represent the typical residences associated with mineral examinations and discoveries, the beginnings of mineral booms, and the general exploration of the Black Hills. Clearly definable resources with integrity are uncommon, and the combination of tent platform, sparse artifact assemblage, and corral remnant are important characteristics and attributes. Prospectors' camps may also be eligible under Criterion C if the resource possesses intact architectural features and facilities necessary for prospecting, such as cabins and field forges. These were important aspects of prospecting and few survive today.

NRHP Criterion D: Under *NRHP Criterion D*, few resources are likely to be eligible as occupation was brief and archaeological deposits are unlikely. However, in cases where camp sites possess building platforms, privy pits, and refuse dumps that feature buried archaeological deposits, testing and excavation may reveal information regarding the lifestyles, social structures, and demography of prospectors, as well as the presence of families and women. Such studies are important because these subjects were not extensively documented at the time.

Property Subtype: Workers' Housing

Resource Description: Workers' housing ranged from primitive cabins to single-family houses to boardinghouses. The unifying definition is that the residents who lived in the building were confirmed to be mining industry workers. Houses and boardinghouses near mines and mills are likely to qualify because of their proximity to these industrial operations. Similarly, houses in company towns usually qualify because most men were employed at one of the mines. Residences in general mining towns such as Deadwood, however, are more difficult to assess because anyone could have lived in the buildings.

Often, individual mines and mills had houses and boardinghouses for their employees. Although the residences are workers' housing, they should be recorded as components of the larger mine or mill sites. Workers' housing can be recorded as an independent resource in itself under several conditions:

1. When workers' housing cannot be tied to a specific industrial complex. For example, residences may lie near a cluster of mines, and yet be far enough away so that the residences cannot be attributed to one specific operation.
2. When the residences are within a town dependent on mines or mills, and whose population was dominated by industry workers. Company towns are the most common communities where most residences are workers' housing.
3. When the residential features are a component of a larger industrial site, but the industrial aspects have been destroyed or have little integrity. The residential features may be the only surviving portion of the site. In this case, the residential features would be a site in themselves, but the lost or damaged industrial complex should be noted.

As a resource, workers' housing includes all features associated with inhabitation and other domestic activities. The sites were usually complexes centered on at least one residential building, and often several. The buildings may have been cabins or formal houses occupied by a miner and family, or shared by two to four unmarried workers. Boardinghouses provided accommodations for four or more unmarried workers, who dined and spent leisure time in a communal setting. Isolated mines and mills commonly had boardinghouses for the workers and separate cabins or houses for the superintendent and family. Typically, archaeological features such as building platforms, foundations, and ruins represent the residential buildings today.

Workers' housing complexes almost always possess additional features, primarily archaeological in nature. Privy pits and refuse dumps reflect primitive waste disposal practices. The dumps usually extend downslope from the residence doorway and consist of domestic refuse, and primarily materials generated by food preparation. Residents usually cleared an area by the building for chopping firewood, cleaning laundry, and other outdoor activities. Complexes for numerous workers often included root cellars for the storage of perishable food such as meat and vegetables.

Figure 4.2: The photo depicts the interior of a typical log cabin associated with the Black Hills mining industry. Both miners and prospectors endured such primitive and austere living conditions between 1875 and 1920. Courtesy of the State Archives of South Dakota Historical Society.

Resource Eligibility: Workers' housing is a broad resource type ranging from individual cabins and houses to large complexes with multiple buildings. Because workers' housing was a direct function of the mining industry, the resource type shares the same Periods of Significance as the mining industry. The first spanned 1874 to 1885, when the Black Hills were in a frontier state and mining evolved into an industry. The second occurred from 1886 through 1920. During this time, mining was an industry of significance and included a variety of company operations ranging from placers to hardrock mines to ore treatment mills. The third was the Great Depression revival, beginning in 1933 and ending with the Federal ban on gold mining in 1942.

To be eligible, a workers' housing complex must possess physical integrity relative to one of the Periods of Significance. Outside of existing towns, integrity is expected to be archaeological in nature because most buildings collapsed or were dismantled. For a site to retain integrity on an archaeological level, the remnants should permit the virtual reconstruction of the locations and general types of the buildings, and also represent support facilities such as privies and root cellars. Earthen platforms, foundations, and ruins usually represent the buildings. Privy pits and root cellars manifest as depressions, and activity areas are often level areas. Artifact assemblages are extremely important and should be rich enough so researchers can interpret the demography and lifestyles of the residents.

Some workers' housing complexes may possess standing buildings, which can contribute architectural integrity under certain conditions. Architectural integrity requires that a building retain its original appearance, materials, workmanship, and location. Major additions and alterations usually compromise architectural integrity. In general, workers' housing complexes with intact buildings are uncommon resources, and most are in existing towns.

NRHP Criterion A: Workers' housing complexes are associated with historical trends and patterns important on statewide and local levels. Several Areas of Significance may be relevant, and some carry over from the general mining industry. A complex's timeframe must be established so relevant trends and patterns can be determined. Timeframe can usually be defined because dateable artifacts and architectural construction methods tend to be numerous.

In the Areas of *Architecture and Engineering*, mining companies adapted conventional engineering and architectural practices to the needs of the mining industry. This movement involves mostly boardinghouses built by well-capitalized, progressive mining companies. A few well-capitalized companies, especially in remote locations, erected handsomely appointed accommodations for their workers for several reasons. The most common was to attract quality, skilled workers and entice them to live in a company atmosphere. Less common reasons were to provide comfortable housing out of humanitarian concerns and to make a statement to the mining world of a company's productivity and progressiveness.

Community Planning and Development was an important Area of Significance because workers' housing directly participated in the settlement patterns of the Black Hills. Some complexes were seeds for communities, others reinforced established towns, and isolated complexes were a form of disbursed settlement on a cumulative basis.

Economics is an Area of Significance for workers' housing. Residences, especially communal boardinghouses and bunkhouses, were microcosms of important economic activities. They were the sites of personal financial transactions such as the exchange of time and labor for pay, and the exchange of pay for room, board, and goods.

Industry is a relevant Area of Significance. Workers' housing supported the workforce that, cumulatively, made the mining industry function.

Another important Area of Significance involves *Social History*. Communal residences were the place of cultural practices, traditions, and diffusion, be the cultures American or from other countries and ethnicities. Also, residences were places where workers could attend to the necessities of life outside of the workplace. On a broad scale, the sum of workers' housing sheltered much of the mining industry's workforce and saw it fed. Workers' housing also was a direct manifestation of and instrument for permanent settlement in the Black Hills.

NRHP Criterion B: Workers' housing complexes may be eligible under *NRHP Criterion B* when occupation by an important person can be confirmed. The important individual must have lived or worked at the complex, or been directly present during its construction. If the important individual designed the complex or building but did not live there, then Criterion C applies. Mere ownership of a property, investment in a company, or very brief occupation such as a visit is too indirect an association for Criterion B. The complex must retain integrity, even if on an archaeological level, relative to the person's occupation. The researcher should provide a brief biography explaining why the individual was important and how they were involved with the complex.

NRHP Criterion C: Workers' housing complexes can be eligible under *NRHP Criterion C* under a variety of conditions. Here, it is best to divide the discussion between resources with standing buildings from those that have been reduced to archaeological features.

Currently, workers' residences in the forms of cabins, houses, and boardinghouses stand intact throughout the Black Hills. Small and simple houses and cabins are the most common types of residences, although relatively few retain integrity relative to a single Period of Significance due to alterations over time. Historically, the small houses and cabins tended not to be involved with major engineering or architectural contributions. However, they can serve as important representations of the simple and austere architecture typical of wage workers. The researcher must define the building type, timeframe, and architectural style, and why the building is an important example.

In contrast to cabins and houses, boardinghouses are uncommon and often participated in the adaptation of residential engineering and architecture to the needs of both the mining industry and the community. Those boardinghouses with integrity may be eligible under the same Criteria as houses and cabins.

In a few cases, residential buildings can be attributed to important architects and builders. The researcher must identify who the individual was and provide biographical information explaining why the individual was important. If the building retains integrity relative to the original design, it may be eligible as the work of a master architect or builder.

If the residence possesses innovative architectural aspects and retains integrity relative to a single Period of Significance, it may be eligible as an example of its type. Innovative aspects include adaptations of conventional architecture to environmental, climatologic, and geographic environments. They can also include unusual designs, functions, construction methods, and materials uses.

Many residential buildings are located in existing historic mining communities. If the community retains integrity as a whole and was important, a residence may be a contributing element if it is compatible in timeframe and appearance. Such residences contribute to the community's historic feel and ambiance. In such cases, the residence may be eligible because it belongs to a greater whole of importance. It is important to note that if the greater whole was important and collectively retains integrity on a broad scale, it may be worthy of district designation.

Outside of existing communities, most workers' housing complexes have collapsed or been removed, leaving archaeological features such as building ruins, building platforms, and privy pits. When on an archaeological level, the complexes can be eligible if they offer important or defining characteristics and attributes, and possess integrity relative to a Period of Significance. Archaeological integrity requires intact assemblages of surface artifacts and non-architectural features clearly conveying the organization and infrastructure of the housing, and aspects of the residents and their lifestyles. Such resources can be described as archaeological examples of workers' housing. Design of the complex is an important attribute, and the design may have been formal or a spontaneous response to local conditions. Evidence of how the residents inhabited the complex, conducted domestic activities, and added support facilities are additional attributes. Intact artifact assemblages are important because they reflect resident demography and lifestyle.

Even when reduced to archaeological features, housing complexes may be eligible as contributing elements of a greater whole when part of a historic community. The researcher must note that the complex retains archaeological integrity and contributes to the settlement's historic fabric, which is defined as the sum of the settlement's archaeological features.

NRHP Criterion D: Workers' housing offers a high potential for eligibility under *NRHP Criterion D* because it may contribute meaningful information in several arenas. An analysis of a complex and any architectural features may enlighten the existing understanding of workers' housing and the residential environment associated with the mining industry. Workers' housing complexes often possess a diverse array of artifacts found on ground-surface. Building platforms, privy pits, and refuse dumps feature buried archaeological deposits with artifacts of a different nature. An analysis of both may reveal information regarding the lifestyles, social structures, and demography of workers, as well as the presence of families and women. Such studies are important because these subjects were not extensively documented at the time.

Property Subtype: Isolated Residence

Resource Description: Isolated residences are places of developed inhabitation that cannot be clearly tied to an industry or other pattern of subsistence because evidence is insufficient. Such resources lack characteristics or artifacts that can clearly associate the resource with prospecting, mining, logging, transportation, or agriculture. Determining whether a residence in a mining district is an isolated residence can be subjective since it may have served as base of operations for prospectors, hunters, or homesteaders. Isolated residences are simple and usually consist of a few residential features, generic and impoverished artifact assemblages, and no industrial or commercial attributes. If buildings stand, they are likely to be small cabins or frame houses vernacular in appearance and form.

Resource Eligibility: By definition, isolated residences cannot be directly attributed to an industry or other pattern of subsistence. For this reason, their historical associations and Areas of Significance remain unknown until detailed studies or archaeological investigations provide clarifying information.

Property Subtype: Unincorporated Settlement

Resource Description: Popularly known as mining camps, unincorporated settlements were informal communities established in response to several stimuli. They also served combinations of purposes. Mineral booms were among the most common reasons behind unincorporated settlements. When prospectors and miners joined a local rush, they tended to erect residences in a common area that offered flat ground, open space, and water. Informal settlements also grew as bedroom communities to house the workforce of a primary industry.

Figure 4.3: A cluster of buildings in Bear Gulch illustrates several characteristics of unincorporated settlements, also known as mining camps. The buildings were the settlement's center and housed basic businesses such as the mercantile at center. The row also reflects typical vernacular architecture, ranging from log construction at center to the frame buildings at the ends. All are simple, rough, have gabled roofs, and few windows. Courtesy of the State Archives of South Dakota Historical Society.

Unincorporated settlements were rarely planned in advance and instead evolved organically according to local housing needs. The communities usually possessed no formal organization or infrastructure, and their buildings tended to be disbursed among the most favorable micro-environments. Mining companies and individual workers built residences near their points of employment, and this assumed form as a settlement when concentrated in one area. When the population became large enough, entrepreneurs and community activists established basic services and businesses such as a post office, a mercantile, a saloon, and a combination restaurant and hotel. The businesses then became the settlement center, although residences were few and scattered around.

As a center for a working population, an unincorporated settlement usually was the hub of a local transportation network. Several wagon roads linked the settlement with the nearest nodes of commerce, and packtrails fanned out to places of employment. Because draft animals were a principal transportation method, residences for multiple people had corrals. Sanitation was limited to privies, and water came from streams, springs, and wells. By the 1910s, some settlements enjoyed electricity for lighting, wired from nearby mines or mills.

The architecture in unincorporated settlements tended to be vernacular in appearance and form. The buildings were rarely designed by architects, and were instead planned in the field primarily for function and economy. The residents imitated familiar methods and forms as best they could, and adapted them to the local environment and incorporated available materials. Milled lumber was preferred for its regularity, but residents substituted local building materials such as logs and stone masonry.

When a settlement was in infancy, almost all its buildings were wall tents, small cabins, and buildings with any combination of logs, lumber, and canvas. Mature settlements often featured at least several substantial frame buildings, as well as log cabins with plank or board-and-batten siding for a formal appearance. By the 1900s, residents made increased use of corrugated sheet iron and imitation brick siding. Some business buildings had false-fronts, and nearly all possessed gable roofs.

Today, few if any unincorporated settlements survive in high states of preservation. Although some settlements may still possess intact buildings, most have been reduced to archaeological sites. Features such as earthen platforms, foundations, and ruins represent the buildings. Such remnants are usually center to associated features such as yards, refuse dumps, privy pits, root cellars, and wells. At sites completely overgrown with sod, differentials in vegetation may outline any or all these features. If a researcher suspects a site to be an unincorporated settlement, then they should survey a large area for outlying residences, primitive infrastructure such as community springs, and industrial complexes. Companies frequently built ore treatment mills and sawmills in drainages near settlements.

Resource Eligibility: Most unincorporated settlements in the Black Hills were a direct function of gold and silver mining. Some settlements in the northwestern portion of the state grew in response to coal mining. Predominantly, the resource type shares the same Periods of Significance as the mining industry. The first spanned 1874 to 1885, when the Black Hills were in a frontier state and mining evolved into an industry. The second occurred from 1886 through 1920, when mining was an industry of significance. A variety of company operations ranging from placers to hardrock mines to ore treatment mills gave rise to numerous settlements. The third was the Great Depression revival, beginning in 1933 and ending with the Federal ban on gold mining in 1942. During this time, formerly abandoned settlements were reoccupied by workers employed at surrounding mines. A few coal settlements were inhabited during the 1940s and 1950s.

An unincorporated settlement must possess physical integrity relative to at least one of the Periods of Significance above to be eligible. Some settlements were continuously occupied over the course of several Periods. Such a site would be an example of serial occupation.

Integrity is expected to be primarily archaeological in nature because most buildings collapsed or were dismantled. For a site to retain integrity on an archaeological level, the material evidence should represent the general content and layout of the settlement. Earthen platforms, foundations, and ruins usually represent the buildings. Privy pits and root cellars manifest as depressions, and wells, springs, and ditches are distinct. Artifact assemblages are extremely important and allow researchers to interpret building function, timeframe, and the demography and lifestyles of the residents.

Some settlements possess standing buildings, which can contribute architectural integrity under certain conditions. Architectural integrity requires that a building retain its original appearance, materials, workmanship, and location. Major additions and alterations usually compromise architectural integrity. In general, settlements with intact buildings are uncommon resources.

NRHP Criterion A: Unincorporated settlements are usually associated with a variety of historical trends and patterns on statewide and local levels. Many Areas of Significance are often relevant, and only the broadest are reviewed below. The researcher should review the discussion of the Areas in Chapter 2 to refine how they might apply. The timeframe when a settlement was occupied must be established so relevant trends and patterns can be determined. Timeframe can usually be defined by comparing archival research with dateable artifacts and architectural construction methods.

In the Areas of *Architecture* and *Engineering*, settlements were places where both mining companies and independent residents adapted conventional engineering and architectural practices to the Black Hills environment. This movement involves mostly boardinghouses built by well-capitalized, progressive mining companies. A few well-capitalized companies, especially in remote locations, erected handsomely appointed accommodations for their workers for several reasons. The most common was to attract quality, skilled workers and entice them to live in a company atmosphere. Less common reasons were to provide comfortable housing out of humanitarian concerns and to make a statement to the mining world of a company's productivity and progressiveness.

Community Planning and Development was an important Area of Significance. On a broad scale, unincorporated settlements were nodes and centers of transportation and communication, crucial to the success of the mining industry. The supplies, equipment, and services required by mining companies often flowed into the settlements prior to their distribution, and ore and mill products flowed out. The settlements also influenced the distribution of population and workforce in the Black Hills, and some were communities that supported residents during difficult times.

The Area of *Economics* is relevant for settlements on several levels. Mature settlements with company housing and businesses were local economic microcosms. Workers exchanged time and labor for pay, reinvested some of their pay for room and board, and diverted more into local businesses. Such settlements were also tied to larger economic systems of regional and statewide importance. The businesses and mining companies conducted trade with outside firms, fostering the development and then perpetuation of complex economic systems. On another level, the mature settlements drew capital to a mining district by fostering legitimacy among investors. If the settlement offered accommodations, investors were more willing to visit the district and provide capital. Some settlements then became points through which that capital flowed to the associated mines and mills.

The Areas of *Politics* and *Exploration/Settlement* applies to settlements predating 1885. When the Black Hills were in a frontier state, the settlements were centers of local government, law enforcement, and judicial systems. Administrative and regulatory bodies formed to establish mining districts, laws, claim registration and regulation, and records keeping. The settlements also served as polling stations, and the populations were instrumental in electing government officials.

Industry is an applicable Area of Significance. Unincorporated settlements housed mining industry workers, and sometimes company offices and mills. Most settlements were also transportation and communication nodes. Prospectors purchased supplies and found security in mature settlements. These functions were vital to the success of the mining industry.

Another important Area of Significance involves *Social History*. The settlements were a place of cultural practices, traditions, and diffusion among gender, nationalities, and ethnicities. Settlements were places where residents attended to the necessities of life outside of the workplace. Settlements also were direct manifestations of and instruments for permanent Euro-American settlement in the Black Hills.

NRHP Criterion B: The Criterion recognizes settlements as eligible when an important person spent an appreciable amount of time there, but only under limited conditions. Overall, the general inhabitation of a settlement by an important person is too indirect an association. The individual's specific residence or place of employment must be identified, and in such cases, only that resource feature will qualify under Criterion B. The settlement can qualify as a whole if the person held a direct, regular, and frequent presence throughout the entire place. Examples include a contractor who personally constructed or maintained most of the buildings. Mere ownership of the property or investment in an associated company are too indirect an association for Criterion B. The complex must retain integrity, even if on an archaeological level, relative to the person's occupation. The researcher should provide a brief biography explaining why the individual was important and how they were involved with the complex.

NRHP Criterion C: Unincorporated settlements can be eligible under *NRHP Criterion C* for a variety of reasons. Integrity at least on an archaeological level is required. Although some settlements currently possess standing buildings, all will include a majority of archaeological features.

Settlements can be eligible in entirety if the archaeological, architectural or engineering features and artifacts clearly convey broad patterns of the community. The settlement's organization and design is one example. The design may have been formal or a spontaneous response to local conditions. The settlement's constitution and distribution of residences, businesses, and industrial facilities is a second example. The transportation infrastructure, water sources, and waste disposal practices, however primitive, are additional patterns of importance.

Archaeological integrity requires intact assemblages of surface artifacts because they convey important information unavailable from other sources. Artifacts are necessary to interpret timeframe and function of the settlement, as well as its individual buildings. Boardinghouses, cabins inhabited by families, and different businesses left distinct types of artifacts. By analyzing the artifacts, the researcher may be able to determine the function of some buildings or their archaeological remnants. The residents were among the most important aspects of a settlement, and they are best perceived through the artifact assemblage. A researcher can interpret socioeconomic status, gender, ethnicity, and modes of employment; and characterize lifestyle such as diet, health, substance abuse, and consumerism.

Currently, some unincorporated settlements have a few standing buildings, and their presence can complicate a settlement's eligibility. Buildings retaining architectural integrity relative to a Period of Significance may be contributing elements of a site. Architectural integrity is defined as appearance, materials, workmanship, and location relative to a Period of Significance. Settlements inhabited today often possess buildings that were constructed outside of the relevant Periods of Significance. If the number of such buildings exceeds those within the Period or disrupts the settlement's historic fabric, the settlement as an entity may no longer possess the necessary level of integrity.

Even if an unincorporated settlement lacks integrity as a whole, standing buildings may be individually eligible under Criterion C. If the building retains architectural integrity relative to a single Period of Significance, it may be a representation of the simple and austere architecture common to primitive mining settlements. Most buildings, however, were altered over time. They may be examples of serial occupation and changes in preferred materials, styles, and space requirements. The researcher must define the building type, timeframe, and architectural style, and why the building is an important example.

Some buildings possess innovative designs, construction methods, and materials used in response to the conditions of a specific area. Such buildings may be eligible as adaptations of architecture to the environment, climate, and geography of the Black Hills.

In a few cases, residential buildings can be attributed to important architects and builders. The researcher must identify who the individual was and provide biographical information explaining why the individual was important. If the building retains integrity relative to the original design, it may be eligible as the work of a master architect or builder.

Even when reduced to archaeological features, settlements may be eligible under Criterion C when they are contributing elements of historic mining landscapes. Archaeological features, roads, and changes in vegetation provide enough visual impact to contribute to the setting and feeling of an area. The site may also belong to a greater body of resources that, in total, represents an area's history.

NRHP Criterion D: Unincorporated settlements offer a high potential for eligibility under *NRHP Criterion D* because most can contribute meaningful information in several arenas. An analysis of the organization pattern and the distribution of gender, ethnicity, and class may enlighten the existing understanding of small and informal settlements commonly associated with the mining industry. Settlement sites often possess a diverse array of artifacts found on ground-surface. Building platforms, privy pits, and refuse dumps feature buried archaeological deposits with artifacts of a different nature. An analysis of both may reveal information regarding the lifestyles, social structures, and demography of the residents, as well as the presence of families and women. Such studies are important because these subjects were not extensively documented at the time.

<u>Property Subtype: Townsite</u>

<u>Resource Description:</u> Of all the resource types in the Black Hills, townsites may range the most in preservation, original elements, and authenticity. Some small towns changed little after their boom period, while others like Deadwood have been moved and rebuilt to appear old. Although townsites certainly hold the potential to be eligible for the NRHP, applying the Criteria is more complicated than all the other types of mining resources. Small and simple townsites may be recorded and evaluated as individual entities and can be treated in a manner like the unincorporated settlements discussed above. But the large

towns, with their numerous buildings and extant populations, require an approach different than an archaeological context generalized to the mining industry. The large towns warrant a separate context designed for architectural surveys and evaluating buildings in the urban environment. Such a context should define the types, forms, architectural styles, and materials for commercial, institutional, and residential buildings. This is beyond the scope of the present guide. Below are broad eligibility guidelines only for small and simple townsites.

When a mineral boom matured from prospecting toward development and production, the new industry often drew a working-class population that demanded goods and services. The shift ushered in a stage of growth, and a common result was the evolution of unincorporated settlements into organized towns. In many cases, the towns remained small and were abandoned within a short time, but if the industry was successful, some became large and sophisticated.

Small or large, both forms of community shared some basic physical characteristics. An identifiable business district was the most elementary, offering goods and services proportional in volume and diversity to the population and demography. Towns in early stages of growth usually featured a few mercantiles, saloons, restaurants, and hotels, as well as a butcher, bakery, assayer, laundry, livery, and blacksmith. As the population increased in number and sophistication, entrepreneurs began additional businesses such as newspapers, law practices, surveying, confectioneries, clothing retailers, stationary and book stores, medical and dental, and hygiene. Gaming houses were ubiquitous in the Black Hills, and towns large enough to afford some social anonymity also drew prostitution. Although not heavily documented, women and families were an essential and present component of mining town demography and reflected a stabile, working-class population. They demanded Victorian social institutions such as schools, churches, fraternal organizations, and public meeting halls.

The organization patterns of both small and large towns were similar. Business districts, however small, served as town centers, and they were surrounded by formal residences usually occupied by members of an upper socioeconomic status. In many towns, business proprietors lived in their commercial buildings, which could have been one or two stories in height. The town core conformed to a surveyed grid of lots and blocks, while outlying residences may have been scattered and haphazard in organization. They were usually inhabited by workers and other members of a low socioeconomic status. More workers often rented space in boardinghouses and family homes anywhere in town. As the town grew and population diversified, both the business and residential districts divided further among socioeconomic and even ethnic lines.

The architecture in towns was a function of several factors, including community development, success of the mining industry, timeframe, and distance from shipping and manufacturing centers. In a town's early period, the architecture tended to be vernacular in appearance and form. Builders adapted familiar form and construction methods to suit function, environmental conditions, and economic resources. The builders preferred milled lumber and some manufactured elements, but made extensive use of local materials when these were costly or unavailable. In the Black Hills, logs were the most common local material for walls and roof beams, and rocks for foundations and other structural elements.

The earliest buildings in a town were wall tents and log cabins. Although the period 1874 to 1880 was early for the Black Hills in general, the concept of early was also relative to when a specific community was established. Within several years, the residents assembled their buildings from any combination of lumber, logs, canvas, and sheet iron. Frame architecture was preferred but unaffordable until the town had a sawmill or a wagon road to outside commercial centers. In form, most buildings were simple with rectangular or L-shaped plans, gabled roofs, and one or two stories. Commercial buildings often featured false-fronts and plank walks or stoops. In constitution and structure, the buildings usually stood on informal foundations, had roofs sided with shingles or log strips, and featured walls clad with boards-and-battens, planks, or clapboards. By the late 1890s, corrugated sheet iron became a popular construction material. Members of upper classes added some ornamentation to their buildings such as gingerbread trim as a display of their socioeconomic status and to imitate architecture in established cities. Contiguous business districts also offered boardwalks to spare patrons from mud.

Architectural improvements were hallmarks of community maturation and economic stability. New buildings tended to be larger than the old, commercial structures were substantial, and elements of architectural style began to appear. Residents and business owners of upper socioeconomic statuses added the ornamentation necessary to impart Greek Revival, Italianate, and Queen Anne styles on both homes and commercial buildings. Even though some business owners did not attempt a specific architectural style, they still decorated their buildings with lathed columns, molding, ornamental brick- or woodwork, and polychromatic effects.

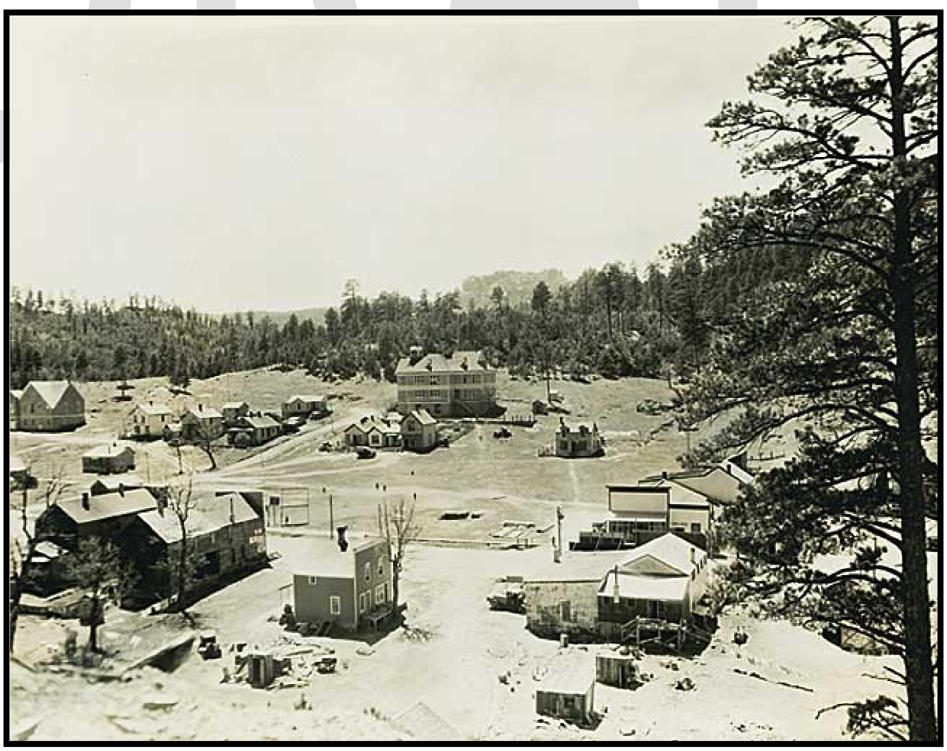


Figure 4.4: By 1929, when the photo was taken, Keystone was a shadow of its former size. Regardless, the townsite exemplifies a common pattern of organization. Keystone was formally platted with a grid of lots and

blocks, and residences developed around a core business district, marked by the commercial buildings in the foreground and the hotel in the background. Courtesy of the State Archives of South Dakota Historical Society.

Standardized construction materials superseded logs. An increase in building lot values, the perceived obsolescence of logs, and the attraction of designed frame buildings of greater sizes all contributed to gradual architectural improvement. As a given town continued to grow, brick and stone masonry replaced lumber for some of the most important buildings, primarily in the business district. Fires, a widespread but not guaranteed occurrence, expedited the transition. In response to the popularity of masonry, sheet iron manufacturers introduced imitation brick and stone siding.

Most mining towns possessed infrastructures proportional in sophistication to the success of the mining industry, the size of the population, and the expectation of permanency. On a base level, most infrastructures catered to transportation, communication, and some forms of public utilities. Transportation infrastructures usually featured trunk roads that carried freight and passenger traffic to the town, and feeder roads that extended to the surrounding mines and mills. Streets and footpaths directed traffic within the town, and even though many towns were arranged according to a grid, the roads and paths did not always conform. The ultimate transportation system was the railroad, but railroad companies considered most towns in the Black Hills not important enough to justify the cost.

Early in a town's development, communication systems were limited primarily to the postal service and newspapers. By the early 1880s, the principal towns enjoyed the telegraph, followed by telephone systems within a few years. By around 1900, many towns of lesser importance also subscribed to telephone service.

Water systems were one form of public utility that saw application in both towns and workers' housing erected by mining companies. Water systems made an appearance in principal towns during the 1880s, and although some minor towns followed during the subsequent twenty years, many small communities never saw water systems.

The introduction of flush toilets, bathtubs, and sinks during the 1900s and 1910s fostered a demand for sewer systems in the large towns. Common systems consisted of little more than pipes and culverts that drained into local waterways.

One of the most popular forms of public utility in the principal towns was electricity, which did not become common until the 1910s. The ability to subscribe to domestic and commercial service was based on socioeconomic status, which excluded many residents until the 1940s.

Every center of mining in the Black Hills had at least one developed townsite, and each was important for a wide variety of reasons. As historic resources, the small townsites were similar to unincorporated settlements in form, content, and changes over time. The two types of resources therefore share many characteristics today. State of preservation is one, and most have been reduced to archaeological sites. Site features such as earthen platforms, foundations, and ruins usually represent the buildings no longer standing. Buildings or their remnants are usually center to associated features such as yards, refuse dumps, privy pits, root cellars, and wells. Differentials in vegetation may outline any or all these features in sites not overgrown with trees.

The presence of intact buildings is another similarity between townsites and unincorporated settlements. Many townsites are still inhabited and offer combinations of new and historic architecture, and even those that are not may possess at least one original building. Architectural resources are important because they mark the location of what was a larger entity.

Townsites can differ from unincorporated settlements in the density and variety of archaeological features and artifacts. Historically, defined business districts anchored surrounding residential districts, however small. Thus, the density of archaeological features is greatest at the center of a townsite. Features representing commercial buildings line the main street, residential building platforms flank other streets, and all usually conform to a grid of lots and blocks.

If a researcher suspects a site to have been a town, then they should survey the encompassing area for evidence of outlying residences, refuse dumps, water infrastructure, and telephone and power lines. Towns often had subsidiary industries such as sawmills, lumber yards, ore treatment mills, and drayage businesses with corrals. These are likely represented by archaeological complexes and can be recorded and evaluated separately if well outside the townsite.

Resource Eligibility: Most townsites in the Black Hills and the surrounding piedmont were a direct function of gold and silver mining. Some towns in the northwestern portion of the state grew in response to coal mining.

Identifying Period of Significance for a townsite can be difficult because some towns survived the boom-and-bust cycles of mining. Those towns that adapted to other forms of economy between the boom periods remained important for reasons other than an association with the mining industry. Each town should be assessed for its non-mining Periods of Significance independently through research.

During its good times, the mining industry had a significant impact on associated towns. Given this, the mining industry's Periods of Significance apply to townsites. The first spanned 1874 to 1880, when speculators organized the first real townsites in the Black Hills and mining attracted enough people to develop them. The second occurred from 1881 through 1920, when mining was an industry of significance and depended on the goods, services, and population of the towns. The third was the Great Depression revival, beginning in 1933 and ending with the Federal ban on gold mining in 1942. The mining industry kept towns alive, and the towns continued to provide the needed services and workforce. Although limited, the coal mining industry supported a few towns in the northwestern portion of the state through the 1940s and 1950s.

A townsite must possess physical integrity relative to at least one Period of Significance above to be eligible. The large towns were continuously inhabited and would be examples of serial occupation.

The small, abandoned townsites will possess integrity primarily on an archaeological level. For a townsite to retain integrity on an archaeological level, the material evidence should represent the general content and layout of the settlement. Earthen platforms, foundations, and ruins usually represent the buildings. Privy pits and root cellars manifest as depressions, and wells, springs, and ditches are distinct. Artifact assemblages are extremely important because they allow researchers to interpret building function, timeframe, and the demography and lifestyles of the residents.

Some settlements possess standing buildings, which can contribute architectural integrity under certain conditions. Architectural integrity requires that a building retain its original appearance, materials, workmanship, and location. Major additions and alterations usually compromise architectural integrity. In general, settlements with intact buildings are uncommon resources.

Continuously inhabited and redeveloped townsites often possess incomplete integrity because land use tends to erase original features. For eligibility, a townsite and its buildings must be in their historic locations. If they have been moved, then the townsite's Period of Significance starts with the time of relocation.

NRHP Criterion A: Each townsite has its own unique history and was important at least on a local level. Most were also tied to historical trends and patterns significant on statewide and sometimes national levels. Nearly all the NRHP Areas of Significance are relevant to some degree, and only the broadest are reviewed below. The researcher should review the discussion of the Areas in Chapter 2 to refine how they apply to a specific townsite. Because the Areas were relevant during specific timeframes, the townsite's physical attributes must be dated. Timeframe can usually be defined by comparing archival research with dateable artifacts and architectural construction methods.

The Area of *Architecture* is applicable in several ways. First, townsites were places where builders and independent residents adapted conventional construction practices, building types, and forms to the Black Hills environment. This movement involves primarily large buildings. Second, townsites provided an environment for the application of defined architectural styles to the commercial and residential buildings typical of the mining industry. It should be noted that when architectural styles changed, they continued to appear in the townsites through new construction and the alteration of existing buildings.

Community Planning and Development was an important Area of Significance. On a statewide level, townsites were instrumental in the permanent Euro-American settlement of western South Dakota. They also influenced the distribution of population and workforce, and facilitated businesses and industry. In regards to the latter, townsites were nodes of transportation and communication crucial to the success of mining. Supplies, equipment, and services flowed into the settlements prior to their distribution, and ore and mill products flowed out.

Townsites were vehicles that brought primitive urban planning to the western portion of the state. Urban planning included townsite plats, organization within communities, passage of municipal ordinances, and business development. By the 1900s, townsites also fostered the development of electrical and water systems.

The Area of *Economics* is relevant for townsites on several levels. Townsites were centers of commerce, banking, business, and trade, linking local economic systems with those beyond South Dakota. Townsites served as anchors and conduits for the economic systems specific to the mining industry and its participants. Established towns lent legitimacy to a local mining industry, which fostered confidence among potential investors. These investors were more likely to personally examine a mining district and provide capital if it featured an established settlement. The town then became a funnel through which that capital flowed to associated mines and mills, and profits flowed out.

Towns could have participated in the Area of *Engineering* in two principal ways. In those towns with water, power, or sewer infrastructures, civil engineers adapted conventional design, construction methods, and materials to the environment of the Black

Hills. Their contribution was a vernacular form of system engineering typical of mining in the central mountains. Towns also participated in a vernacular form of civil engineering. Town planners adapted known organization patterns to the local topography, climate, and even mining landscape geography. The movement was also typical of the central mountains.

Industry is an applicable Area of Significance. Towns housed mining industry workers and the businesses that catered to them, as well as mining company offices, mills, and dependent industries. Towns were also transportation and communication nodes. These functions were vital to the success of the mining industry.

The Areas of *Politics* and *Exploration/Settlement* apply to townsites predating 1885. When the Black Hills were in a frontier state, the early towns were centers of local government, law enforcement, and judicial systems. The settlements also served as polling stations, and the populations were instrumental in electing government officials.

Another important Area of Significance involves *Social History*. Towns were centers for both passive and active cultural practices and traditions. Inhabitants passively followed their cultural patterns, traditions, and ways almost unconsciously in daily life. Inhabitants actively participated in cultural traditions such as performances, lectures, salons, organizations, and community events. In addition, the interaction of the mining industry, wilderness landscapes, and frontier ambiance fostered a culture of its own, which became pronounced in mining settlements. The result was a mining culture that not only left a permanent mark on South Dakota, but also joined a larger movement that spread throughout the central mountains.

The towns attracted a variety of individuals who did not work directly in mines or mills but were important to the development of the social fabric. This included women, families, day laborers, and businessmen, and all were critical. Their arrival fostered a demand for cultural and social institutions that were both embraced and distained. Institutions that communities accepted were schools, churches, civic associations, unions, and meeting halls. Institutions tacitly accepted at best included prostitution businesses, dens of substance abuse, a drug trade, and saloons.

NRHP Criterion B: The Criterion recognizes townsites as eligible when an important person spent an appreciable amount of time there, but only under limited conditions. Overall, the general inhabitation of a townsite by an important person is too indirect an association. The individual's specific residence or place of employment must be identified, and in such cases, only that place will qualify under Criterion B. The townsite can qualify as a whole if the person held a direct, regular, and frequent presence throughout. Examples include a contractor who personally constructed or maintained multiple buildings or infrastructure. Mere ownership of the property or investment in a townsite company are too indirect an association for Criterion B. The townsite must retain integrity, even if on an archaeological level, relative to when the person was present. The researcher should provide a brief biography explaining why the individual was important and how they were involved with the place.

NRHP Criterion C: Townsites can be eligible under *NRHP Criterion C* for a variety of reasons. Integrity at least on an archaeological level is required. Although some townsites currently possess standing buildings, all will include a majority of archaeological features.

Townsites can be eligible in entirety if the archaeological, architectural or engineering features and artifacts clearly convey broad patterns of the community. The townsite's organization and design is one example. Although most designs were based on grids, some towns grew spontaneously in response to local conditions. Road intersections, railroads, and subsidence of underground mine workings greatly influenced a town's ultimate form. The constitution and distribution of residences, businesses, and industrial facilities is another broad pattern. The transportation infrastructure, water sources, and waste disposal practices, however primitive, are additional patterns of importance.

Archaeological integrity requires intact assemblages of surface artifacts because they convey important information unavailable from other sources. Artifacts are necessary to interpret timeframe and function of the townsite, as well as its individual buildings. Boardinghouses, cabins inhabited by families, and different businesses left distinct types of artifacts. By analyzing the artifacts, the researcher may be able to determine the function of some buildings, even when represented by archaeological remnants. The residents were among the most important aspects of a town, and they are best perceived through the artifact assemblage. A researcher can interpret socioeconomic status, gender, ethnicity, and modes of employment; and characterize lifestyle such as diet, health, substance abuse, and consumerism.

Many townsites currently have a few standing buildings, and their presence can complicate a townsite's eligibility. Buildings retaining architectural integrity relative to a Period of Significance may be contributing elements of a site. Architectural integrity is defined as appearance, materials, workmanship, and location relative to a Period of Significance. Settlements inhabited today often possess buildings that were constructed within recent years. If the number of such buildings exceeds those within the Period or disrupts the townsite's historic fabric, then the townsite as an entity may no longer possess the necessary level of integrity.

Even if a townsite lacks integrity as a whole, standing buildings may be individually eligible under Criterion C. If the building retains architectural integrity relative to a single Period of Significance, it may be a representation of a type common to that era. Most buildings, however, were altered over time. They may be examples of serial occupation and changes in preferred materials, styles, and space requirements. The researcher must define the building type, timeframe, and architectural style, and why the building is an important example.

Some buildings possess innovative designs, construction methods, and materials uses in response to the conditions of a specific area. Such buildings may be eligible as adaptations of conventional architecture to the environment, climate, and geography of the Black Hills.

In a few cases, buildings can be attributed to important architects and builders. The researcher must identify who the individual was and provide biographical information explaining why they were important. If the building retains integrity relative to the original design, it may be eligible as the work of a master architect or builder.

Even when reduced to archaeological features, townsites may be eligible under Criterion C when they are contributing elements of historic mining landscapes.

Archaeological features, roads, and changes in vegetation provide enough visual impact to contribute to the setting and feeling of an area. The site may also belong to a greater body of resources that, in total, represents an area's history.

NRHP Criterion D: Townsites offer a high potential for eligibility under *NRHP Criterion D* because most can contribute meaningful information in several arenas. An analysis of the organization pattern and the distribution of gender, ethnicity, and class may enlighten the existing understanding of settlements associated with the mining industry. Townsites often possess a diverse array of artifacts found on ground-surface. Building platforms, privy pits, and refuse dumps feature buried archaeological deposits with artifacts of a different nature. An analysis of both may reveal information regarding the lifestyles, social structures, and demography of the residents, as well as the presence of families and women. Such studies are important because these subjects were not extensively documented at the time.

Features Common to Mining Settlement and Residence Resources

As historic resources, settlement Property Subtypes possess a broad and diverse array of architectural and structural features, and their archaeological manifestations. To avoid a cumbersome and lengthy list, only the most common features are defined below. The researcher should review the entire list because most Property Subtypes share similar features.

Prospectors' Camp Features

Corral Remnant: Prospectors usually relied on pack-animals to carry their goods and penned the animals in informal corrals near their camps. The corral boundaries maximized natural obstructions, and had fences of branches, stumps, and wire.

Dugout: A dugout was among the most impermanent and primitive forms of residence. They were created by prospectors who lacked wall tents but were unwilling to invest time and resources in superior accommodations. A dugout consisted of an excavation in a slope, 8 by 10 feet or larger in area, roofed with logs or branches covered with earth. The front often had a log or rock masonry façade, a window, and doorway. A chimney or stovepipe extended out the roof.

Dugouts were not limited to residential use, and the design served other purposes. Root cellars, hay storage, and explosive magazines appear similar to dugouts. To recognize a resource as a dugout, it should be center to an assemblage of domestic refuse, which reflects inhabitation.

Dugout Ruin: Dugouts usually collapsed when abandoned. Ruins manifest as ovoid depressions embedded with structural materials. A sparse artifact assemblage of domestic refuse should be present.

Fire Hearth: Prospectors often built large outdoor rings or rock structures for cooking and heating fires. The ring should be near the tent or cabin platform and exhibit signs of aging such as collapse and revegetation.

Pack Trail: Pack trails often radiated outward from prospectors' camps to the areas under examination, and to the nearest commercial centers. Most were created by foot and pack-animal traffic, and others were intentionally graded to fulfill claim assessment requirements. Pack trails are no wider than 8 feet.

Tent Platform: Prospectors often graded small platforms, usually less than 20 by 20 feet in area, for wall tents. In some cases, prospectors placed rocks on the platform's edges or corners to support a tent's wood pallet floor, and drove stakes along the edges to guy the walls. A paucity of structural artifacts, the presence of tarpaper washers, and disbursed domestic artifacts characterize tent platforms.

Workers' Housing Features

Boardinghouse: Mining companies erected boardinghouses for crews of four or more workers. The residents lived in a communal atmosphere, may have shared sleeping quarters, and usually consumed meals prepared in the building. Privies, outdoor work areas, and domestic refuse dumps or scatters are usually associated with boardinghouses.

In form, the buildings were often greater than 20 by 25 feet in area, one or two stories in height, and rectangular, L-shaped, or irregular in plan. Roofs were usually gabled with a loft underneath, and foundations were informal on earthen platforms. Although builders preferred lumber, they used locally available materials to save capital. In style, boardinghouses were typically vernacular, in that the builder adapted conventional form and construction methods to local conditions and available materials.

Boardinghouse Platform: Boardinghouses usually stood on earthen platforms, which may feature rock or log footers and a collapsed a root cellar. The platform often represents the building's size and footprint.

Boardinghouse Ruin: The structural remnants of a collapsed boardinghouse.

Bunkhouse: Bunkhouses were a type of company housing where workers slept and spent leisure time, but did not regularly prepare food. Instead, they ate in a boardinghouse or company dining hall. Given this, bunkhouses often feature few food-related artifacts relative to the size of the building and the number of inhabitants. In form, construction, and style, bunkhouses were similar to boardinghouses, noted above.

Bunkhouse Platform: Bunkhouses stood on earthen platforms similar to those for boardinghouses, noted above. The platform should feature few food-related artifacts, and it usually represents the building's size and footprint.

Bunkhouse Ruin: The structural remnants of a collapsed bunkhouse.

Figure 4.5: Unmarried miners often lived in boardinghouses such as this building in Terraville. Although the photo was taken in 1879, the utilitarian vernacular architecture changed little in later decades. When distant from settlements, mining companies provided such housing on-site. Courtesy of the State Archives of South Dakota Historical Society.

Cabin: A cabin was a self-contained residence for several workers or a family. In form, cabins were less than 20 by 25 feet in area, rectangular or L-shaped in plan, and one to one-and-one-half stories high. Workers built cabins with any combination of logs, lumber, canvas, and sheet iron. In style, cabins were typically vernacular, in that the builder adapted conventional form and construction methods to local conditions, available materials, and need. Because cabins were self-contained households, they usually offer a wide array of domestic artifacts. Privies and refuse scatters are often associated.

Cabin Ruin: The collapsed remains of a cabin.

Cellar Pit: Cellars, mistaken for dugout residences, were subterranean structures that provided cold storage for perishable food. They usually had plank walls retaining an earthen pit, a plank or log roof covered with earth, and a sunken doorway. In some cases, cellars were underneath cabins and boardinghouses. When the walls and roof collapsed, the cellars tend to manifest as pits with notches marking the entry. A lack of domestic refuse is a common attribute.

Chimney Ruin: A collapsed chimney, usually consisting of rocks or bricks. Chimneys are usually components of building platforms.

Cistern: Organized, well-capitalized residential complexes occasionally included cisterns for fresh water. Cisterns were plank, concrete, or stone masonry chambers sunk into the ground, usually with inlet and outflow pipes.

Corral: Pack animals provided transportation in the mining industry before 1940, when automobiles became common. Company housing complexes, unincorporated settlements, and towns almost always had corrals to impound multiple animals. The corrals varied widely in size, plan, and constitution, depending on the number of animals and type of impoundment operation. Livery businesses tended to build large corrals geometric in plan with wooden or wire fences, feed troughs, and stables. Mining and logging companies, on the other hand, built smaller corrals that utilized natural features as barriers to save construction costs. Such corrals were built in open areas bordered by streams, rock outcrops, thickets, and slope changes, and incorporated combinations of branches, upended stumps, and wire as fencing.

Corral Remnant: After abandonment, corrals may feature evidence of their boundaries such as wires, branches, upended stumps, individual fence posts, and cobble alignments marking a fence line. The interior should either be open or feature vegetation younger than in the surrounding area.

Figure 4.6: This residence in Rockerville exemplifies the log cabins typical of the boom era in the Black Hills. The building is rectangular, vernacular in construction, and one-and-one-half stories high. Lumber, the preferred construction material, began to supersede logs during the 1880s, but logs were common through the 1910s in remote communities. Courtesy of the State Archives of South Dakota Historical Society.

Figure 4.7: When intact, this building was a typical log cabin, but it has decayed into what is currently termed a *cabin ruin*. These types of cabins were a universal form of housing at mines and in towns. Source: Carol Beam, Boulder County Parks and Open Space, Colorado.

Figure 4.8: Privy pits usually manifest as vegetated depressions near commercial and residential buildings. They often contain meaningful buried deposits. Source: Carol Beam, Boulder County Parks and Open Space, Colorado.

<u>Developed Spring:</u> Settlements depended on water for existence, and residents were able to subsist on surface sources when a community was still in its early stages of growth. Springs were preferred because of their purity. When water was difficult to collect, the residents developed the spring by excavating a chamber, lining it with planks or masonry, and diverting drainage around the excavation.

<u>Domestic Refuse Dump:</u> People usually threw their solid refuse downslope from their residences, forming deposits of domestic artifacts. Large deposits that were high in volume qualify as dumps. Artifacts are usually domestic in nature, primarily food-related, and include food cans, fragmented bottles and tableware, and personal articles.

Domestic Refuse Scatter: A refuse scatter is a light amount of domestic artifacts disbursed over a broad area. Domestic scatters usually extend downslope from a residential feature.
House: A house was a formal residence for several workers or a family. Houses varied widely in form, construction, and architectural style. Timeframe and sophistication of community influenced house size and appearance. Overall, houses superseded cabins and the common single-occupancy residence after a community passed through its initial development stages. Houses tended to be made of frame construction, one story high with gabled roof, and rectangular, L- or T-shaped in plan. A detailed house typology is beyond the scope of the archaeological context.
House Ruin: The collapsed remnant of a house.
Privy: Until flush toilets became common during the 1940s, most people outside of principal towns relied on privies for their personal use. Privy buildings enclosed toilet benches with cut-out holes as the seats. Most buildings were vernacular with shed or gabled roofs, plank floors, and a plank door. The residents often preassembled the walls, leaned them together, and nailed the corners. The buildings stood over a pit on posts or rocks.
Privy Pit: Privy pits were excavated in the ground underneath privies to receive waste. When a pit became full, the residents relocated the privy building, topped the depression off with domestic refuse, and shoveled over a soil cap. The cap subsided as the pit contents leached away and decayed, creating a depression usually less than 6 feet in diameter. Pits often feature backdirt downslope, some domestic refuse in the interior, and ashy soil. The pit may be surrounded by more refuse and footers for the privy building.
Residential Building: Settlement sites may feature buildings that material evidence defines as residential, but the buildings do not clearly possess the characteristics of boardinghouses, bunkhouses, or small cabins. Such buildings can be recorded as general residences.
Residential Building Platform: An earthen platform, confirmed by artifacts, to have supported a residential building of uncertain type.
Residential Building Ruin: The structural remnants of a residential building.
Road: Roads were ubiquitous transportation arteries graded for wagon traffic and, later, trucks. Roads are at least 8 feet wide and usually had unimproved surfaces.
Root Cellar: Residences and businesses that handled high volumes of perishable food had root cellars for storage. Such enterprises were commonly boardinghouses, restaurants, hotels, and markets. Root cellars, often mistaken for dugouts, were excavated near their associated buildings. Walls usually made of rocks, logs, or lumber retained the earthen sides and a roof covered with more earth. Because root cellars were not residences, they usually offer few domestic artifacts and lack stovepipe ports.
Spring Box: A spring box was a small enclosure built over a developed spring. The structures had plank walls, often a masonry or concrete chamber, a roof, and an entry door.
Stable: Mining companies and livery operators erected stables to house draft animals used for wagon drayage. Stables were vernacular, poorly constructed, and assembled from inferior materials to save costs. In form, stables were square to rectangular, and one-story high with shed or gabled roofs. Logs were used for the foundation and walls, and lumber and sheet iron for the roof. Defining characteristics include wide doorways, low ceilings, broad gaps in the walls, and mangers and stalls in the interior.
Stable Ruin: A collapsed stable.
Well: Because many settlements lacked reliable and clean sources of water, residents turned to wells. Three types were common in mining districts. The earliest was a hand-dug shaft lined with dry-laid masonry and crowned by a platform at the collar. Once hardware was available, residents sank pipes into the ground and fitted them with hand-pumps. In some cases, communities or mining companies installed steam- or gasoline-powered pumping stations over large-diameter wells.

Townsite and Unincorporated Settlement Features

Townsites and unincorporated settlements usually included some of the same features described above with Workers' Housing. Additional features are listed below.

Figure 4.9: The commercial buildings in Rockerville's business district are characteristic of Black Hills mining towns. The building at left has a false-front of frame construction, but the other walls are of log construction. Although the front follows no formal architectural style, the owners added ornamental trim imitative of commercial buildings in Eastern towns. The building at right is tidy and based on a lumber frame. Both buildings are small and share a boardwalk. Courtesy of the State Archives of South Dakota Historical Society.

Assay Shop: An assay shop was a facility where a trained metallurgist tested ore samples for their mineral content. In function, content, and form, the shops were like those described with the Ore Treatment Mill property subtype above. The shops in unincorporated settlements may have been an independent business or run by a mining company, while those in towns were usually businesses.

Assay Shop Foundation/Platform: Assay shops often stood on earthen platforms or foundations of concrete and rock masonry. Distinct characteristics can define a platform as that for an assay shop. Foundations or other remnants of an assay furnace, its blower, and small crushers may remain. Artifact assemblages typically include furnace clinker, fire-bricks, broken assay crucibles, mineral samples, and laboratory artifacts.

Assay Shop Ruin: The collapsed remnants of an assay shop.

Bakery: Bakeries were retail businesses that produced bread and other baked goods. In form, the buildings were vernacular, rectangular in plan, as high as two stories, and had gabled roofs. Inside, bakeries featured a front room for sales and light dining, a large kitchen, and a storage area. The kitchen had a masonry oven or a large pad for a portable unit. Buildings in nascent settlements were assembled from logs or lumber. Those in developed towns were larger, usually of frame construction, and had ornamental trim if not elements of formal architectural style.

Bakery Foundation/Platform: Small bakeries stood on logs or rock alignments arranged on an earthen platform, and large establishments may have had formal foundations of masonry or concrete. Some platforms had cellars for storage, and evidence of a masonry oven may exist. The artifact assemblage offers a high proportion of baking pans, flour-processing implements, baking powder cans, butchered bones, and canning jars.

Blacksmith Shop: Blacksmiths were vital to mining communities because they manufactured hardware, maintained tools, and shoed draft animals. Nearly every community had a blacksmith, who kept shop on the fringes of the business district. Community blacksmith shops were equipped like those at mines, and the buildings were vernacular and simple in form. They were square, rectangular, or L-shaped, one-story, and gabled. In construction, they consisted of combinations of logs, lumber, and sheet iron, and were rough. The floor was the underlying earthen platform and the foundation usually of logs or rocks. The interior was open and featured workbenches, a coal bin, a forge, an anvil block, and a blower to force air into the forge.

Blacksmith Shop Platform: Blacksmith shops usually stood on earthen platforms larger than the building for storage of materials and large items. Rock alignments and deposits of forge clinker usually define the building's footprint. The artifact assemblage is distinct and includes much forge clinker, forge-cut iron scraps, hardware, and sheet iron.

Blacksmith Shop Ruin: The collapsed remnants of a blacksmith shop.

Commercial Building: Commercial building is a general term applied to a structure that housed a business. Preferably, the building should be named after the business type if known. Commercial buildings were usually located in or near a town's business district.

In form, the buildings conformed to a variety of plans, were as high as three stories, and had gabled roofs. Commercial buildings in nascent settlements were vernacular and consisted of any combination of logs and lumber. They were small and featured an open main floor, a back room, and a storage area. Buildings in developed towns were larger, usually of frame construction, and had ornamental trim if not elements of formal architectural style. Some were brick or stone masonry, and most had false-fronts.

Commercial Building Foundation/Platform: Primitive commercial buildings stood on logs or rocks laid on earthen platforms. Large buildings may have stood on formal foundations of masonry or concrete. Artifacts and buried archaeological deposits are often few because most service and retail businesses generated little refuse.

Commercial Building Ruin: The collapsed remnants of a commercial building.

Ditch: Many unincorporated settlements and towns featured ditches that delivered fresh water for consumption and other uses. The ditch, the most primitive public utility, tapped the nearest reliable source and carried the water through the settlement.

Hotel: A hotel was a business that housed guests on a short-term basis. A boardinghouse, in contrast, provided long-term accommodations. In the early years of unincorporated settlements and towns, hotels were small and featured only several rooms. In mature settlements, the hotels were more substantial and complimented by a dining and drinking establishment.

In form, hotels had varying floorplans, were often two stories in height, and had gabled roofs. In construction, small buildings were usually made of logs and stood on foundations of logs or rocks, while large hotels were lumber with formal foundations. Most were vernacular in appearance and had false-fronts, boardwalks, and ornamental trim. In established towns, hotels featured elements of formal architectural style.

Hotel Foundation/Platform: Small hotels stood on rock alignments and logs laid on earthen platforms, while larger hotels may have had formal masonry or concrete foundations. The platforms tend to be large and may feature a cellar pit if the hotel had a kitchen. The artifact assemblages are often distinct and can include a high proportion of small personal items, clothing hardware, decorative domestic wares, furniture parts, and lamp parts. Large and numerous privy pits are often associated.

Livery: A livery was a business that temporarily boarded draft animals. Defining characteristics include corrals, collapsed fences, evidence of stables, earth packed by animal traffic, and manure deposits. Because of noisome pests and odors, liveries were usually located on the fringes of a settlement. The artifact assemblage should include a high proportion of tack straps and hardware.

Mercantile: A mercantile was a retail establishment that sold a variety of goods. In form and construction, mercantiles were similar to the commercial buildings described above.

Mercantile Foundation/Platform: Mercantiles may be identified by a substantial platform or foundation, an associated privy pit, and little evidence of residence, such as food-related items.

Restaurant: A restaurant was a food service business that may have also sold baked goods. Similar in form and construction to commercial buildings, restaurants featured a dining room, a kitchen, a storage area, and a root cellar. Work areas also usually existed behind the restaurant building. The artifact

assemblage is distinct and includes high proportions of cans, broken tableware, butchered bones, and stove clinker. Large and numerous privy pits were behind the buildings.
<u>Restaurant Foundation/Platform:</u> Restaurant platforms are similar to those for commercial buildings, except they almost always offer large quantities of food cans, fragmented tableware and bottles, butchered bones, and kitchen implements.
<u>Saloon:</u> A saloon was a business that served primarily alcoholic beverages and, possibly, light dining fare. Most saloons ranged in construction from small log buildings in nascent settlements to formal brick buildings in developed towns. They usually featured a bar room, a storage area, and a root cellar.
<u>Saloon Foundation/Platform:</u> Saloons stood on platforms similar to those for commercial buildings. The artifact assemblage is distinct and includes high proportions of fragmented bottles relative to other items.

Property Type: Rural Historic Mining Landscape

<u>Resource Description:</u> Rural Historic Landscapes are a large-scale property type representing the history of an area's human occupation, life ways, and relationship with the land. The National Park Service recognizes other types of landscapes for the NRHP, such as Designed Historic Landscapes. Rural Historic Landscapes evolved organically over time and possess characteristics that distinguish them from the other categories. The National Park Service explains Rural Historic Landscapes in detail in its *National Register Bulletin: Guidelines for Evaluating and Documenting Rural Historic Landscapes*. In overview, the Bulletin states:

> "A rural historic landscape is defined as a geographical area that historically has been used by people, or shaped or modified by human activity, occupancy, or intervention, and that possesses a significant concentration, linkage, or continuity of areas of land use, vegetation, buildings and structures, roads and waterways, and natural features."[1]

Concise areas that experienced intense mining form the subset of Rural Historic Mining Landscapes. Such landscapes provide a physical context for individual resources, and when viewed in total, the resources and their setting constitute a greater whole. The extensive tracts of land, its natural features, and the smaller scale historic resources represent the history, people, and traditions of mining in South Dakota and the American West.

The National Park Service organized the defining characteristics of Rural Historic Landscapes into eleven categories. The first four are the result of processes, and the last seven are physical attributes.[2] The categories are listed below but interpreted for mining landscapes:

1. *Land uses and activities:* Land use activities are the principal human forces that left an imprint on the landscape. Prospecting, mining, and ore treatment had an enormous physical impact on the Black Hills. The mining industry contributed to settlement patterns, development of infrastructure, water use, and transportation networks. All the landscapes have been in continuous use, although not necessarily for mining.
2. *Patterns of spatial organization:* A combination of the natural environment, technology, economics, and the culture of mining affected how landscapes were organized. In most cases, the organization was a dynamic process and evolved organically rather than being planned. Geology may have been the most influential natural factor. The location of gold and silver governed where centers of mining developed. The distribution and richness of placer deposits and ore bodies influenced the spacing of individual operations. Topography, waterways, dominant landforms, and the industrial geography of the mines in turn fostered communities, ore treatment mills, and transportation networks. Large-scale

[1] McClelland, et al., 1999:1.
[2] McClelland, et al., 1999:3.

patterns established by industry may remain constant in mining landscapes, while individual features such as buildings and roads changed over time.

3. *Response to the natural environment:* Rural landscapes were heavily influenced by the natural environment. In general, natural topographical features and vegetation determined what land people chose to use and how, where they settled, and the locations of their communities and transportation networks. Mining defied traditional land use patterns because the natural environment became a secondary consideration. In the mining industry, people responded to the location of placer deposits and ore bodies first, and then adapted communities and transportation networks to the immediate natural environment. Forests influenced the choice of construction materials, the siting of individual buildings, and the fuel selected for heating and steam power.
4. *Cultural traditions:* In general, cultural traditions affected the way that land was used, occupied, and shaped. Social customs, ethnic identities, and trades and skills may be evident today in small-scale landscape features and overall uses of the land. Mining industry participants from a variety of backgrounds brought ethnic customs that spread and diffused into communities as they traveled. Influenced by industry and the environment, a culture specific to mining in the American West evolved, and it shaped the landscape.

   Social customs determined the structure of communities, their buildings, and infrastructure. Cultural traditions dictated how mines were developed, where mills were built, and what was done with the waste. Traditional building forms, methods of construction, stylistic finishes, and functional solutions evolved in the work of local individuals.
5. *Circulation networks:* Circulation networks are systems for transporting people, goods, and raw materials from one point to another. They range in scale from packtrails and footpaths, to roads and railroads. Some networks were limited to mining districts, and others such as roads and railroads provided links with the outside.
6. *Boundary demarcations:* Boundary demarcations define areas of ownership and land use, such as townsites or placer mining. They also separate smaller areas of specific functions, such as mine dumps. In mining landscapes, claim posts, concentrations of buildings, ditches, meadows, roads, and railroads commonly marked historic boundaries.
7. *Vegetation related to land use:* Various types of vegetation bear a direct relationship to long-established patterns of land use. Whereas many landscapes change over time, vegetation is one of the most dynamic attributes. Some species may replace trees selectively cut by early inhabitants, and yet conform in community to historic vegetation patterns. Aspen trees, for example, may reclaim old clearcuts in evergreen forests while retaining the original shape of the cut. Vegetation may also reflect industrial impact on the land. Weeds and thistles, for example, grow in placer workings lacking topsoil. Geometric patterns of grass, brush, and trees can mark historic boundaries such as building and structure footprints. Introduced vegetation sometimes represents what were larger plantings such as crops, orchards, and gardens. Age of vegetation communities is also relevant. Older stands of brush or trees may reflect undeveloped land while young stands could have taken over land originally used for other purposes.
8. *Buildings, Structures, and Objects:* Various types of buildings, structures, and objects serve human needs related to the occupation and use of the land. Their function, materials, date, condition, construction methods, and location reflect the activities, customs, preferences, and skills of the people who built and used them. Mining industry buildings and structures exhibit patterns of vernacular design typical of the central mountains. Some designs may be unique to their region. Buildings and structures may reflect the sizes of historic mining operations, levels of capital investment or profitability, or era. The repeated use of construction methods, forms, and materials may indicate successful solutions to building needs, or demonstrate the unique skills, workmanship, or talent of local individuals.
9. *Clusters:* Groupings of features reveal patterns of land use, as well as the customs, traditions, and preferences of people. Clusters of prospect workings and mines, for example, reflect the distribution of ore bodies and the response of mining industry participants. Mills, communities, and other landscape features are manifestations of transportation networks, topography, or other influences, cultural or natural. Repetition of similar clusters throughout a landscape may indicate vernacular patterns of siting, spatial organization, and a region’s cultural geography.

10. *Archaeological sites:* The sites of mines, mills, and communities may be marked by foundations, ruins, changes in vegetation, and other surface remains. They may provide information about land use, social history, settlement patterns, and the mining industry.
11. *Small-scale elements:* Examples of small-scale elements include signs, fence posts, and abandoned mining machinery. These elements add to the historic setting of a mining landscape and may be remnants of larger components.

The defining characteristics of a rural historic mining landscape also can be described in terms of "landscape of work."[3] Mining outfits molded the landscape for the efficiency, organization, and economics of finding ore, extracting it, and processing the material. Mining landscapes of work include characteristics such as placer mines on drainage floors, and water collection systems that diverted streams and carried the water to the workings. Hardrock prospects are concentrated in areas where ore was likely, and hardrock mines lie on land where ore formations were confirmed, regardless of topography. Ore treatment mills were sited either at the mines or in drainages where water and open ground were available. Companies erected workers' housing at mines and mills that were distant from established communities. Unincorporated settlements and formal towns grew in the most suitable environments near the centers of mining and milling. Circulation systems in the form of packtrails linked prospects with communities, and roads connected mines, mills, and transportation centers. Ditch systems diverted water from streams to reservoirs for industrial and community consumption. The forests around the mines and communities were cut over to provide wood for heating, steam power, and lumber. Sawmills were located close to the mature stands to minimize the distance workers hauled the cut logs. All are variations on the work related to the mining industry.

Resource Eligibility: For a mining landscape to be eligible, it should impart the feeling and represent the history of the industry in an area. The landscape must retain physical integrity and combine an assemblage of individual historic resources with an intact natural setting. Integrity on an archaeological level is sufficient and should be relative to one of the Periods of Significance outlined in previous property types. According to the National Park Service: "Integrity requires that the various characteristics that shaped the land during the historic Period be present today in much the same way they were historically."[4] Mining landscapes change to varying degrees due to continuity in occupation and use. Continuations of mining can be compatible with integrity by maintaining the character and feeling of the industry. Modern intrusions can compromise integrity if not consistent with mining land use patterns. Such intrusions should be few and unobtrusive. Most of the individual sites should present some visual impact, although the impact of some may be limited to an immediate and subtle level. If the individual resources meet these qualifications, then they are contributing elements of the landscape. Most of the individual resources in a landscape must be contributing elements, and they should collectively constitute an intact historic fabric. The researcher must clearly demonstrate that most of the sites comprising a landscape are contributing elements. A defensible strategy for achieving this is to record and evaluate the sites on an individual basis, and then discuss the results in terms of the landscape.

NRHP Criterion A: If a landscape and its contributing elements date to one of the mining industry's Periods of Significance, the landscape will be associated with important trends

[3] Messick, et al., 2001:62.
[4] McClelland, et al., 1999:21.

and events. Several Areas of Significance are relevant, but in a broad sense applicable to the mining industry as a whole. The researcher should review the Areas discussed in Chapter 2 to refine how they may be applied to landscapes.

The Area of *Industry* is fundamental. Mining landscapes are tied to and representations of the mining industry, which was important in South Dakota, as well as the greater central mountains. Prospectors and mining outfits adapted known methods and technology for finding, producing, and processing ore to the conditions of the Black Hills. In so doing, they contributed to the development of mining technology and engineering, and made South Dakota one of the nation's most productive states.

Landscapes can be important in the Area of *Community Planning and Development* if they reveal settlement patterns characteristic of mining. Unlike traditional settlement patterns, mining industry participants established residential complexes near centers of mining or related industry regardless of environmental conditions. Proximity to mines and industry was a first priority, and the best micro-environment for a residence or community was second. Landscapes can reflect the development patterns of the industrial aspect of mining, and its geographic influence on settlement. It should be noted that settlement is not limited to concentrations of residences, such as townsites. The workers' housing and prospectors' camps scattered throughout the Black Hills are another settlement pattern.

The Areas of *Economics and Commerce* can manifest in mining landscapes. Assemblages of sites including mines, mills, roads, and railroads reflect the overall process of converting natural resources into wealth. The mines produced ore that was carried over the roads to mills. The ore was processed at the mills, gold was recovered, and the concentrates shipped by road or rail to a smelter for the final processing. Each stage furthered the ore-to-wealth cycle. Each stage also represents a divestment of money into the region through workers' wages and the consumption of goods. Communities in the landscape were local economic centers where the divested funds supported commerce.

NRHP Criterion B: Small-scale landscapes such as individual placer mines or milling complexes may be eligible under *NRHP Criterion B* through residence, employment, or other involvement by a significant individual. The associated resource must retain physical integrity relative to that person's occupation during their productive period of time. Further, the resource must date to the same timeframe of when the individual achieved significance. Integrity on an archaeological level is sufficient. If an individual can be connected with the landscape, then the researcher must explain their significant contributions in a brief biography. In some cases, important people invested in mining companies or owned land but did not occupy the property. Such an association does not meet Criterion B. The individual of note must have been present on the ground.

Large-scale landscapes may be eligible under Criterion B, but relatively few will qualify because of their size. For an entire landscape to be eligible, an important person must have played a direct role and been present during its development, or spent an appreciable amount of time throughout the terrain. Most large-scale mining landscapes, however, were not impacted by one individual. Instead, they evolved organically through the actions of numerous people.

NRHP Criterion C: Mining landscapes hold a high potential for eligibility under *NRHP Criterion C*. Landscapes may be eligible if buildings, structures, their archaeological remains, and natural features represent mining, its subsidiary industries, and their settlement patterns. Landscapes occupied for extended periods of time reflect the evolution of land use, while those occupied for a narrow period reflect land use patterns of that era.

Intact buildings and structures are important and often rare contributing elements of mining landscapes. The Areas of *Architecture* and *Engineering* are relevant. Mining industry participants adapted conventional designs and construction methods to the environment of the Black Hills. Conditions included topography, natural landscape features, local climate, and available building materials. Some individuals also participated in the introduction of formal building design and elements of architectural styles. In the context of a landscape, a spectrum of buildings can represent the evolution of architecture specific to the mining industry. Similarly, structures may be significant representations of mining engineering, and multiple structures within a single landscape may reflect the evolution of function, design, methods, workmanship, and materials.

A landscape may be eligible under Criterion C if it was the work of a master planner, engineer, geologist, architect, or other industry official. This usually applies to small-scale, engineered landscapes such as mines, mills, infrastructures, and settlements. The researcher must identify the individual and the landscape history and explain who the individual was and why they were important.

Most of the individual resources comprising the landscape should retain integrity at least on an archaeological level. Modern intrusions should either be minimal or compatible with the historic land use. The researcher must discuss how the landscape's characteristics and contributing elements represent an aspect of the mining industry.

NRHP Criterion D: Landscapes may be eligible under *NRHP Criterion D* when they hold a high potential to contribute meaningful information upon further study. The arenas of inquiry can be broad and rely on information offered by the landscape as a whole rather than a few of its individual sites.

If residential complexes within the landscape possess building platforms, privy pits, and refuse dumps with buried archaeological deposits, testing and excavation may reveal important information regarding lifestyle and demography of the occupants. When the results from multiple complexes are compared, regional patterns may become apparent. Important areas of inquiry include but are not limited to diet, health, and substance abuse. Other areas of inquiry relate to the distribution of gender, families, ethnicities, professional occupation, and socioeconomic status.

Comparative studies of industrial sites may find patterns regarding the application of systems engineering, ore treatment processes, and preference of equipment. Other patterns regarding construction methods, materials, structural design, and architecture may become apparent. Such information can be compared to geology, mineralogy, and the successful or failed operations for a full understanding of a region's industry.

Intact underground mine workings is another area of inquiry under Criterion D. Groups of mines may feature connected workings that can contribute to the understanding of broad-scale mine engineering, planning, and operations.

Additional Reading on Mines and the Industry

The descriptions of the Property Types, their operations, and their technologies can help the researcher identify, define, and interpret specific resources. The descriptions are, however, necessarily brief. Cultural resource specialists unfamiliar with the nuances of mines, mills, and the mining industry should consult specialty publications for a greater understanding of mining-related sites. The following publications, listed in order of relevance to mining technology, can provide insight.

Twitty, Eric *Riches to Rust: A Guide to Mining in the Old West* Western Reflections, Montrose, CO, 2002. (Discusses in detail the constitution, layout, development, and equipment of mining. Focuses on mine surface plants and how to interpret today's remains).

Meyerriecks, Will *Drills and Mills: Precious Metal Mining and Milling Methods of the Frontier West* Self Published, Tampa, FL, 2001. (Provides accurate and comprehensive coverage of common mining and milling practices and equipment).

Young, Otis E. *Western Mining* University of Oklahoma Press, Norman, OK, 1989 [1970]. (Discusses hardrock prospecting, mining, and milling methods employed prior to 1893. The timeframe is limited and discussion of methods broad).

Twitty, Eric *Blown to Bits in the Mine: A History of Mining and Explosives in the United States* Western Reflections, Montrose, CO, 2001. (Discusses conventional mining practices with an emphasis on underground work and artifacts).

Hardesty, Donald *The Archaeology of Mining and Miners: A View from the Silver State* Society for Historical Archaeology, 1988. (Discusses mining-related sites as archaeological resources).

Francaviglia, Richard *Hard Places: Reading the Landscape of America's Historic Mining Districts* University of Iowa Press, Iowa City, IA, 1991. (Focuses on reading and interpreting mining landscapes).

Bailey, Lynn *Supplying the Mining World: The Mining Equipment Manufacturers of San Francisco, 1850-1900* Westernlore Press, Tucson, AZ, 1996. (Discusses various types of mill and mine machines).

Bailey, Lynn *Shaft Furnaces and Beehive Kilns: A History of Smelting in the Far West, 1863-1900* Westernlore Press, Tucson, AZ, 2002. (Presents a comprehensive history of smelters, charcoal manufacturing, and related technology).

Sagstetter, Bill and Sagstetter, Beth *The Mining Camps Speak: A New Way to Explore the Ghost Town of the American West* Benchmark Publishing, Denver, CO, 1998. (Discusses the examination of mine sites through remaining material culture. The authors make a few inaccurate generalizations and dates of artifacts).

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