MINING DISPLACEMENT:
Embracing Change on the Iron Range

A THESIS PROJECT
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF ARCHITECTURE

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December 2009

ACKNOWLEDGEMENTS

I owe my deepest gratitude to all who have supported me in making this thesis possible. I would like to extend a special thank you to my thesis committee: Ozayr Saloojee (chair), John Comazzi, and Kristen Paulsen.

Ozayr's amazing ability to provide calm direction at times of highest stress, John's unwavering support and thought provoking comments, and Kristen's fresh and consistently constructive critique made the thesis process an intensely rewarding experience.

I would also like to thank the many friends I have made over the course of my architectural education. While all of them have been influential and supportive, none has been more so than Federico Garcia Lammers. His honest and insightful critique, fueled by a true passion for design, was always a welcome addition to my work.

DEDICATION

I would like to dedicate this thesis to my family, both immediate and extended. I can only begin to hope that they are as proud of me as I am of them.

The love and unconditional support I received from my parents, Bill and Karen Jarvi, is truly the foundation of my success. Though my mother is no longer with us, she was, and will always be, an unending source of inspiration. My father, a true Iron Ranger in the very best sense of the term, continues to inspire and influence me in ways I may never be able to fully express.

I must also extend my deepest gratitude to my wife, Katie. Her love, support, and patience throughout this process will be forever appreciated.

Thank you.

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Fig. 1.1: Looking West from the Hull-Rust Mineview.

1. INTRODUCTION

"...a working country is hardly ever a landscape. The very idea of landscape implies separation and observation."[1]

- Raymond Williams

This statement rings especially true if the term landscape is understood in its original meaning: an image of the land rather than the land itself. In no place is this idea more applicable than the Mesabi Iron Range of northeastern Minnesota. It is the very definition of a working country. Iron ore mines, which have operated across the Iron Range for nearly 120 years, have been the source of great success and great failure. This process has left both land and people scarred and has defined the identity of an entire region.

The ore mined on the Iron Range has won wars, built our cities, and made the consumer products we've all come to rely on readily available. The Mesabi now accounts for nearly 80% of all iron ore mined in the United States, with Hibbing's gaping Hull-Rust mine being historically the single greatest contributor.[2]

Fig. 1.2: Nat'l Register of Historic Places Marker.

The Hull-Rust pit complex , originally made up of over 30 individual mines has merged into one giant pit some 5 miles long by nearly 2 miles wide. It was first opened in 1895 and, under the name of Hibbing Taconite, continues to produce marketable ore to this day.

Its significance to the city of Hibbing, the region, and the nation cannot be overstated. In fact, due to its vital role in the war effort (25% of all U.S. ore came from Hull-Rust), it was nominated for and added to the National Register of Historic Places.[3]

Despite the significance of this place, the mining processes that created it and the scale of change they inflict on the land remain relatively unknown. Only those who work directly in the mines (and there are fewer and fewer of them) can truly grasp this amazing process…..

Geologically scaled change is happening on a hyper-industrial time scale, yet due to safety concerns, land ownership issues, and the region's tenuous relationship with the mining industry, it goes mostly unnoticed by the general public. This change is so massive and ever evolving that public agencies such as the USGS do not even attempt to map it.

Fig. 1.3: Warning Sign at the Hull-Rust Mineview.

Currently, the only legal, safe, public access to the operation (albeit only visual in nature) is a small shelter and viewing platform along the southern edge of the pit. From this vantage point, one is provided with a dramatic, though distant and scaleless, overview of the mine.

The Hull-Rust mine, however, is much more than a visually stimulating landscape. It is a place deeply rooted in history and process that means many different things to many different people. The tenuous notion of permanence, or lack thereof, on the site has been a part of the Hibbing's collective psyche since the town itself was displaced by the mine and forced to move in 1918.

This thesis is a proposal that aims to move beyond the static "image" of the site both by acknolwedging the active industrial process that continues to shape it, and by allowing visitors to the site to experience, not simply view, the power of its ongoing transformation.

THE MESABI IRON RANGE

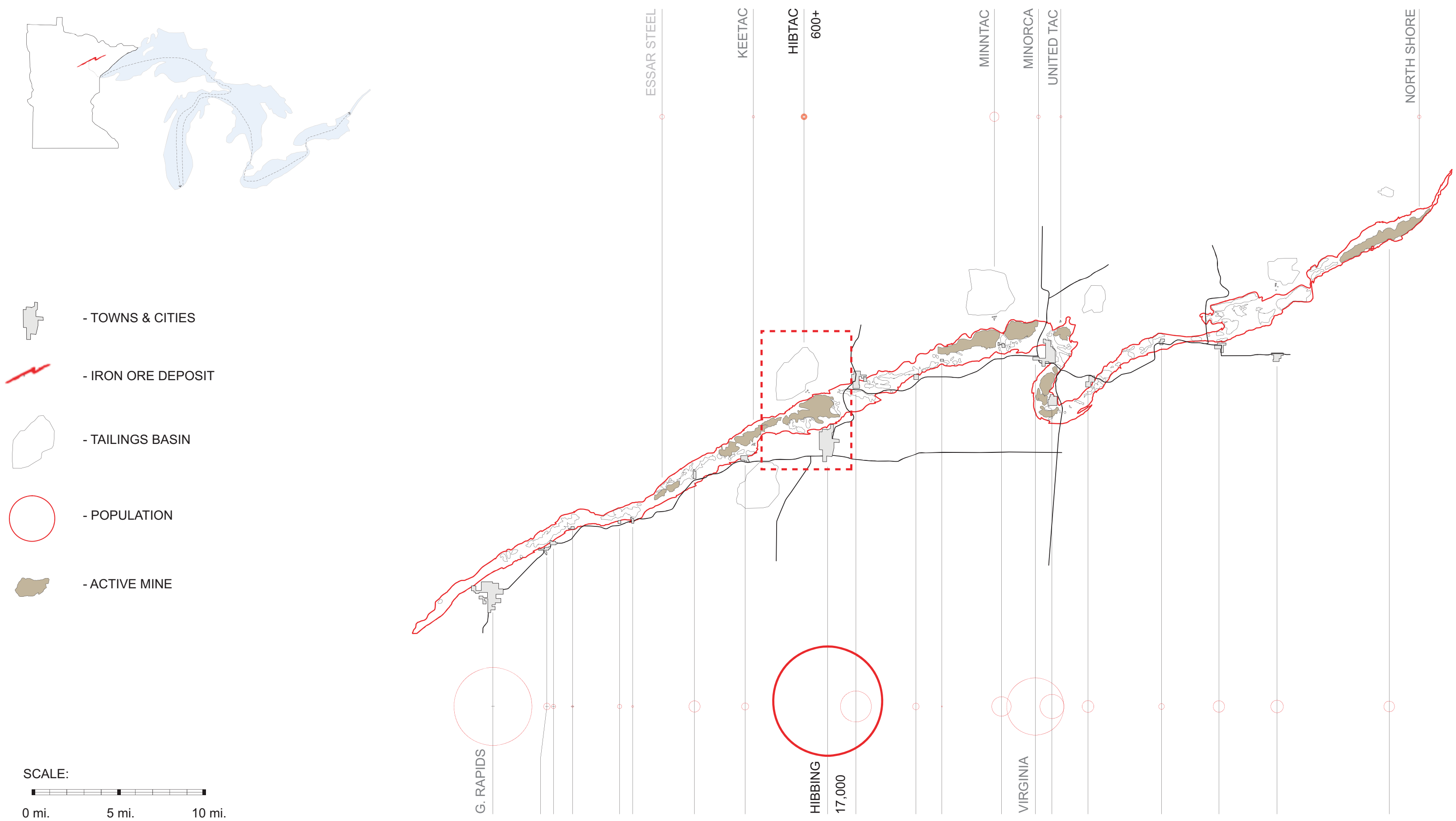


Fig. 1.4: Map of Minnesota's Mesabi Iron Range.

Fig. 1.5: Overview of Hibbing Taconite (Including the Hull-Rust-Mahoning Pit Complex).

Fig. 1.6: Overview of Proposal Site (Including Existing Hull-Rust Mineview).

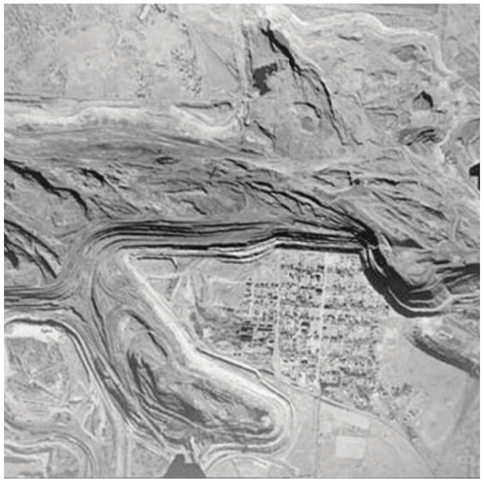


Fig. 1.7: Site Aerial, 1948. (Left)
Fig. 1.8: Site Aerial, 1989. (Middle)
Fig. 1.9: Site Aerial, 2005. (Right)

2. HISTORICAL OVERVIEW

EARLY HISTORY

Though there are many Native American legends in the region describing a special “hard rock” thought to be iron ore, the first official accounts of its so-called discovery date back to 1844 when a group of government surveyors in Michigan’s Upper Peninsula noticed their instruments behaving strangely.[1] Further exploration revealed the presence of high grade iron ore. Several years passed, however, before the discovery gained much attention. The first significant ore shipments from the region didn’t begin until 1856 when mines in Michigan’s Marquette Range took advantage of the newly opened shipping canal at Sault Ste. Marie, the predecessor to today’s Soo Locks.[2] This development spurred further exploration in the Upper Peninsula, resulting in the discovery of ore in the Menominee Range in 1873 and the Gogebic Range in 1883.

DISCOVERY OF IRON ORE IN MINNESOTA

As the iron magnates of the lower Great Lakes states expanded their search for raw materials, surveyors and prospectors soon reached the arrowhead of Minnesota.

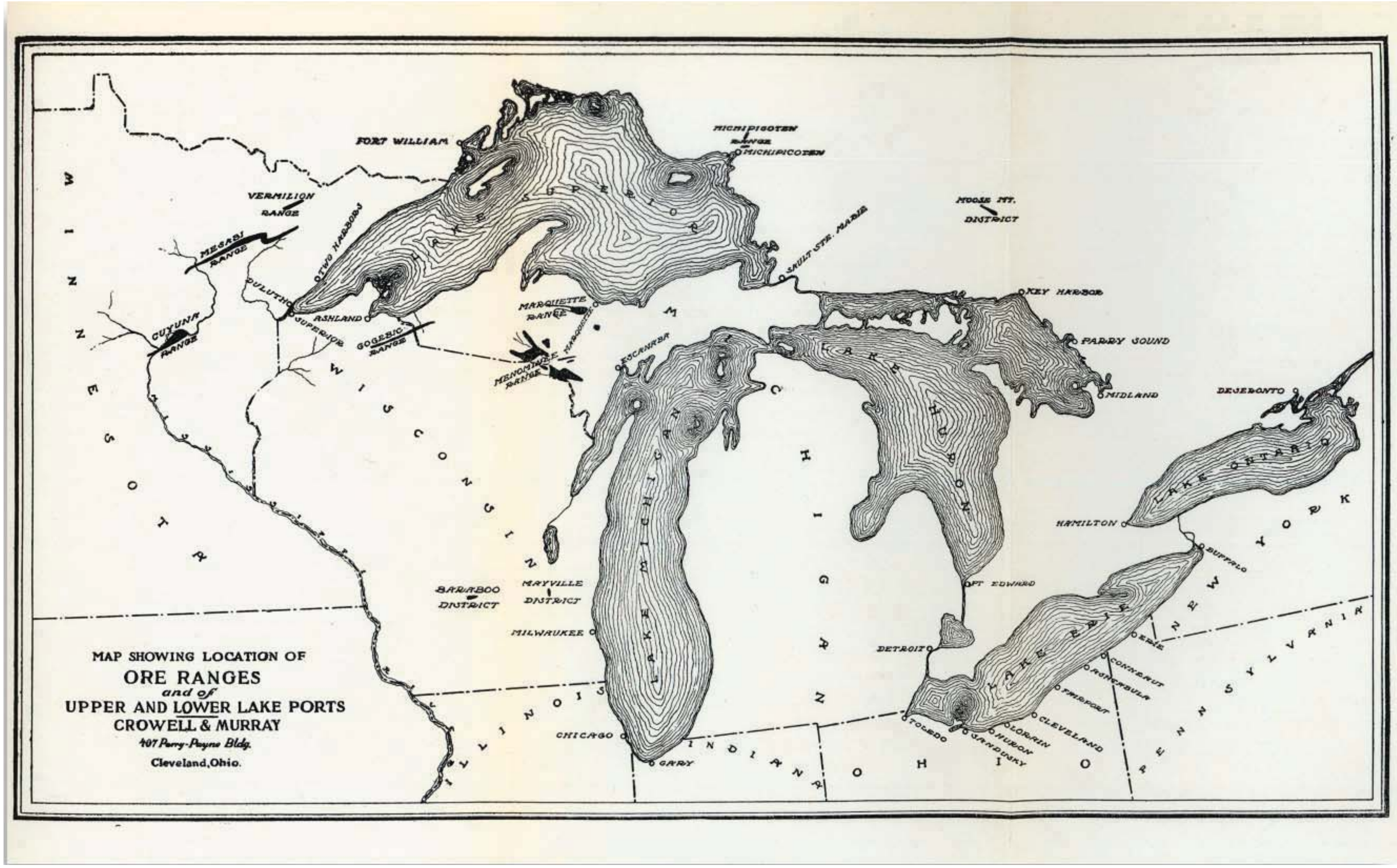


Fig. 2.1: Major Iron Ranges in the United States,1930.

Though gold prospectors had accidentally discovered iron ore in northeastern Minnesota as early as the 1860s, the first large scale body of iron ore to be discovered in the state occurred in 1882 on the Vermilion Range near the present day towns of Ely, Tower, and Soudan.[3]

This discovery marked the start of rapid development for the iron ore industry in Minnesota. By 1884, just two years after the initial discovery, a wealthy industrialist name Charlemagne Tower had founded the Minnesota Iron Company and funded the construction of a railroad line, the Duluth and Iron Range Railroad, to transport raw material to the Twin Ports of Duluth, MN and Superior, WI.[4] From the head of Lake Superior, ore could easily be shipped to the industrial cities of Ohio and Pennsylvania.

AWAKENING THE SLEEPING GIANT

With the discovery of iron ore on the Vermilion Range in the 1880s came an interest in the exploration of the rest of northeastern Minnesota. This exploration was rewarded in 1890 with the discovery of high grade ore at Mountain Iron, the first mine on the newly named Mesabi Iron Range. The name Mesabi, also referred to as Missabe or Mesaba, comes from the Ojibwe term for

Total Annual Shipments of Lake Superior Iron Ores by Ranges

Years	Marquette Range	Menominee Range	Gogebic Range	Vermilion Range	Mesabi Range	Mayville Range
Unknown	73,553					
1854	3,000					
1855	1,449					
1856	6,790					
1857	25,646					
1858	22,876					
1859	68,832					
1860	114,401					
1861	49,909					
1862	124,169					
1863	203,055					
1864	247,059					
1865	198,758					
1866	296,713					
1867	465,504					
1868	506,505					
1869	649,097					
1870	856,245					
1871	818,966					
1872	949,073					
1873	1,174,972					
1874	935,604					
1875	898,974					
1876	955,224					
1877	1,013,144	10,405				
1878	1,039,368	82,824				
1879	1,135,396	247,135				
1880	1,384,010	560,950				
1881	1,579,834	738,987				
1882	1,829,394	1,170,819				
1883	1,305,425	1,078,551				
1884	1,558,034	896,282	1,022	62,124		
1885	1,430,422	692,950	119,590	225,484		
1886	1,627,380	892,148	75,362	304,396		
1887	1,851,417	1,196,043	1,322,875	394,252		
1888	1,923,733	1,191,101	1,437,096	511,953		
1889	2,642,814	1,796,754	1,988,394	844,782		
1890	3,000,805	2,282,237	2,847,911	880,014		
1891	2,512,242	1,824,619	1,841,580	894,618		
1892	2,665,169	2,261,499	2,973,077	1,167,650	4,245	9,044
1893	1,837,140	1,466,197	1,329,385	820,621	613,620	7,925
1894	2,060,260	1,137,949	1,809,468	948,513	1,793,052	10,511
1895	2,093,791	1,923,798	2,547,976	1,077,838	2,781,587	16,472
1896	2,606,790	1,560,467	1,799,971	1,088,090	2,882,079	13,144
1897	2,712,947	1,937,013	2,258,236	1,278,481	4,275,809	10,546
1898	3,119,461	2,522,265	2,498,462	1,265,142	4,613,766	18,151
1899	3,738,192	3,301,052	2,795,856	1,771,502	6,614,383	19,731
1900	3,479,242	3,261,221	2,875,296	1,655,820	7,809,535	20,986
1901	3,246,611	3,619,053	2,938,155	1,786,063	9,004,892	22,400
1902	3,865,350	4,612,509	3,654,930	2,084,263	13,331,025	30,219
1903	3,040,092	3,749,567	2,938,938	1,676,699	12,899,609	27,545
1904	2,851,745	3,074,848	2,399,420	1,282,513	12,155,914	46,120
1905	4,235,651	4,495,451	3,705,788	1,677,186	20,158,651	60,588
1906	4,057,187	5,109,088	3,642,160	1,792,355	23,820,351	77,471
1907	4,388,073	4,964,728	3,633,459	1,685,267	27,491,439	23,610
1908	2,413,575	2,679,156	2,699,967	841,544	17,258,225	71,341
1909	4,252,622	4,875,385	4,088,058	1,108,215	28,176,359	82,759
1910	4,392,726	4,237,738	4,315,314	1,203,177	29,199,418	91,682
1911	2,835,902	3,911,174	2,603,319	1,088,930	22,093,790	115,629
1912	4,202,723	4,711,440	5,006,266	1,844,981	32,047,860	104,031
1913	3,967,918	4,967,354	4,531,558	1,566,600	34,038,984	145,010
1914	2,491,857	3,221,258	3,568,482	1,016,993	21,467,121	105,765
1915	4,106,178	4,982,672	5,477,767	1,733,595	29,756,742	80,583
1916	5,409,582	6,364,363	8,489,700	1,947,200	42,525,906	125,970
1917	4,874,150	6,045,750	7,979,877	1,530,692	41,440,225	93,997
1918	4,354,297	6,379,332	7,936,700	1,192,908	40,396,215	88,812
1919	2,992,212	4,446,412	6,229,560	929,049	32,003,169	92,819
1920	4,608,323	6,569,384	8,763,332	1,007,435	37,147,705	78,544
1921	1,116,560	1,584,403	2,336,493	869,313	16,349,896	52,413
1922	2,818,374	4,079,444	6,220,985	1,211,559	28,064,247	87,439
1923	3,891,801	4,855,370	6,579,730	1,278,684	41,806,230	111,460
1924	3,174,835	3,836,826	5,159,990	978,163	29,142,247	99,005
1925	4,197,846	5,269,633	7,068,478	1,437,741	35,890,174	106,113
1926	4,435,029	5,946,377	7,537,078	1,586,030	38,250,856	131,950
1927	4,147,777	5,213,256	6,385,558	1,547,847	32,975,506	92,654
1928	4,298,717	4,841,637	6,540,019	1,671,466	35,398,660	7,426
1929	5,409,712	5,645,395	7,624,085	1,873,742	43,008,239	....
Totals	169,910,209	168,322,269	181,254,723	56,641,490	858,687,731	2,379,865

Fig. 2.2: Historic Ore Shipments,1930.

"sleeping giant," a reference to the low ridge that runs from southwest to northeast throughout the region.[5]

Early mining operations on the Mesabi were controlled by the Merritts, a group of seven industrialist brothers from Duluth known as the "Seven Iron Men" of Minnesota.[6] Not even the Merritts, however, could have predicted how appropriate the sleeping giant name would soon become.

The Ojibwe had long believed this ridge, now called the Laurentian Divide, held special powers. Of particular significance is the Hill of Three Waters, a geographic feature so named because it is the meeting point of three different watersheds: the St. Lawrence which drains through the Great Lakes to the Atlantic, the Mississippi which drains into the Gulf of Mexico, and the Hudson which drains north into Hudson Bay.

Despite the numerous Ojibwe legends surrounding the Mesabi, it was the rapid development of large scale iron ore mining that would soon come to define the region. A mere ten years after the Merritts opened the Mountain Iron Mine, there were over 100 active mining operations on the Mesabi Iron Range, establishing it as the nation's

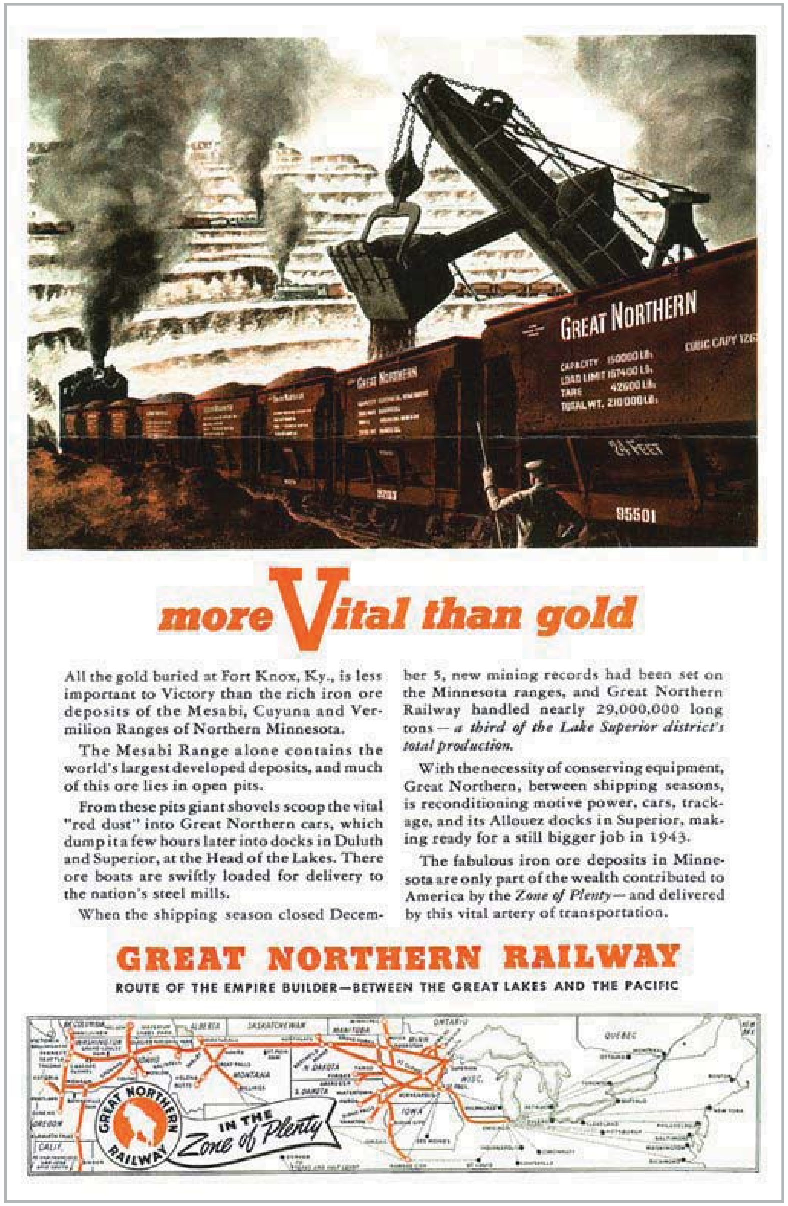


Fig. 2.3: WWII Propaganda Poster,1943.

largest iron ore producing region.[7] By 1895, just three years after the first commercial shipment from the Mountain Iron Mine, the Mesabi Range beat out the well established Marquette Range to become the Lake Superior region's most productive Iron Range. By 1903 the mines of the Mesabi were producing more than the Marquette (MI), Menominee (MI), Gogebic (MI), and Vermilion ranges combined. The dramatic pace of mining expansion on the Mesabi Range continued and by 1930 it was supplying a full sixty percent of all iron ore extracted in the United States.[8]

The Hull-Rust-Mahoning mine near Hibbing, MN has historically been the largest producer of iron ore on the Mesabi. Developed in 1895, several years after the discovery of ore at Mountain Iron, the Hull-Rust-Mahoning mine got its start out of what was once a series of 53 separate mines that eventually grew together. The Hull-Rust-Mahoning mine's significance both to the Mesabi Iron Range and the nation was established during its peak production years that stretched from WWI through WWII and into the 1950s. During this period, the Hull-Rust-Mahoning mine alone produced one quarter of all iron ore mined in the United States, having a tremendous impact on the outcome of both World Wars.[9]

The great demand for steel during the two World Wars and in the era of high consumer demand that followed World War II also had a tremendous impact on the Mesabi Range itself. By the end of the 1940s it was becoming clear that the high grade natural ore that had made the Mesabi into a giant was nearly depleted. If "consumption of iron is the social barometer by which to estimate the relative height of a civilization," as once stated by a notable 20th Century industrialist, then the Mesabi Iron Range was soon nearing its downfall.[10]

THE ERA OF TACONITE

Things were looking bleak for the Mesabi in the post-War years. Realizing this, the state legislature moved quickly to put new tax laws into place that would help encourage researchers and mining companies alike to explore the feasibility of mining and processing Taconite, the low grade ore that remained in abundance across the Iron Range.[11] Researchers at the University of Minnesota had been studying this process since at least the 1920s but attempts to put it into effect had all failed. One of the researchers, a man named E.W. Davis, persisted and was able to perfect a technique of separating and concentrating the iron content in Taconite, which in its natural state is generally less than 30 percent, to levels greater than 60 percent.[12]

The shift to taconite became reality in the mid-1950s when two new taconite plants opened. Minnesota, however, soon fell behind as other iron ore mining regions boomed, many using the very technique developed by E.W. Davis. The 1964 decision to amend state law and ensure that the newly formed taconite companies would be fairly taxed finally allowed the industry to boom.[13] There have been several boom and bust cycles since then, the most notable occurring in the early 1980s, but taconite mining continues to this day across northeastern Minnesota.

GEOLOGY

Ironically, it was the very geologic conditions that led to the development of the Mesabi Range that also hastened the rapid depletion of its high-grade ores. Unlike the neighboring Vermilion Range, where deposits of ore lay in thin vertical veins deep beneath the surface, the Mesabi's ore body lay in broad, gently sloping horizontal

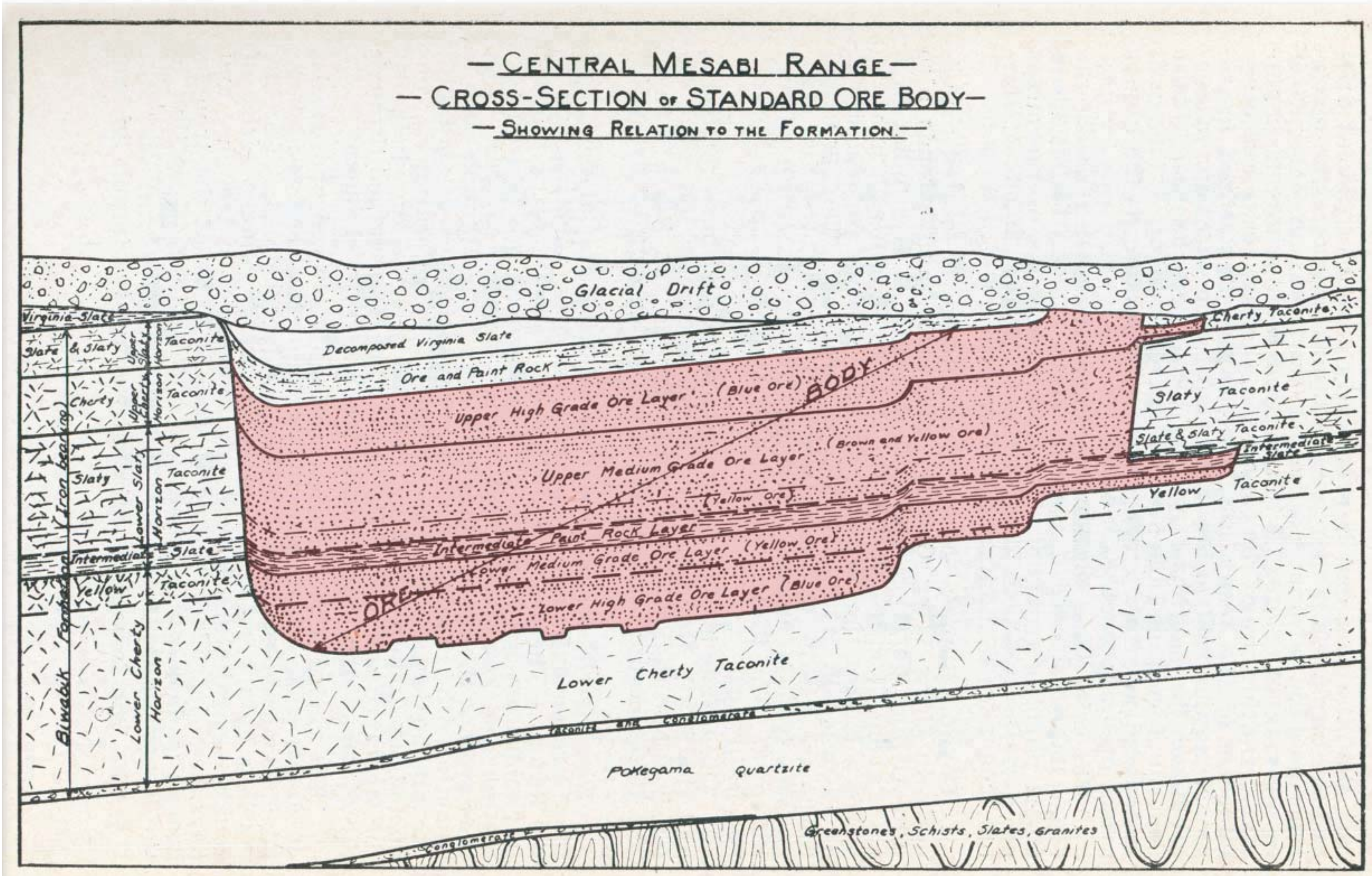


Fig. 2.4: Geologic Section of the Mesabi Range,1930.

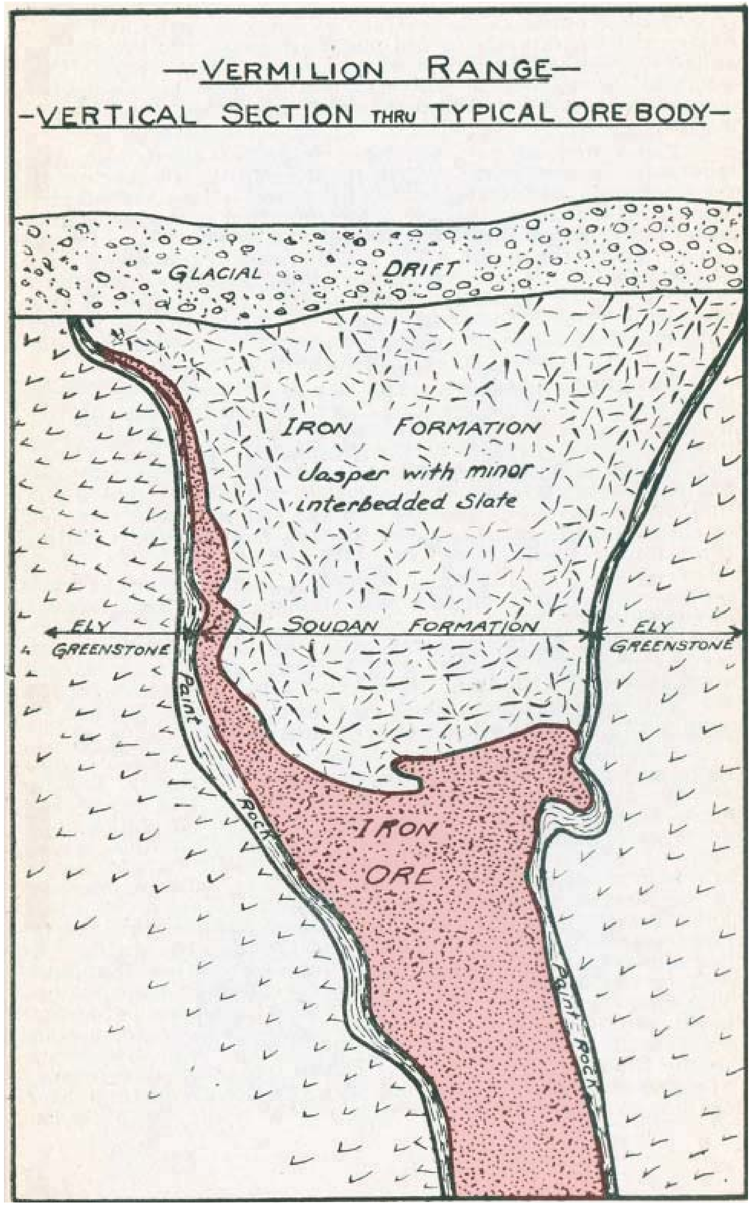


Fig. 2.5: Geologic Section of the Vermilion Range,1930.

bands only a few hundred feet below the surface. The Vermilion, as a result, was made up almost entirely of underground mines, some reaching depths of well over 2,000 feet. Such conditions likely hindered the development of efficient large scale extraction operations.

Underground mines had their place on the Mesabi as well, though mostly in the earliest years of its development. It soon became evident, however, that the shallow nature of the ore deposit could be more easily and efficiently extracted through large open pit mines.

The iron ranges of the Lake Superior region, including the Mesabi, are part of the ancient pre-Cambrian area of North America. The iron deposits of the Mesabi are comprised of a part of the Upper-Huronian series referred to as the Biwabik formation.[14] This formation was created nearly 1.5 billion years ago as iron rich particles settled to the bottom of an ancient sea to form layers of sedimentary rocks.[15] The iron content of these rocks was then concentrated in certain areas by the movement and forces of underground water. Wherever there was sufficient underground water movement, silica and other non-iron bearing particles were washed away, leaving behind concentrated areas of iron rich rock.[16] These deposits were eventually discovered, in some cases due entirely to their concentrated magnetic strength, and have become the areas of intense extraction that we today call iron ranges.

As previously mentioned, the ores here have been easily mined due to the fact that in most locations they are capped only by a relatively thin layer of glacial drift overburden. The main body of ore slopes gently downward from north to south at an angle of roughly seven degrees. The high grade ore that was depleted by the middle of the 20th Century was primarily a soft rock called hematite, which typically had an iron content of 55-60 percent.[17] Because of its high iron content, the hematite rich ores that were so sought after on the Mesabi could be shipped directly to the blast furnaces to make pig iron and later steel with little or no post-extraction processing.

Taconite, which has been mined since the 1950s and is much more abundant, contains the iron bearing rock magnetite. Magnetite itself is over 70 percent iron, but the Mesabi's vast taconite deposits contain only low amounts of the rock. As such, the overall iron content in taconite ranges from only 15-30 percent, not enough for direct shipment to the mills. E.W. Davis' pioneering process mentioned previously, concentrates this content into pellets that contain upwards of 60-65 percent iron, which rivals the iron content of the depleted bodies of high grade ore.[18]

THE PEOPLE

Noted regional historian Arnold Alanen writes that "if the landscape of the Iron Range was dominated by massive open-mining canyons surrounded by ocher-colored hills, bluffs, and plateaus, the distinctive social and cultural features of that landscape were provided by the diverse immigrant peoples who settled there."[19] He goes on to note that by 1900 the iron ore bearing regions of the upper Great Lakes had a "larger land area more uniformly inhabited by foreign born groups than any other region of the nation."[20]

The iron ranges of Minnesota, particularly the Mesabi, attracted thousands of immigrants from as many as 25 different countries. The first wave of immigrants arrived in towns like Hibbing, Virginia, and Eveleth almost immediately after the discovery of ore. The first to arrive were primarily western and northern Europeans, many coming to Minnesota after first gaining experience in the iron ranges of upper Michigan. Among these early groups were Cornish, Swedish, and most numerously, Finnish people. Southern European immigrants began arriving en masse around the turn of the century, with "South Slavs" and Italians being the most numerous. It is estimated that by 1910, during the height of the range's population boom, a full 53 percent of all people living on the Mesabi Iron Range were foreign born.[21]

CULTURE

Decades of immigration have made the Iron Range what it is today. Though the influx of immigrants stopped well over 75 years ago, many of their traditions endure. The mixing of some 25 different cultures and languages over more than a century in a sharply defined geographical region has produced a "culture unto itself."[22] This culture remains strong in the form of food, music, or most noticeably, the Iron Range dialect. Shared experience both good and bad has forged this unique collective identity.

Fig. 3.1: The Birth of Hibbing, 1893.

3. SITE STUDY + ANALYSIS

The discovery of iron ore at Mountain Iron in 1890 spurred exploration of the rest of the Mesabi. Prospectors and surveyors soon flooded the area, all searching for their own piece of red gold. One such man was a young German immigrant named Franz Dietricht von Ahlen. Von Ahlen left the German city of Hanover in 1856. Upon arriving in the United States von Ahlen, who was just 18 years of age, changed his name to the more American sounding Frank Hibbing.[1]

Hibbing eventually found himself in the developing port city of Duluth, the base of prospectors and timber cruisers and gateway to Minnesota's Iron Ranges. Hearing of the newly opened Mesabi Range, Hibbing assembled a team and headed north. Settling on a site some 75 miles northwest of Duluth, Hibbing and his men set up camp. Robert Shelton, author of *No Direction Home*, offers the following account of Hibbing and his men:

> Near what was to become the town center, Hibbing is reported to have stuck his head out of his tent one morning in January 1893. It was 40 degrees below zero. Three feet of snow mantled a frozen pine forest. Hibbing, a lean and determined man with a handlebar mustache,


Fig. 3.2: Early Open Pit Mining. Hibbing, 1895.

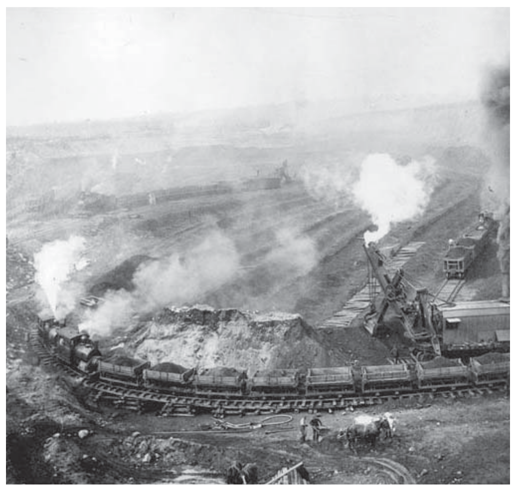


Fig. 3.3: Rapid Mine Expansion. Hibbing, 1899.

> supposedly said: 'I believe there is iron under me. My bones feel chilly and rusty.'[2]

Legend has it that his men began digging later that day, discovering ore and signaling the development of the town that would soon come to be known as "the iron ore capital of world."[3]

Early underground explorations quickly developed into large scale open pits. By 1895, the Hull and Rust mines, which would eventually become the giants of the Mesabi, would ship their first commercial ore. The booming industry began attracting workers first by the hundreds, but soon by the thousands. The isolated outpost had just 426 inhabitants in 1893, most of them lumberjacks hired to clear the land for mining. By 1900, Hibbing was a bustling frontier town of 2,481 residents. "Mud streets, wooden sidewalks, saloon brawls, lumbering and mining accidents, and typhoid fever," however, made for difficult living conditions.[4] While mining operations boomed in these early years, financing them still proved risky. Harvesting the vast stands of red and white pine in the area remained the primary economic driver, even bringing in enough money to fund mining developments.[5]

Fig. 3.4: Boomtown Hibbing, 1903.

U.S. Steel's involvement shortly after the turn of the century allowed the industrial might of the Mesabi to reach its full potential. The impact of this is perhaps most readily apparent in looking at the region's population explosion from 1900 to 1920. The Village of Hibbing went from a rough and tumble northern frontier town of a little over 2,000 in 1900 to an industrial boomtown of nearly 9,000 just ten years later. The growth in the next decade would prove to be just as dramatic as Hibbing soon grew to become a legitimate city of 15,000 residents. Unofficial estimates even placed the population of Hibbing in 1920 at an impressive 20,000 residents.[6]

The population boom experienced in Hibbing was also occurring simultaneously in other cities across the Mesabi. Virginia, a boomtown in its own right, was growing at a pace that nearly matched Hibbing. Paved streets, street lights, and sanitation infrastructure were soon put in place to serve the growing communities. Perhaps the most impressive piece of civic infrastructure on the Mesabi Range was the Mesabi Railway, an inter-urban streetcar line that ran 36 miles from Hibbing to Gilbert with stops in Chisholm, Virginia, and Eveleth along the way.[7] The railway was opened at the height of the boom in 1912 and served the range for 15 years.

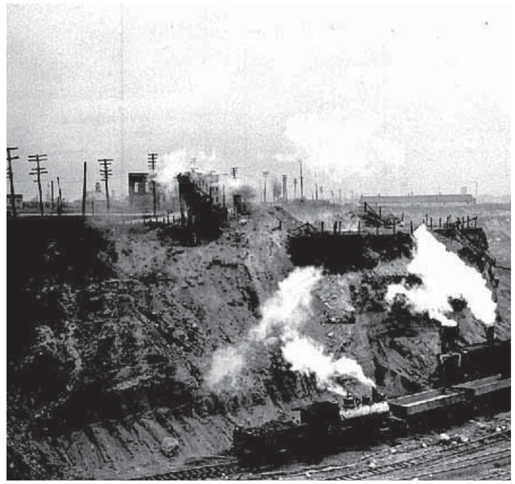


Fig. 3.5: Mines Encroaching on Hibbing, 1915.

DISPLACEMENT

The most visible sign of this prosperity and growth was the rapid pace at which the landscape of the Mesabi Range was changing. Unlike the underground operations of the Vermillion Range, the effects of open-pit mining on the Mesabi were apparent for all to see. The vast open pits, visible signs of new industrial might, began to capture national attention. A journalist from the National Geographic Magazine visited Hibbing in 1917 and offered the following account:

> When one who has visited Panama reaches Hibbing he can almost imagine that Uncle Sam is so enamored of the job of moving mountains with the faith of enterprise that he has decided to repeat his Isthmian performance in Minnesota; for they certainly do 'make the dirt fly' up there. … More than 46,000,000 cubic yards of material, or nearly one and a half times as much for the average month as the best month in Panama's history can show. Think of it – more material dug out, loaded onto cars, transshipped to ore boats, and carried a thousand miles in eight months than Panama was ever able to take out and haul an average of ten miles in fifteen months![8]

His account of the "Iron Ore Capital of the World" is beaming with pride and astonishment of the unimpeded industrial progress occurring in the remote forests of northern Minnesota. He mentions in passing that "most

Fig. 3.6: Displaced Home. Hibbing, 1920.

Fig. 3.7: Moving a Hotel. Hibbing, 1920.

streets in Hibbing begin at one man-made precipice and end at another," an observation that the residents of the town were becoming increasingly aware of.[9]

Less than a decade after the town's founding, a sense of instability had already begun to creep its way into the residents' minds. Rumors of a rich ore vein directly beneath the growing town quickly began to spread.[10] These rumors were undoubtedly intensified when "by 1909, dynamite blasting and extraction activities had moved so close to [Hibbing] that buildings were shifting on their foundations."[11] The relocation of the eastern Mesabi township of Sparta later that year likely turned rumor into a perceived certainty.

News of the intent to displace the town to access the ore soon became official. Work to move the town began in earnest in 1919. While other towns on the Mesabi had been displaced, the disruption had occurred either to small, rather insignificant communities or had taken place before any real development had ever had a chance to occur. Hibbing, however, was a different story. Arnold Alanen writes that "at Hibbing, the magnitude of townsite displacement far exceeded that at any other community on the range."[12]

Fig. 3.8: Abandoned Streets. Hibbing, 1924.

In fact, the residents of the burgeoning city of over 15,000 sought to prevent this displacement with a series of lawsuits, the most notable of which was *H.P. Reed et al v. the Village of Hibbing*. In the suit, residents of the town argued that city officials and mining officers unlawfully conspired to “vacate the streets, change the route of an electric railway, and unlawfully dispose of public property.”[13] Ultimately, the Minnesota Supreme Court found in favor of the mining companies and allowed the move to continue. The court, seemingly unsympathetic towards the plight of the residents’ stated the following in their decision:

> It is reasonable to require those, who take up a business or residence in a municipality dependent for its very existence upon the industry there carried on, to somewhat endure the disturbances and discomforts that unavoidably attend the proper and careful operation of the industry.[14]

The bulk of the move occurred between 1919 and 1921, but lingering structures and people remained in north Hibbing until the late 1950s when the last of the structures were either razed or moved. Throughout this prolonged displacement, an estimated 200 homes and 20 businesses were moved.[15] Countless others were demolished while others were simply vacated and left to decay. The

Fig. 3.9: Remnants of the Past. Hibbing, 2008.

unusual length of this very tangible displacement, along with the traces it has left behind, has ensured that the collective memory of the event remains alive. Hibbing's most famous resident, Bob Dylan, once wrote the following about his childhood town:

> …where I live now, the only thing that keeps the area going is tradition – it doesn't count very much – everything around me rots…if it keeps up soon I will be an old man – and I am only 15 – the only job here is mining – but jesus, who wants to be a miner…I refuse to be part of such a shallow death.[16]

While Dylan acknowledges the physical decay and displacement in Hibbing, his commentary on social upheaval is perhaps even more striking.

JOB LOSS ON THE RANGE

The boom years of the early 20th century were tempered by the realization that high-grade ore was a finite commodity. By the 1950s the town that once boastingly referred to itself as "the richest village in the world" had "dug its own grave with sixty years of mining shovels."[17] The Hibbing Bob Dylan grew up in was one in which the depletion of ore was outpaced only by the depletion of

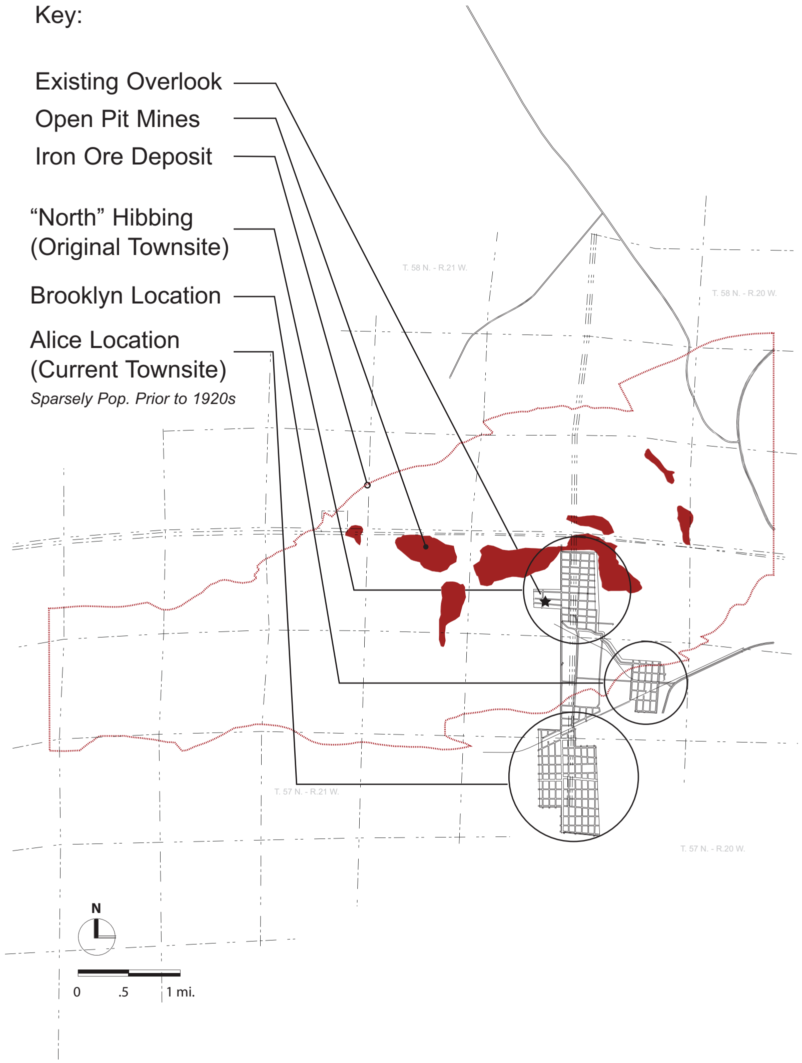


Fig. 3.10: Approx. Extent of Open Pit Mines near Hibbing in 1917.

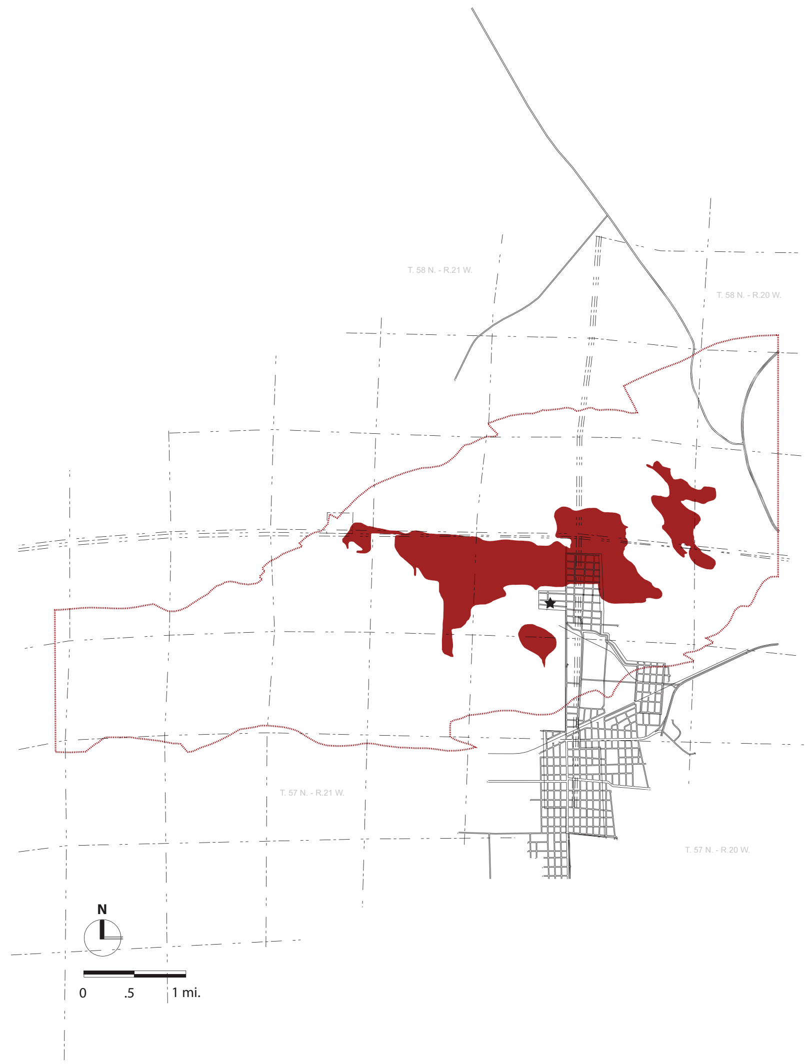


Fig. 3.11: Approx. Extent of Open Pit Mines near Hibbing in 1939.

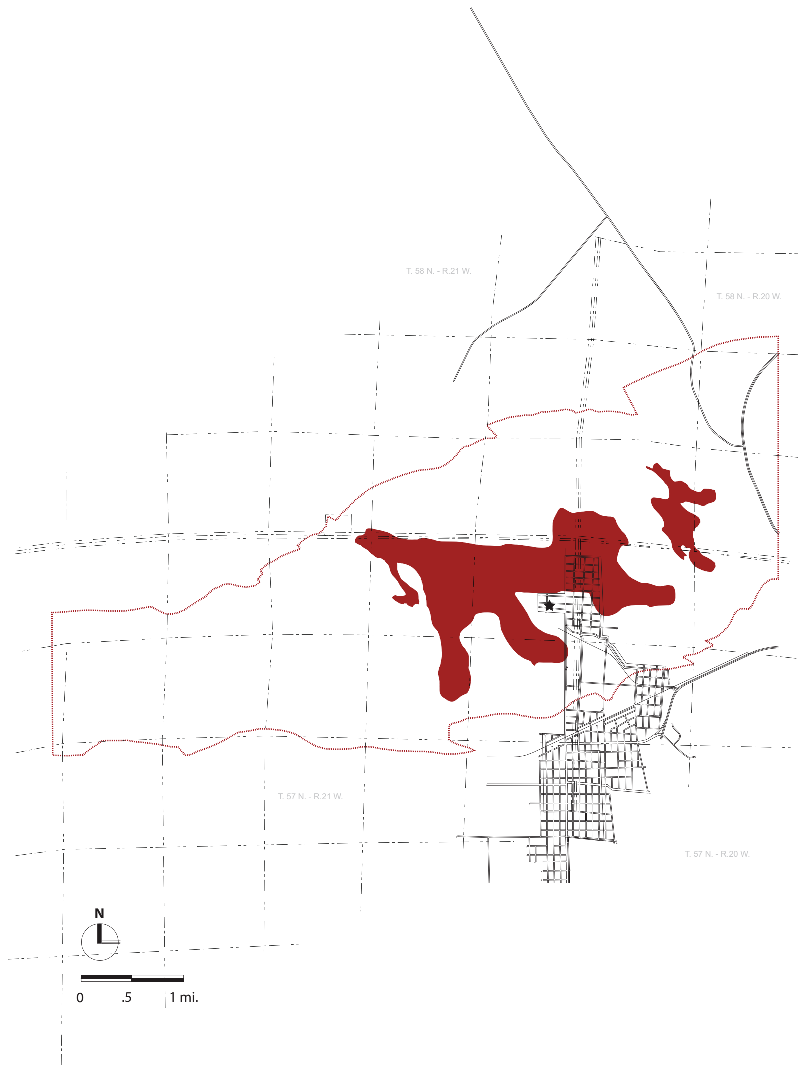


Fig. 3.12: Approx. Extent of Open Pit Mines near Hibbing in 1948.

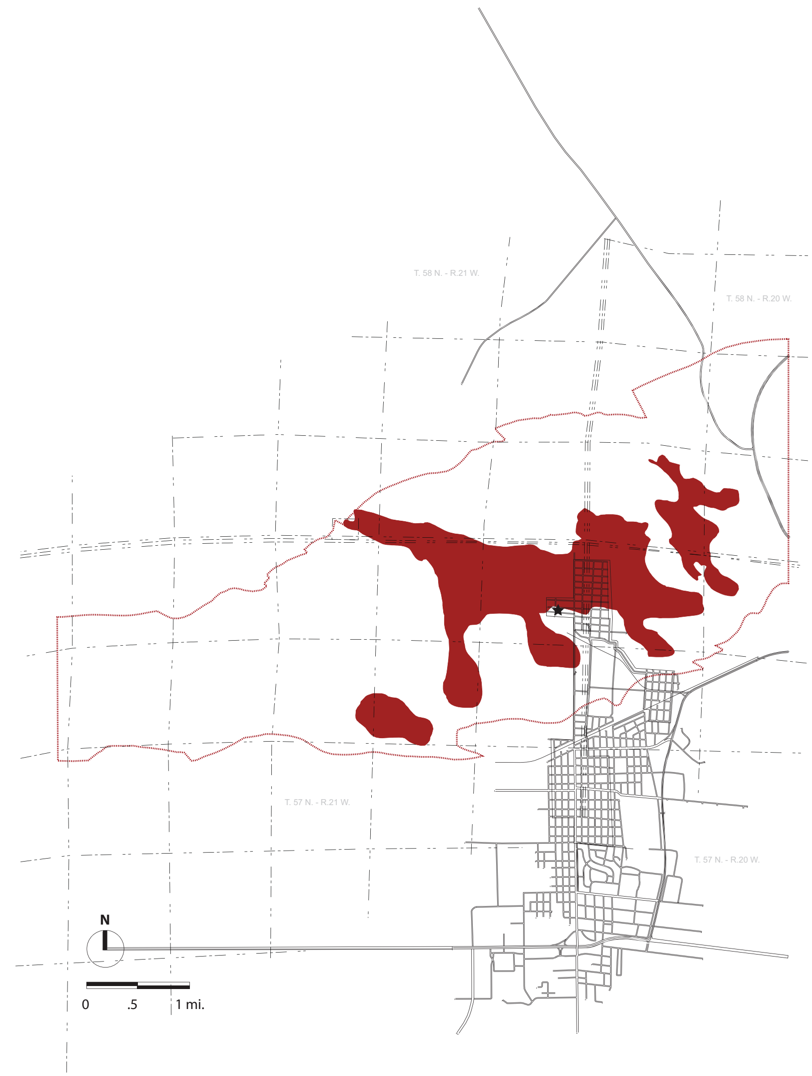


Fig. 3.13: Approx. Extent of Open Pit Mines near Hibbing in 1961.

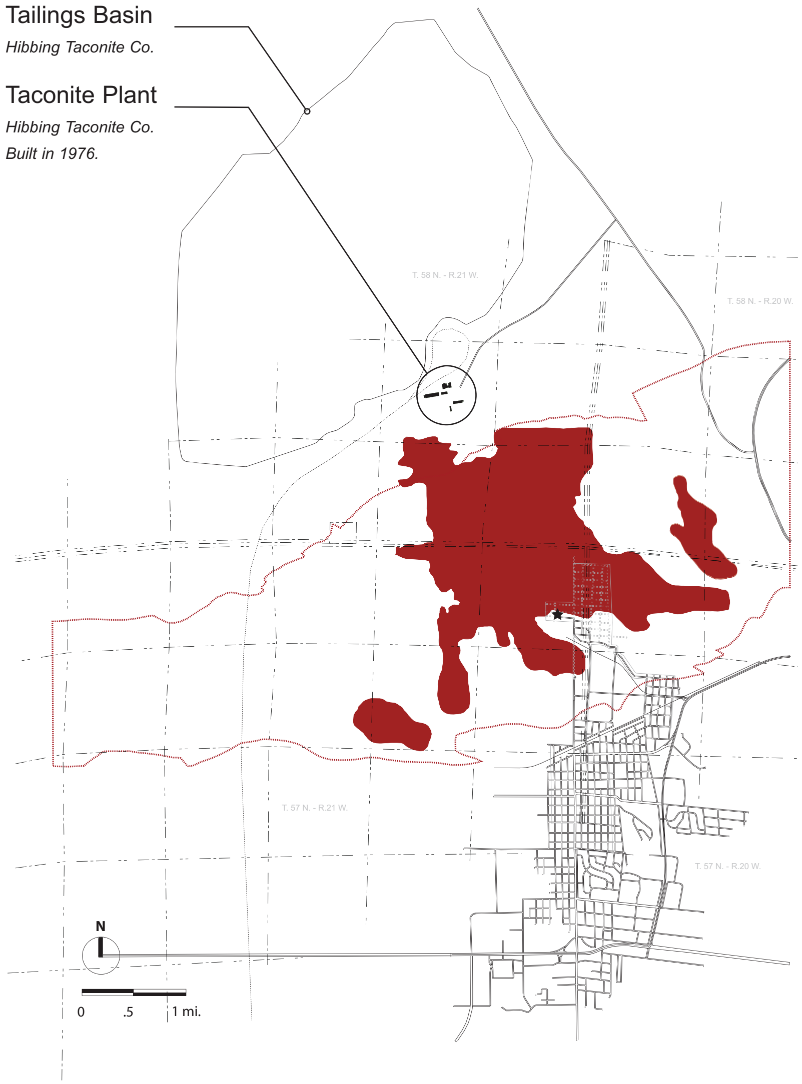


Fig. 3.14: Approx. Extent of Open Pit Mines near Hibbing in 1989.

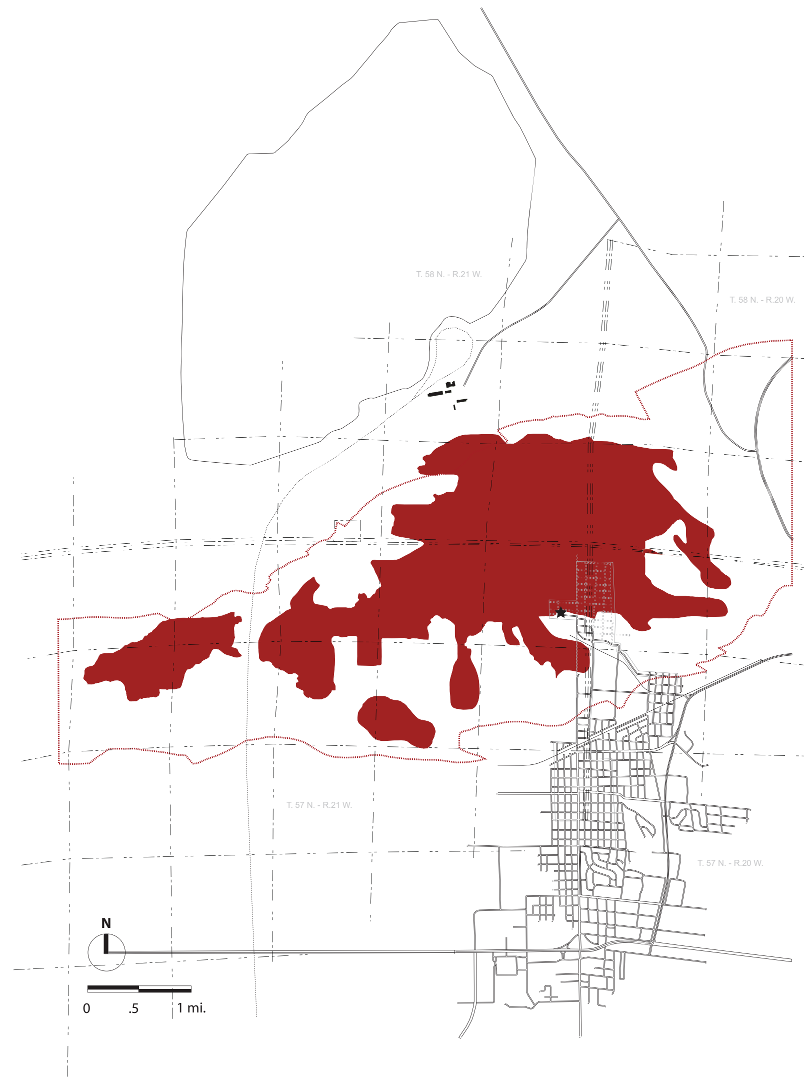


Fig. 3.15: Approx. Extent of Open Pit Mines near Hibbing in 2009.

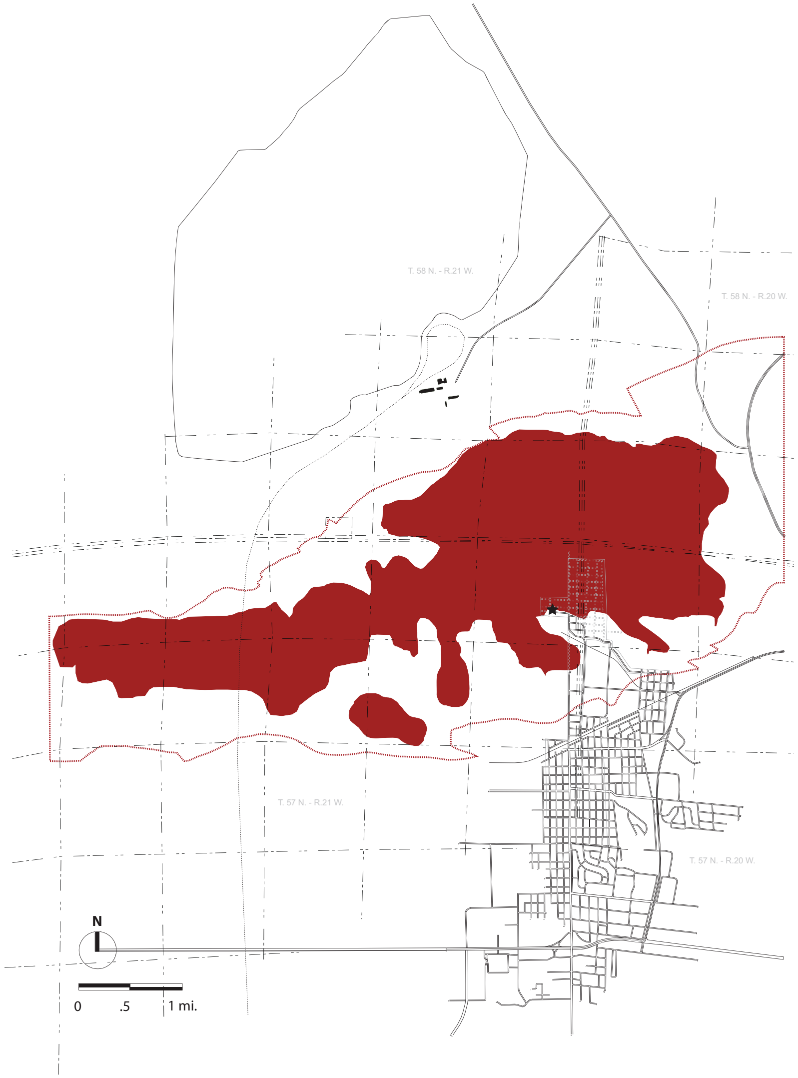


Fig. 3.16: Approx. Extent of Open Pit Mines near Hibbing in 2025.

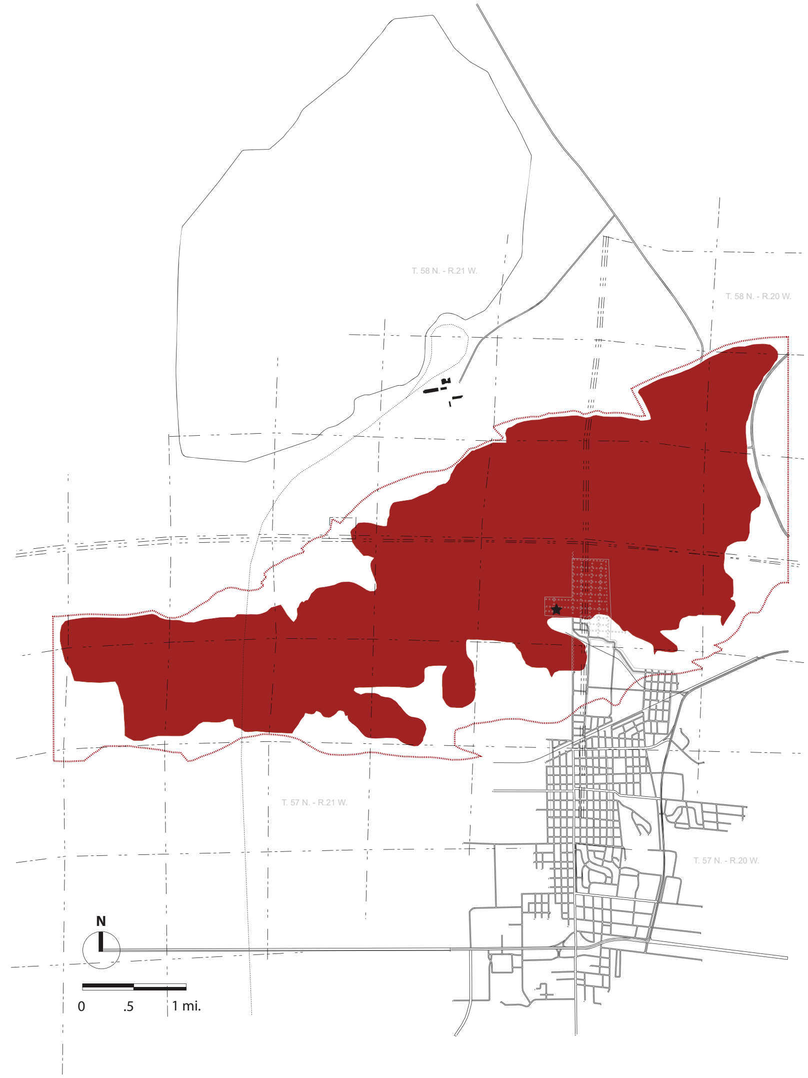


Fig. 3.17: Approx. Extent of Open Pit Mines near Hibbing in 2050.

hope for the future. Taconite mining had yet to take off and thousands were left jobless. In fact, “no part of the state has experienced more volatile economic, social, and landscape alteration.”[18] Economic downturns are magnified in single industry dominated towns like Hibbing where people know that boom time means only one thing; that a bust is soon to follow.

At no time was such dramatic change of fortune more profound than the early 1980s. Following the downturn of the 1950s, new state laws encouraged the growth of the taconite industry. By the late 1970s, the Mesabi Range was in the midst of a boom the likes of which it hadn’t seen since the early 1900s. Mines employed people by the thousands, and towns swelled with people. By the 1980 census, Hibbing had grown to its peak population of 21,193 and business was booming. Towns all across the range grew as the mines of the Mesabi struggled to keep up with demand.

Things, however, took an unexpected and abrupt turn in the first few years of the decade. A nation-wide recession hit, and demand for steel plummeted. Minnesota’s taconite mines saw employment drop from over 14,000 to less than 6,000 in little more than a year. The figure that is most striking, however, is that between the years of 1981 and 1984 a staggering thirty one people per *day* left Minnesota's three iron mining counties (St. Louis, Itasca, and Lake) to seek opportunity elsewhere.[19]

The industry eventually recovered, and though the taconite mines of the Mesabi still produce roughly 78 percent of all iron ore in the United States, employment in the mines has dipped below 4,000. While some of this decline can be attributed to new technology and increased efficiency, one cannot deny the impacts of continued declines in employment. The current recession has already resulted in the layoffs of several thousand miners, and layoffs for the rest appear imminent. This coupled with recent revelations of the potential health risks involved in taconite mining, namely a rare form of cancer called mesothelioma, has yet again called into question Iron Rangers' tenuous relationship with their surroundings.

UNCERTAIN INTERPRETATION

The schizophrenic nature of the people's relation with the mining industry and the physical environment it created is a palpable condition in towns across the range. There is an understandable sense of both stubborn pride in the great contributions to industry that have been made here

Fig. 3.18: New "Branding" Concept. 2009.

and also of a certain wariness that comes from being acutely aware of the consequences of such progress.

Like many Iron Range residents, Bob Dylan himself was often unsure of his feelings towards his home town, "vacillating between nostalgia and repulsion" on an almost daily basis.[20] He was famously quoted as saying "you've seen that great ugly hole in the ground, where that open pit mine was. They actually think, up there, that it is beautiful."[21] A more accurate statement might have been that some of the time, some of the people up there think that it is beautiful.

A 2002 National Geographic article on Hibbing, which incidentally focused more on Dylan than on taconite mining, quoted a local resident as stating that most people in town had never, in fact, even seen the Hull-Rust-Mahoning mine, the great ugly hole to which Dylan was referring. While this may be somewhat of an overstatement, it sheds light on the decline in awareness of what made the region what it is today.

UNIQUE OPPORTUNITY

Attempts to address in any physical way the history of change, either good or bad, on the Iron Range have

Fig. 3.19: IronWorld in nearby Chisholm.

largely been aimed at outsiders. Attractions such as IronWorld, a mining museum, interpretive center, and theme park rolled into one, were billed as tourist draws to bring Twin Cities leisure travelers and school groups up to the Iron Range to spend money. By admittedly focusing on tourists from the beginning, IronWorld automatically aliented the majority of its local audience, many of whom were undoubtedly put off by the notion of being told how they should interpret something they already have deeply personal feelings about.

Other attractions have failed simply because their focus on the panoramic image offers little in the way of unlocking the true experience of place. There are a series of six neglected scenic overlooks across the 110 mile long Mesabi Range. All but one, the Hull-Rust-Mahoning overlook near Hibbing, offer views of pits that have been inactive for decades and now appear as idyllic aquamarine lakes. Hibbing's overlook, known locally as the mine view, is perched over 500 ft. above the pit, allowing for a dramatic view of Hibbing Taconite's active mining operation. This site, as it happens, is also perched on the sliver of land that contains the last remaining traces of the original townsite.

Fig. 3.20: Virginia, MN's "Mineview in the Sky."

Fig. 3.21: Hull-Rust Mineview, Hibbing.

Apart from these facts, this site is quite literally the only point of public access (though only visual in nature) to the Hull-Rust mine complex, a massive pit that now measures three miles long and nearly one and a half miles across. As such, the first task in understanding the site is just that, attempting to understand the physical qualities of the site beyond what is offered from the view at the scenic overlook. The natural first step in attempting to understand a site, especially once with such obviously dramatic topography, is often obtaining contour data from the United States Geological Survey to be used to construct an accurate site model.

Interestingly, such data does not exist in the public realm for the Hull-Rust mine. Due to the almost inconceivable scale of topographic change that occurs on such sites on a daily basis, the USGS has not produced topographic maps of the Mesabi's many mines. Their topographical maps of the region simply indicate the relative location of the mines with hatching to indicate extents of the pits and dumps. It is an interesting, if completely coincidental, fact to discover that a site many people choose to ignore is also so inadequately documented by the public agencies charged with documenting and mapping it.

Fig. 3.22: View of Mining Activity from Existing “Mineview” Overlook. Hibbing, 2008.

Fig. 3.23: Summer View from Existing “Mineview” Overlook. Hibbing, 2008.

Fig. 3.24: Winter View from Existing “Mineview” Overlook. Hibbing, 2008.

Fig. 3.25: Existing “Mineview” Overlook Structure. Hibbing, 2008.

Fig. 3.26: Existing “Mineview” Overlook Structure (Upper Left of Image). Hibbing, 2009.

Fig. 3.27: Hull-Rust Site Overview.

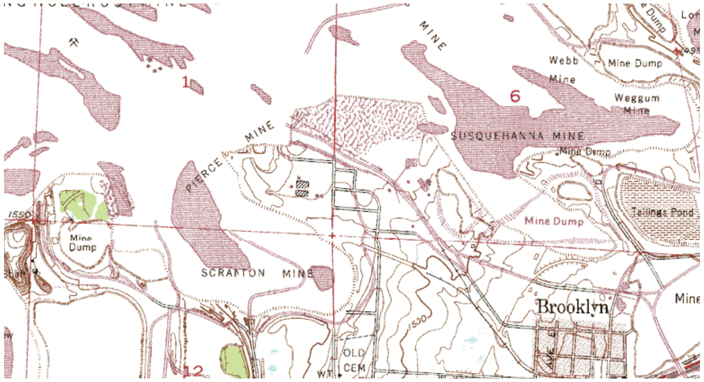


Fig. 3.28: USGS Topographic Map.

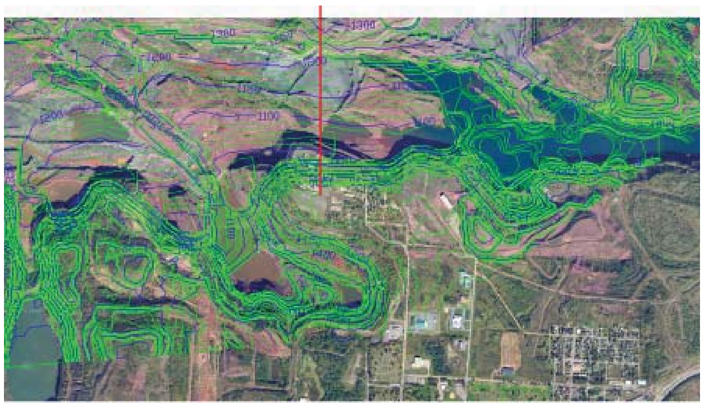


Fig. 3.29: Actual Site Topography.

Topographic information is, however, regularly collected for the mines. It is used, though, for precise engineering of mine operations, and for proprietary reasons, is not publicly available. Attaining such vital information it seemed, was not going to be possible. Fortunes changed as quickly as those of the range itself when a contact within the local DNR office was able to provide a contour file of the Hull-Rust-Mahoning pit.

Countless hours spent examining the file revealed a fascinating discovery, the Hull-Rust mine view itself is actually scheduled to become a victim of the ever-expanding pit. Like the town before it, the mine view is resting on a profitable body of ore. Plans indicate that this site, along with what's left of the original town's ghostly street grid, could potentially be erased forever in the name of progress as early as 2025.

This revelation provides the opportunity to fully communicate the experiential power of displacement in real time and at full scale. Through this experience, it is hoped that one might also be able to gain a true sense of the forces that have shaped both the physical and psychological identity of the entire region.

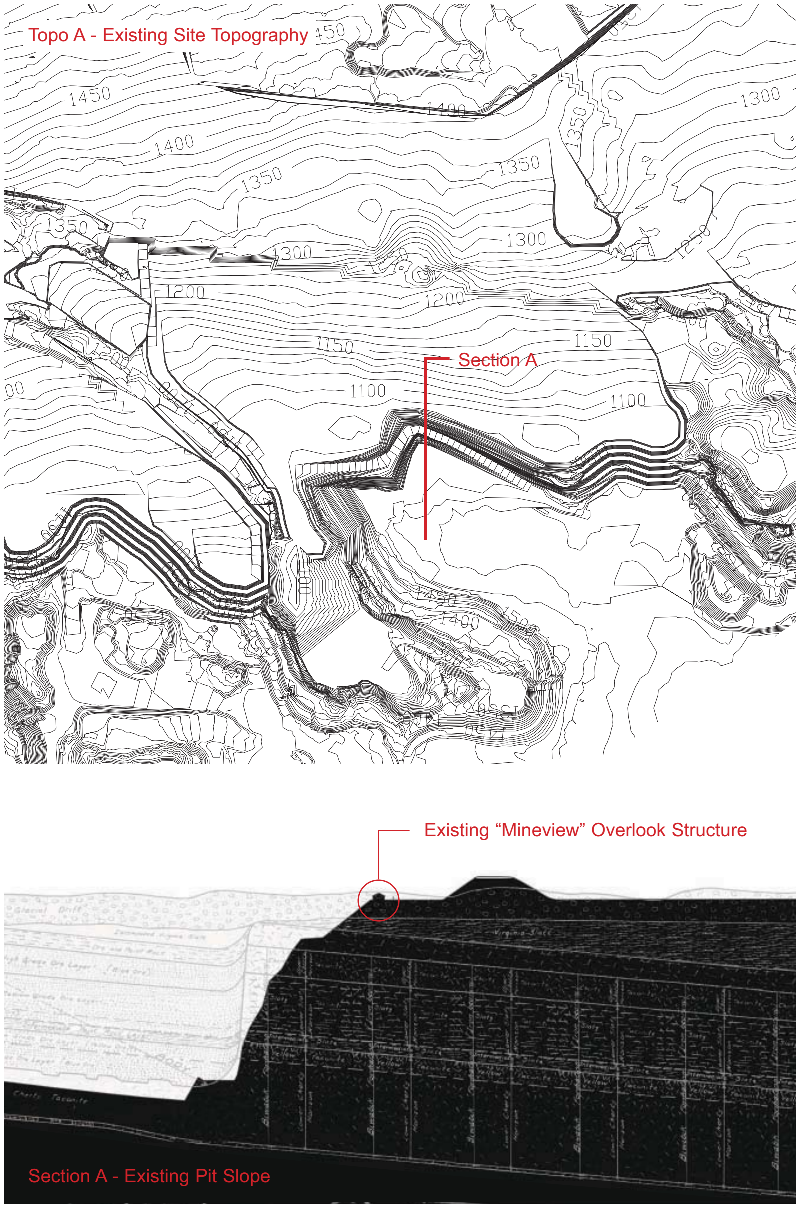


Fig. 3.30: Existing Site Topography and Section.

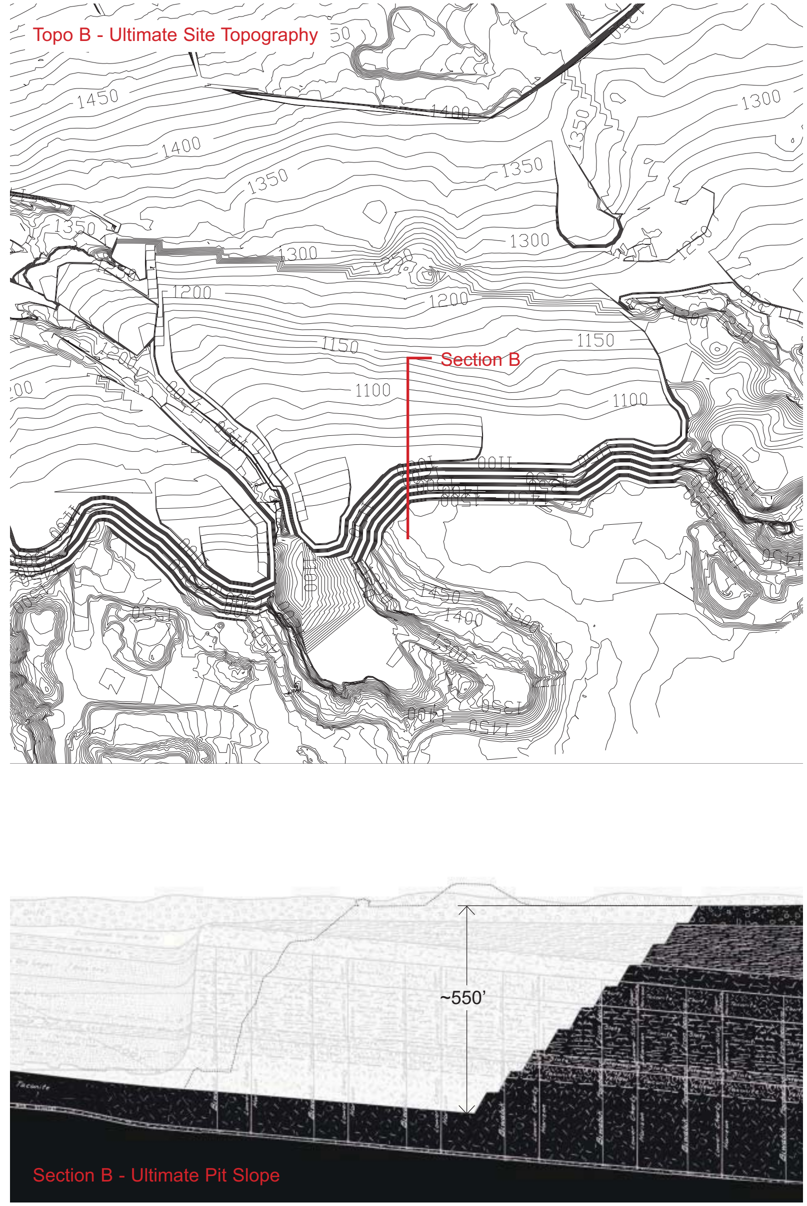


Fig. 3.31: Ultimate Site Topography and Section.

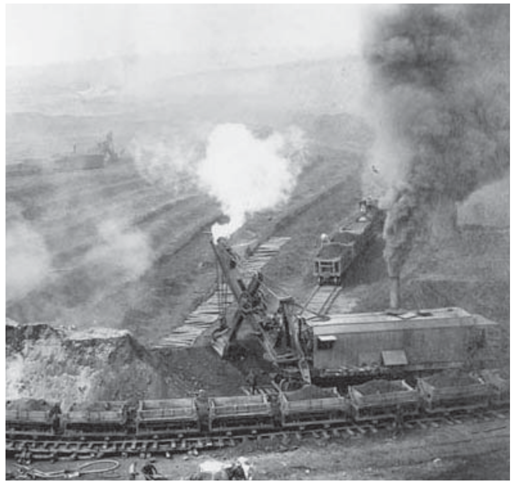


Fig. 4.1: Mahoning Mine Near Hibbing,1899.

4. MINING PROCESSES

HISTORIC METHODS

While the Mesabi Range has become known for its vast open-pit operations, initial mining in the area was a mix of both underground and surface extraction. The earliest underground mines on the Mesabi were rather crude, with little or no regard for safety. Laborers simply dug down into the ore body, stabilizing shafts and rooms haphazardly as they went. This process ultimately led to frequent collapses and low efficiency of extraction. Such operations were quickly replaced by more sophisticated practices, with rooms and shafts supported with regularly spaced timbers.

Eventually, the majority of underground mines on the Mesabi adopted a method called top slicing. Careful engineering and planning allowed this method to be safer and more efficient, resulting in relatively high rates of ore recovery. To bolster efficiency, shafts were placed next to, rather than directly through, the main deposit to be mined. Ore was generally removed from the top down, with subsequent levels being developed until the bottom of the deposit was reached. Once on the floor of the ore body, development of the so-called “slices” was started.

Fig. 4.2: Underground Miners near Hibbing,1910.

Slicing, as described in an early industry manual, consisted of cutting rooms, or drifts, at right angles off of the main circulation drifts.[1] These narrow caverns were just eight feet wide and were mined until they reached an intersecting drift or room. Timber supports in regularly spaced grids were added to stabilize walls and ceilings as the operation advanced. To maximize efficiency, it was typical practice to actively work several different levels simultaneously. To prevent catastrophic cave-in the levels were usually separated vertically by a minimum of ten feet.[2] The natural ore bodies were carefully fragmented through blasting into pieces small enough to be shoveled by hand into cars which then were brought to the surface.

Though underground mining continued well into the 20th century, it was steadily replaced with the open-pit technique. As surveying and exploration methods grew in sophistication, so too did the understanding of the Mesabi's ore deposits. As mentioned in previous chapters, ore on the Mesabi Range is located relatively close to the surface. It was quickly determined that the "cost of stripping plus the cost of mining by open-pit methods [was] less than that of mining underground" for most locations on the Mesabi.[3] This was generally

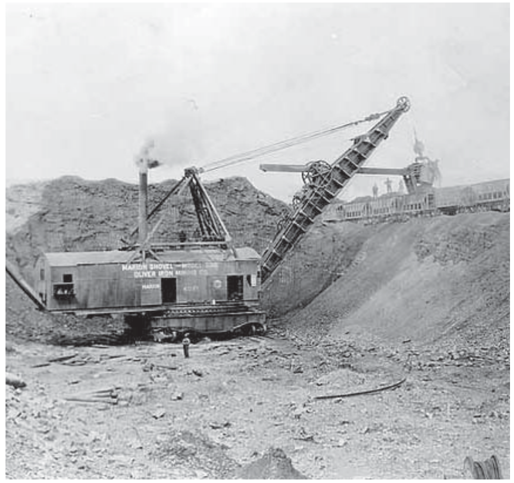


Fig. 4.3: Steam Shovel near Hibbing, 1924.

Fig. 4.4: Ore Train in Open Pit at Hibbing, 1942.

determined to be true if the depth of the overburden, the non-iron bearing earth covering the ore, was less than twice the depth of the ore body itself. Later advances, however, would make such equations obsolete.

The most common method of early open-pit extraction was steam shovel mining. This practice, believed to have been pioneered by miners at Hibbing's Hull-Rust mine, began modestly with small shovels loading ore into rail cars that were dumped by hand.[4] Shovels and rail cars gradually grew in size and capacity, increasing output and turning the Mesabi into the nation's largest ore producing region.

These "hungry mechanical mouths" dramatically altered the region's landscape.[5] Once a gently rolling land covered by vast stands of virgin pine forest, the Mesabi rapidly became a place of barren man-made canyons ringed by artificial mountains. The physical form of these features at first appears chaotic and unplanned. The reality, however, is that every pit's form was strictly determined by both the limits of the machinery used to create it and the geology of the deposit being mined.

Early pits on the Mesabi mined high grade ore dubbed, direct-shipping ore, as it was high enough in iron content to be fed directly into the blast furnaces back east. To efficiently move this material, mines depended on steam locomotives. These heavy gauge trains travelled directly into the pits. Due to the heavy loads they were hauling, the slope of the track had to be kept to a maximum of only 1 ½ percent, or less than 1 degree. As a result of these limitations, early pit walls consisted of spiraling terraces, or benches, 40 to 50 feet tall on which tracks were set that would allow trains access to the shovels on the pit floor.


Fig. 4.5: Electric Shovel at HibTac, 2008.

TACONITE MINING

The nation's demand for ore combined with the efficiency of steam shovel mining resulted in the near complete depletion of high grade hematite ores by the 1950s. E.W. Davis' pioneering process of converting the remaining low grade taconite into usable pellets has been widely credited with saving the Iron Range. Due, however, to the rigorous post extraction processes involved, the face of mining in Minnesota would be forever changed. Unlike the earlier operations which had to, at most, crush and wash the ore before being shipped, this new process had to convert large pieces of flint hard taconite rock into marble sized pellets. This intensive process required the construction of large production plants, huge industrial buildings the likes of which had never before been seen on the Mesabi. It also changed the way ore was extracted from the earth and, as a result, changed they manner in which the earth itself was altered.

The steam shovels used throughout the high grade ore years were replaced with more efficient, larger capacity electric shovels. The ore trains that once spiraled into the pits were soon replaced by more flexible, versatile haul trucks. The trucks provided the advantage of continuously feeding raw material to the plants without having to wait

Fig. 4.6: Raw Taconite Rock and Finished, Concentrated Taconite Pellets.

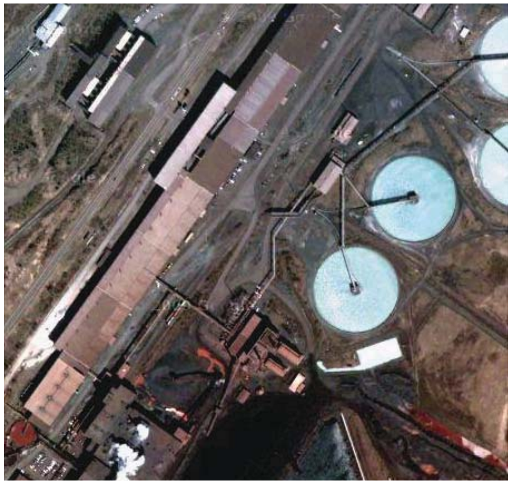


Fig. 4.7: Pellet Plant at Northshore Mining. Year Built - 1955. Location - Silver Bay, MN.

Fig. 4.8: Pellet Plant at United Taconite. Year Built - 1965. Location - Forbes, MN.

Fig. 4.9: Pellet Plant at Minntac. Year Built - 1967. Location - Mt. Iron, MN.

Fig. 4.10: Pellet Plant at Keetac. Year Built - 1967. Location - Keewatin, MN.

Fig. 4.11: Pellet Plant at the Minorca Mine. Year Built - 1974. Location - Virginia, MN.

Fig. 4.12: Pellet Plant at Hibbing Taconite. Year Built - 1976. Location - Hibbing, MN.

Note: Only active taconite plants are shown. Unused former sites and planned future sites are not shown.

Fig. 4.13: Wasterock Mine Dump. Hibbing, 2009.

for an entire train to load up. The constant stream of taconite rocks to the crushers would ensure high productivity and around the clock operation.

Before the rock can be brought to the plant for crushing it must first be extracted from the earth. Because the iron bearing taconite formation dips slightly downward from north to south, it is often covered by a layer of overburden, or non-usable, non-iron bearing material. Removing this material, a process known as stripping, is the first step in the taconite mining process. Because it is not usable ore and has no commercial value it is simply stockpiled in man-made mountains or 'dumps,' as they are known locally. These dumps often ring the edge of open pits, resulting in dramatic landscapes with local relief of nearly 1,000 ft.

After this waste material has been removed, the layer of taconite to be mined is exposed. Since taconite is one of the hardest naturally occurring rocks, it must first be fragmented by a series of violent blasts. These blasts, which routinely register as seismic events with magnitudes as high as 3.4 mbLg, displace massive amounts of earth and break the flint hard rock into pieces small enough to be loaded into haul trucks for transport back to the plant.[6]

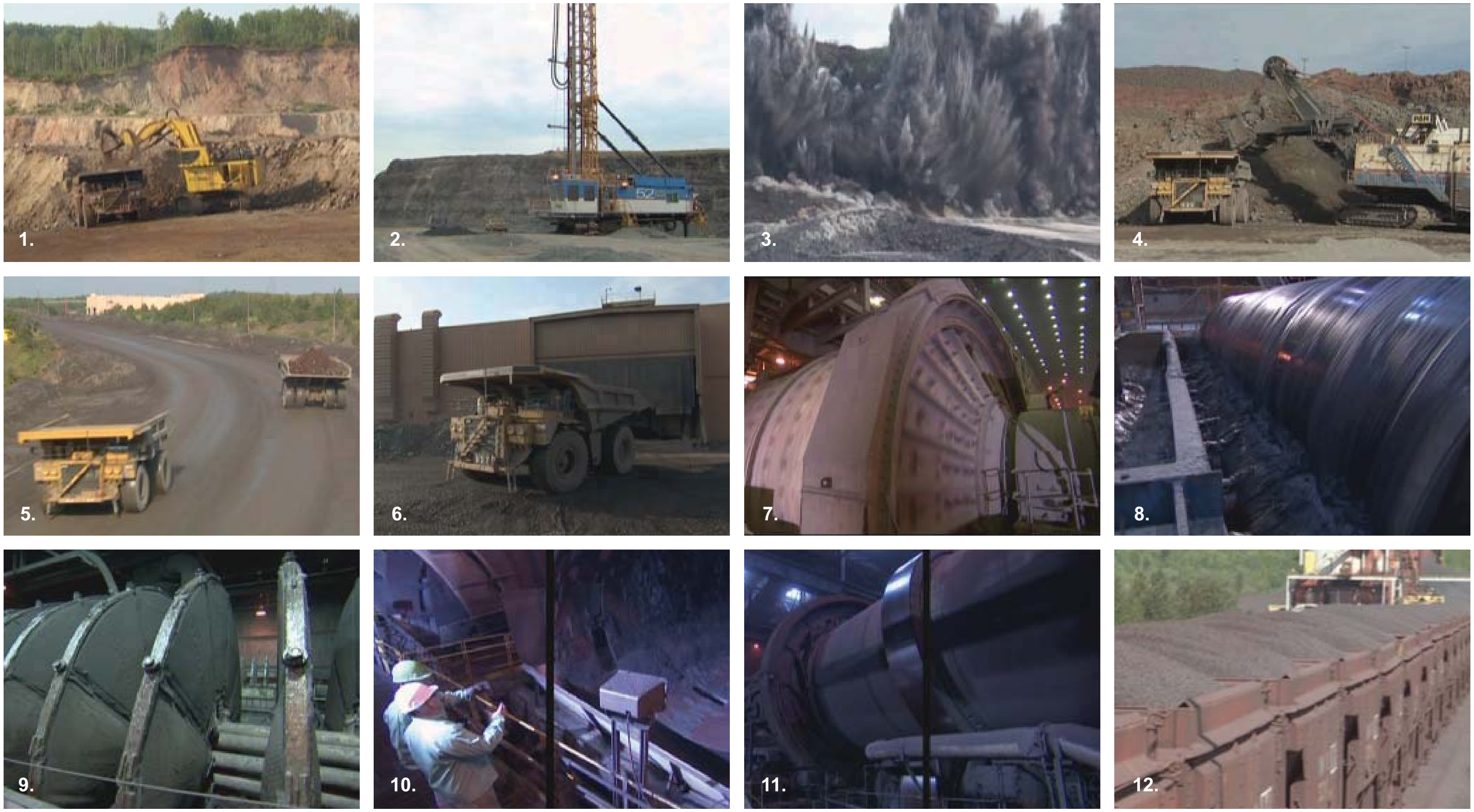


Fig. 4.14: The Modern Taconite Mining Process.

1. Stripping the overburden **2.** Drilling blast holes **3.** Blasting to loosen the rock **4.** Shoveling the loose rock **5.** Hauling rock to the pellet plant **6.** Unloading rock at the crusher **7.** Concentrating crushed rock **8.** Separating the iron content **9.** Agglomerating the iron-rich slurry **10.** Rolling the slurry into pellets **11.** Baking pellets in a kiln **12.** Transporting pellets to Duluth/Superior, Two Harbors, or Silver Bay by train **13.** Shipping the pellets via the Great Lakes to the steel mills of Indiana, Michigan, and Ohio.

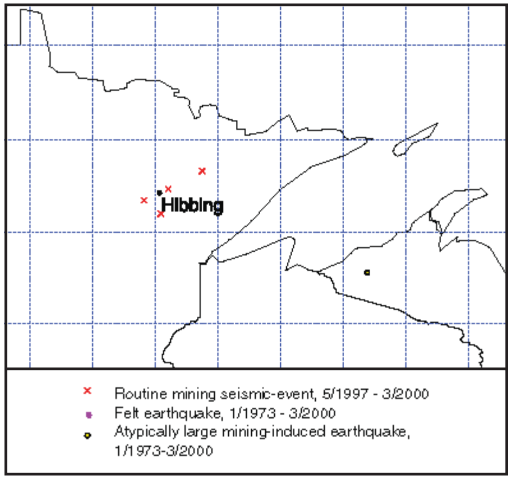


Fig. 4.15: Mining-Related Seismic Activity.


Fig. 4.16: Typical Mesabi Range Mine Blast.

Large drills bore holes up to 14” in diameter some 50’ into the solid rock below. These holes are then filled with ammonium nitrous fuel oil (ANFO), the explosive most widely used in modern taconite mining. Blast hole patterns vary due to geologic conditions and desired fragment size, but are generally laid out in a staggered grid pattern with 45’ spacing between holes.

Once the force of the blast has loosened the rock, a large electric shovel can be brought into place to begin the extraction process. Modern shovels such as the P&H 2800 used at Hibbing Taconite have a dipper, or bucket, capacity of 34 cubic yards. Rock fragments, ranging in size from 3” to several feet in width, are scooped up and loaded into the bed of haul trucks. A shovel operating a 34 cubic yard dipper will drop four loads into the 140 cubic yard truck bed before it’s full.

By the time one truck is full and backing away from the shovel another is waiting to take its place, allowing for a nearly non-stop operation. This sequence is repeated continuously for 24 hours a day and seven days a week, with stops only for shift change or repair.

MASSIVE SCALE

Fig. 4.17: 34 cu. yd. Bucket and Hibbing Ambulance.

In addition to operating 24 hours per day, seven days a week, the modern taconite mines of the Mesabi Range operate 12 months of every year. The high-tech, advanced machinery used in today’s mines allows for complete dominance over the elements and ensures continous operation in even the harshest of conditions.

This virtually seemless process, coupled with the sheer size of the machinery being used, results in landscape alteration at an almost unbelievable scale.

The two most essential pieces of equipment now used in Minnesota’s taconite mines, the electric shovel and the massive, two-story tall haul trucks, combine to displace earth at a scale that is best described as geologic. They do so, however, at a hyper-industrial pace that is much faster than that which could be attributed to any force of nature. The following pages offer a sense of both the size of these massive machines and the staggering amount of earth they displace on a daily, weekly, and monthly basis.

Fig. 4.18: Older Model 170-ton Haul Truck. Modern trucks are much larger 240+ ton models.

Fig. 4.19: Older Model 18-cu.yd. Bucket. Most modern shovels now use 34 cu.yd. buckets.

Fig. 4.20: Modern 34 cu.yd. Bucket Used at Hibbing Taconite.

Fig. 4.21: P&H 2800XPB Currently Used at Hibbing Taconite.

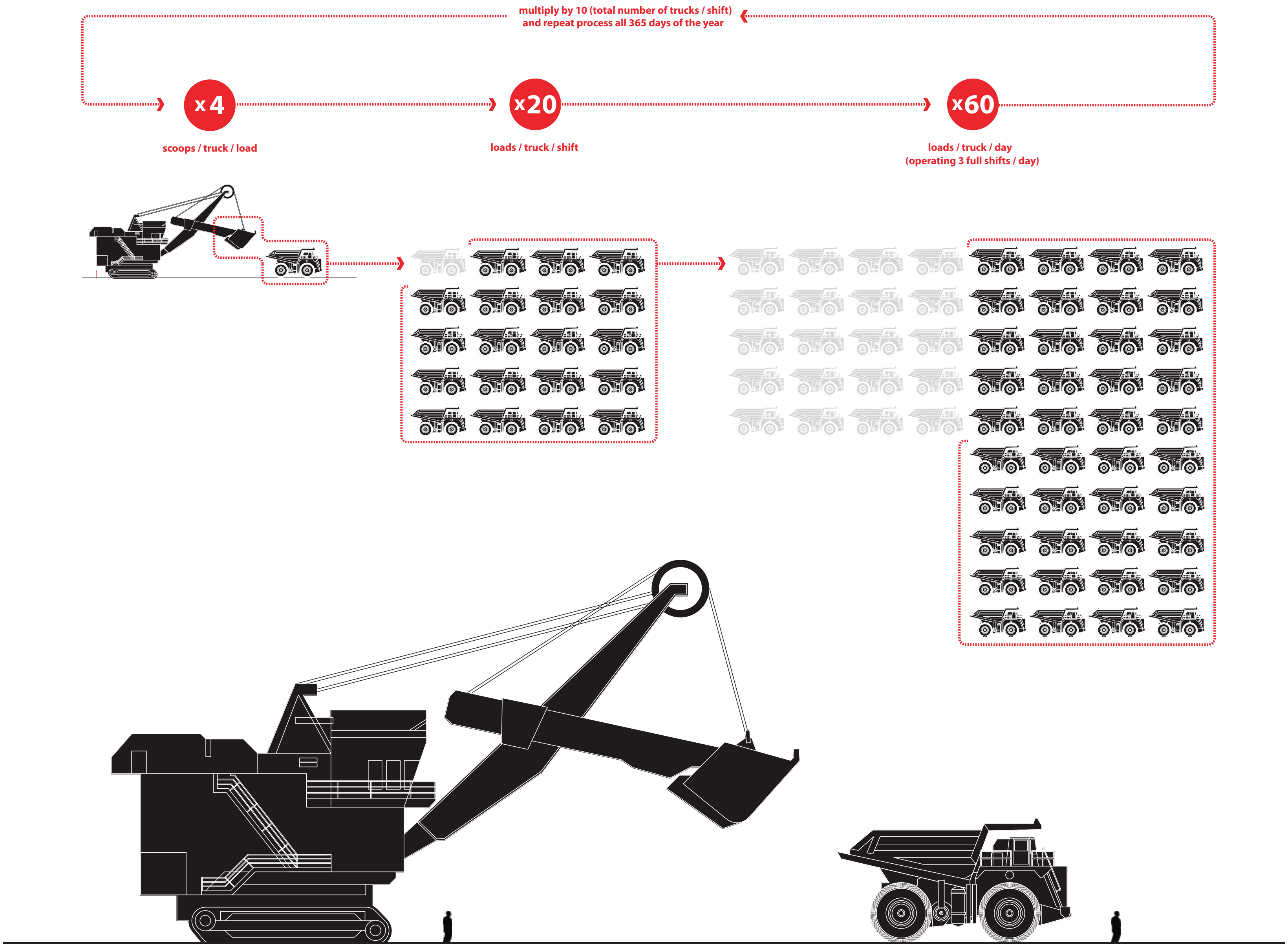
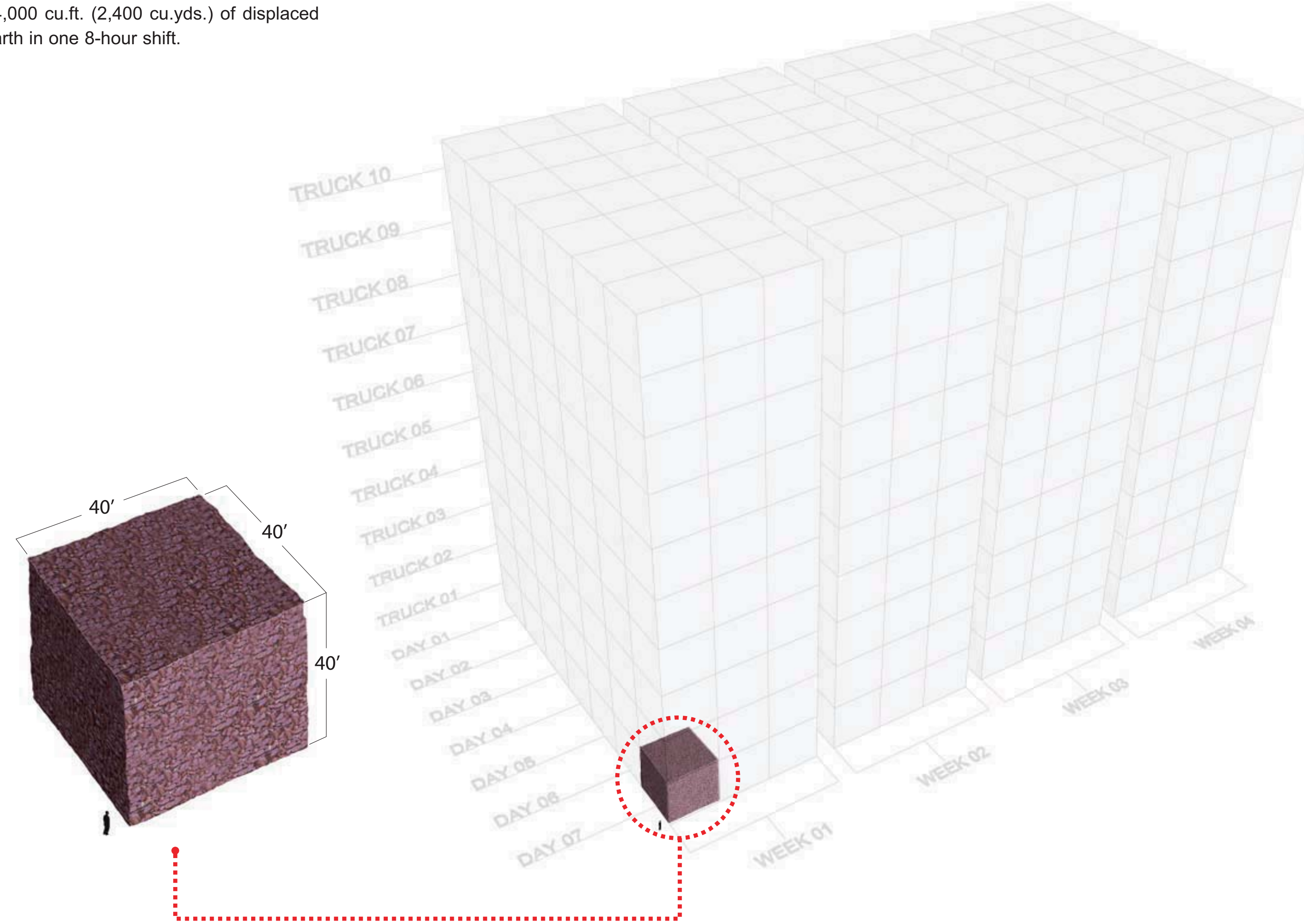


Fig. 4.22: Modern Mining Equipment Scale Comparison.

Fig. 4.23: The Volume of Earth Displaced per Truck per Shift.

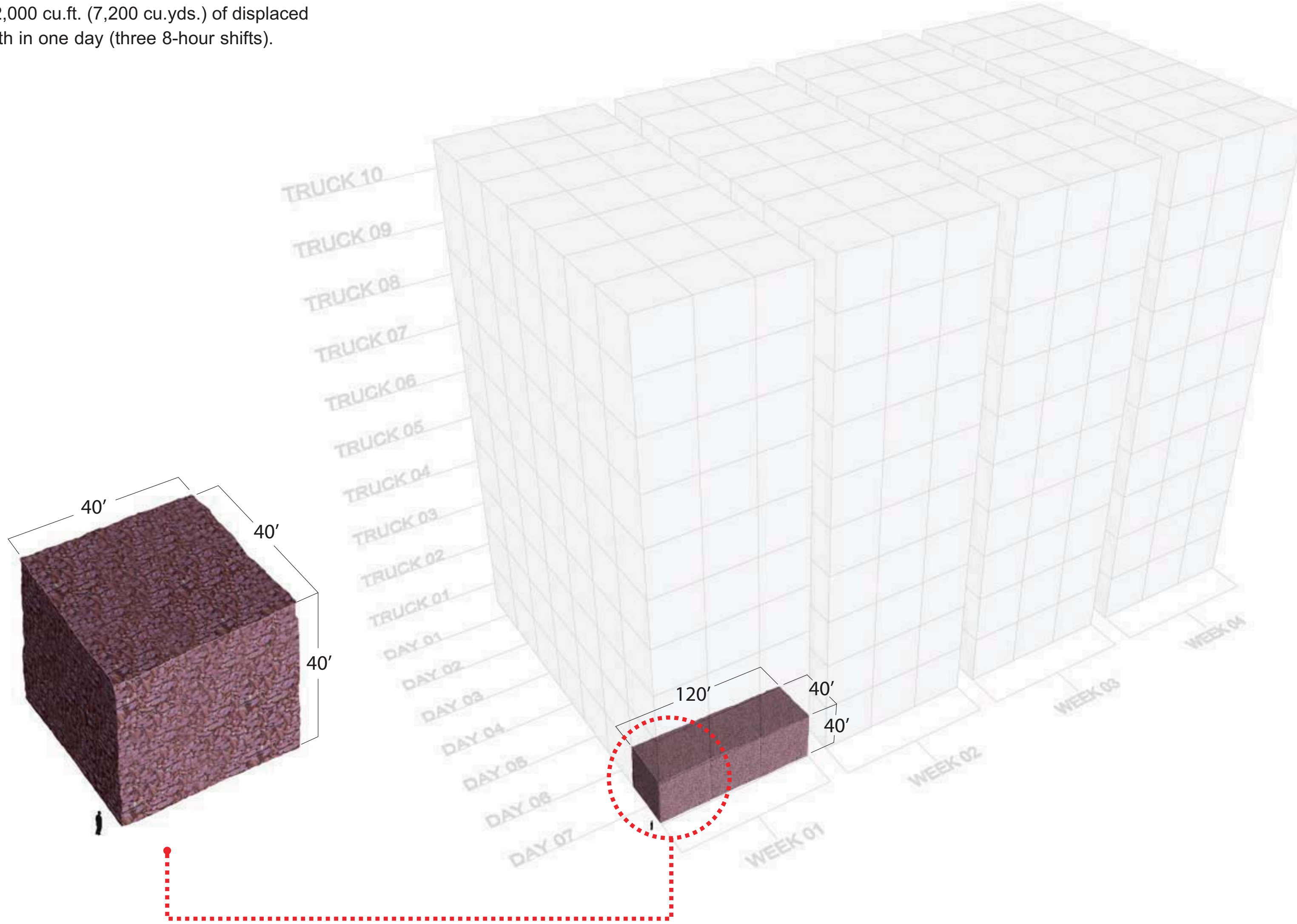
Each of the mine's 10 trucks hauls away 64,000 cu.ft. (2,400 cu.yds.) of displaced earth in one 8-hour shift.



The Volume of Earth Displaced per Truck per Shift.

Fig. 4.24: The Volume of Earth Displaced per Truck per Day.

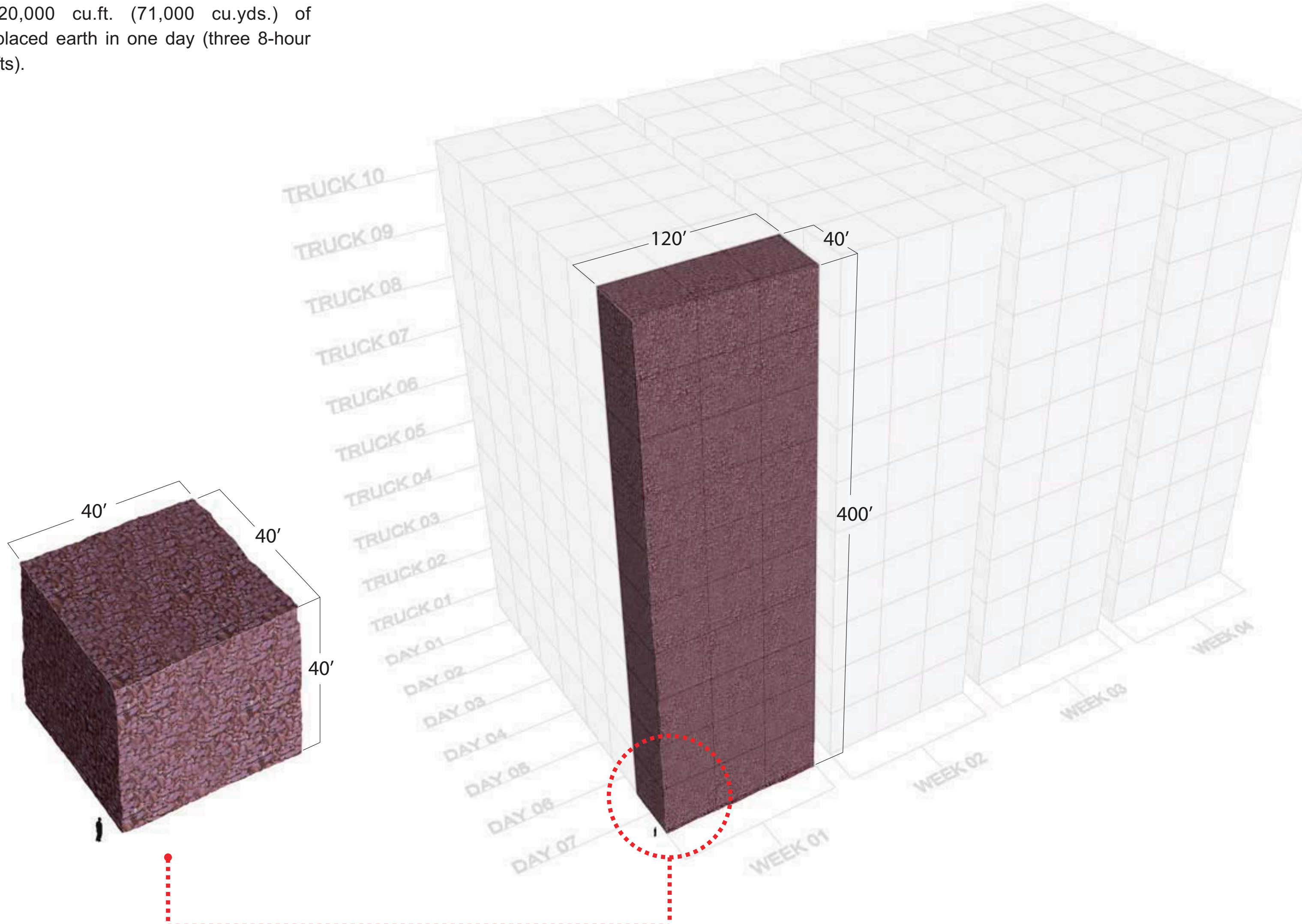
Each of the mine's 10 trucks hauls away 192,000 cu.ft. (7,200 cu.yds.) of displaced earth in one day (three 8-hour shifts).



The Volume of Earth Displaced per Truck per Shift.

Fig. 4.25: The Volume of Earth Displaced by all 10 Trucks per Day.

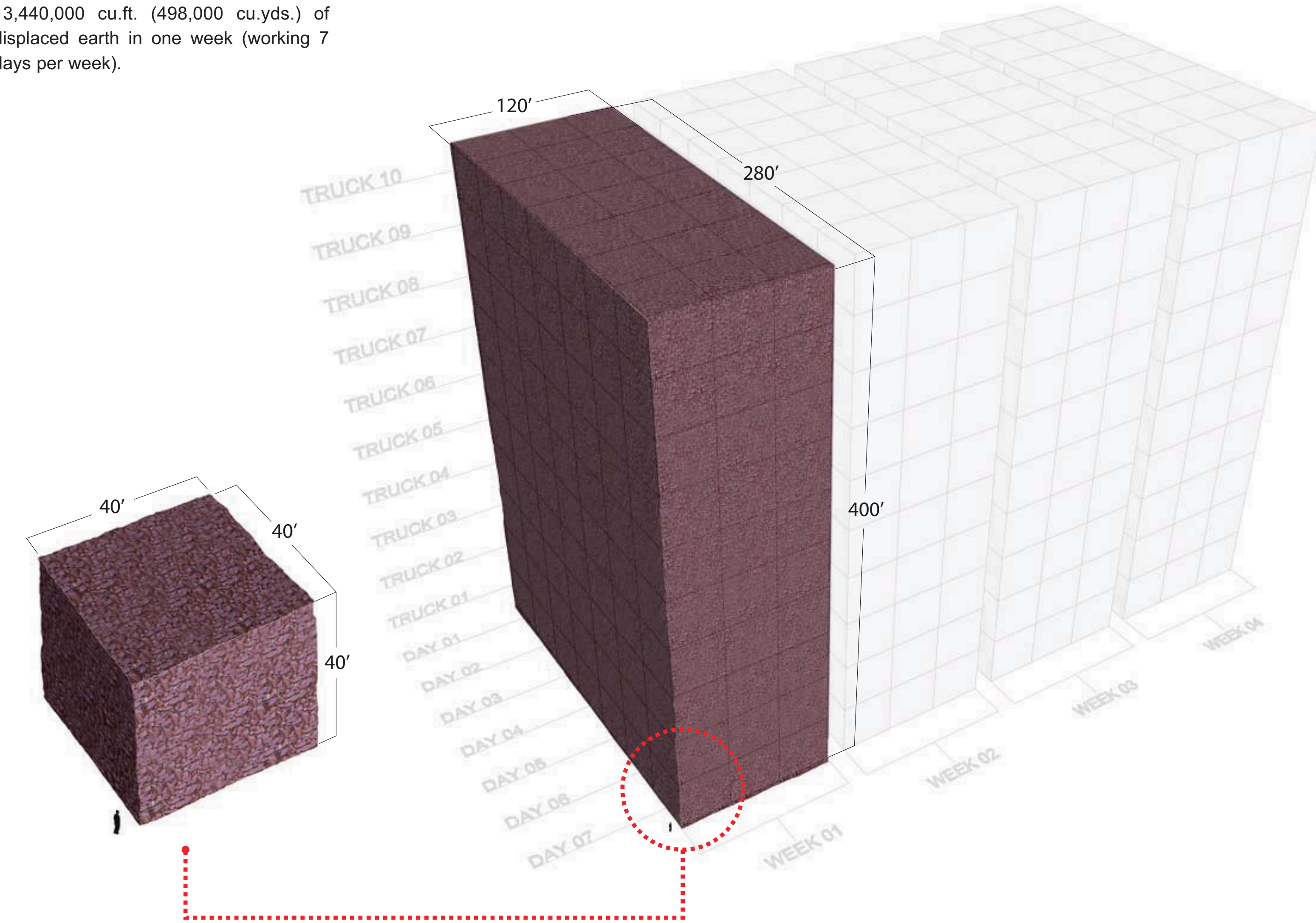
The mine's 10 trucks haul away a total of 1,920,000 cu.ft. (71,000 cu.yds.) of displaced earth in one day (three 8-hour shifts).



The Volume of Earth Displaced per Truck per Shift.

Fig. 4.26: The Volume of Earth Displaced by all 10 Trucks per Week.

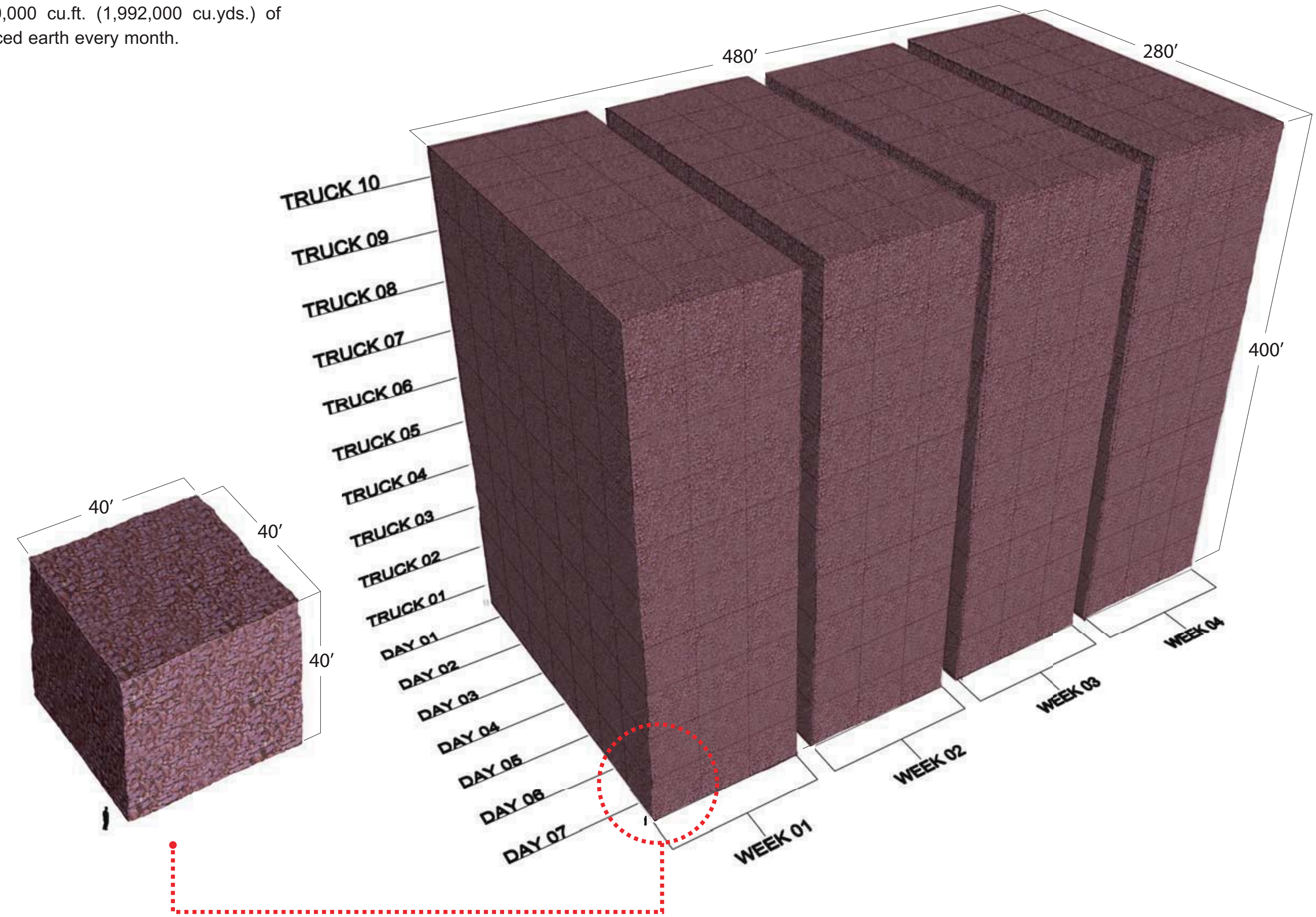
The mine's 10 trucks haul away a total of 13,440,000 cu.ft. (498,000 cu.yds.) of displaced earth in one week (working 7 days per week).



The Volume of Earth Displaced per Truck per Shift.

Fig. 4.27: The Volume of Earth Displaced by all 10 Trucks per Month.

The mine's 10 trucks haul away a total of 53,760,000 cu.ft. (1,992,000 cu.yds.) of displaced earth every month.



The Volume of Earth Displaced per Truck per Shift.

Fig. 5.1: Pedreres de s'Hostal.

5. PRECEDENT STUDIES

Throughout the investigative study and analysis of the site and the processes that have shaped it over the years, it became quite clear that the physical and psychological magnitude of this place could simply not be conveyed by way of a conventional scenic overlook. The search for precedents was, accordingly, broadened beyond the expected typologies of interpretive center or viewing platform. Emphasis was place instead on projects of varied disciplines that met one or more of the following criteria:

- **Engaging the Land** - Projects that moved beyond the singular forced image provided at a scenic overlook.
- **Establishing Scale** - Projects that allowed for a true understanding of a site's overwhelming scale.
- **Visualizing the Invisible** - Projects that acknowledged or even traced what once was but is no longer.
- **Allowing for Change** - Projects that embraced the temporal uncertainties of their sites' very existence.
- **Promoting Open Ended Interpretation** - Projects that allowing for multiples experiences and interpretations.

INTENSIVE EXPERIENCE

Project: Pedreres de s’Hostal

Location: Menorca, Spain

Designer: Unknown

Year: N/A

The incredible physical form of Pedreres de s’Hostal was shaped entirely through the site’s use as a former dimensional stone quarry.

This unique site’s most powerful and most obvious feature is its almost sublime scale. The true extent of this scale is, however, only truly understood by entering into the quarry itself. The top right image would appear quite scale-less without the human figure for reference. Such awareness of the nearly oppressive scale of the quarry simply cannot be achieved through distant viewing.

Another notable feature of the site is the insertion of the program of an arboretum. Letting what Manuel DeLanda would recognize as intensive qualities such as sun and shade, air movement, and moisture retention drive location of different elements demonstrates and allows for a much richer understanding of site.

Fig. 5.2: Pedreres de s’Hostal.

Fig. 5.3: Pedreres de s’Hostal.

GRASPING THE SECTION

Project: Valley Curtain

Location: Rifle, Colorado, USA

Designer: Christo and Jean Claude

Year: 1970-1972

We are often taught that to understand a site, we must understand its section. With Valley Curtain, Christo and Jean Claude have taken this approach literally and highlighted what is essentially a full scale section cut of a rugged Colorado mountain valley.

It is particularly successful in defining the scale of what is not there, the void of the valley itself. By abstractly representing what isn't, one gains an even greater appreciation for what is.

This project is also a fine example of the logistics of working at full scale. Due to the sheer size of the curtain, the installation only stood for a total of 28 hours. The tremendous wind load on the installation ultimately proved too strong to safely leave it up. Christo and Jean Cluade, however, likely took pleasure in this discovery, for the artificially short time frame only served to heighten the awareness of the site's power.

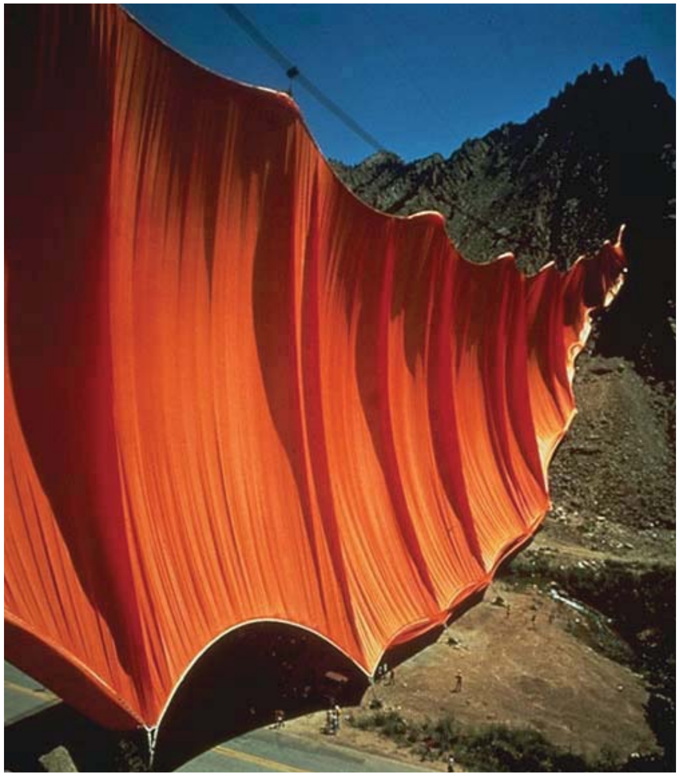


Fig. 5.4: Valley Curtain.

Fig. 5.5: Valley Curtain.

PRESENCING THE VOID

Project: Various

Location: Various

Designer: Rachel Whiteread

Year: Various

Rachel Whiteread's various castings make visual what is not visual. By casting the negative or void space, the true ramifications of the space positive begin to emerge.

This technique is particularly successful in questioning the notion of what is familiar. Casting the void space of every day items literally casts them in a new light. These works are inherently spatial and relate well to the human body.

Focusing on the space defined by any given object, rather than on the object itself, unlocks the potential for the essence of something to remain long after the thing itself is physically gone. It also tells a certain story about the process and, through monochromatic simplification reveals intricacies which may have otherwise gone unnoticed.

Fig. 5.6: Void Castings.

Fig. 5.7: Void Castings.

TRACING RETREAT

Project: Retreating Village

Location: Happisburgh, United Kingdom

Designer: Smout Allen

Year: 2004

Happisburgh is a small coastal community in southern England that has been threatened by receding coastlines every year. Attempts to prevent, or at least stall, the natural forces of erosion have all failed.

This theoretical proposal embraces change and allows for the village to physically retreat as the sea advances. To accommodate this, infrastructure would be put in place to allow structures to slide further inland as the need to do so arises. These rail-like mechanism would then remain, at least temporarily, as remnants and traces of where the town once stood.

In addition to addressing the permanence of the structures, this proposal also accounts for the moving of soil (gardens) in large rope webs. The rope would both allow for suitable structure within the soil (similar to rebar in concrete) and easy transport of the soil when further retreat is needed.

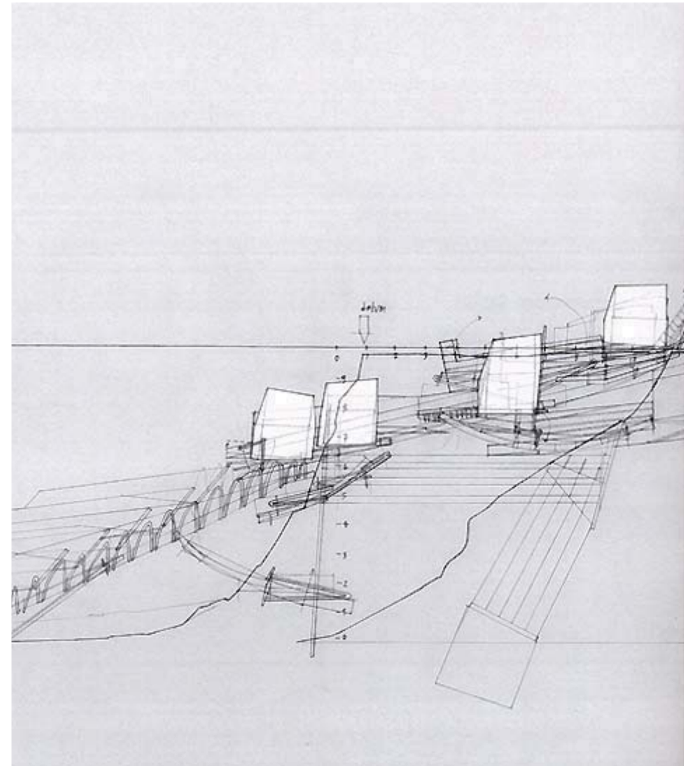


Fig. 5.8: Retreating Village Section.

Fig. 5.9: Retreating Village.

INTIMATE ENGAGEMENT

Name: Parque de Piedra Tosca

Location: Girona, Spain

Designer: RCR Arquitectes

Year: 2005

With no particular program, this subtly powerful landscape provides the opportunity to meander through its paths and feel the forces at work. The cor-ten steel plates that define the space are spaced slightly apart, providing a view, and perhaps even a touch, of the piles of loose rock being retained.

It is a place to explore without predetermined expectation. Experiences here are meant to be discovered and are ever changing as you move throughout the maze-like path of knife edge steel walls. Nature is always present, but somehow manipulated and out of reach, appearing and disappearing over the undulating artificial horizon.

Fig. 5.10: Parque de Piedra Tosca.

Fig. 5.11: Parque de Piedra Tosca.

GRASPING SCALE

Project: Double Negative

Location: Overton, Nevada, USA

Designer: Michael Heizer

Year: 1969-1970

Michael Heizer's Double Negative is wonderfully simple in its approach. Two trenches carved out of the earth straddling Mormon Mesa are the only elements of this massive land art work.

Through two notches in the earth Heizer is able to both drive home the vastness of the American West and also make such vastness comprehendible at a human scale. By leaving the site otherwise untouched, the cuts are allowed to erode and change over time, bending perception of what is natural and what is not.

Double Negative successfully operates in two scales, both of them large. First, by establishing a datum line across the crater it evokes an almost cosmic understanding of scale and one's role in the universe. Then the trenches, which are actually more akin to small canyons, bring the experience back to earth.

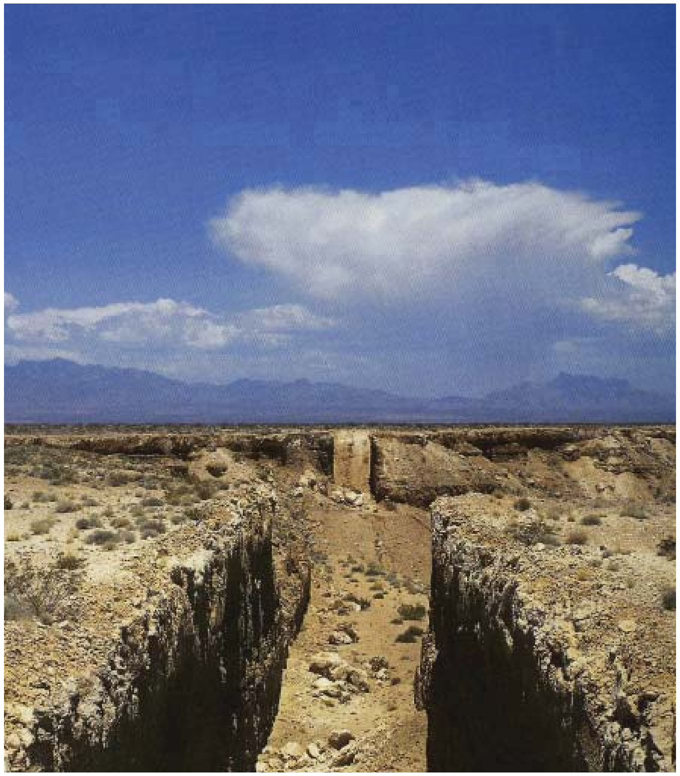


Fig. 5.12: Double Negative.

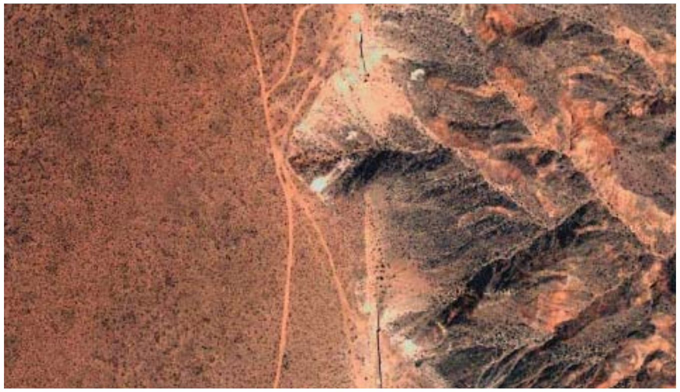


Fig. 5.13: Double Negative Overview.


Fig. 6.1: Hull-Rust Overlook.

6. DESIGN PROPOSAL

The scenic overlook and its singular emphasis on the static, forced image of a place does little to capture and convey the myriad senses and scales present on a site as dynamic as the Hull-Rust mine complex. To allow for a true sense of both the scale and magnitude of landscape change on this site, one must understand and experience the scale and power of the process responsible for its creation.

The ability to experience this change will be made possible by the discovery that the earth beneath the existing Hull-Rust overlook, once thought to be economically unfeasible to extract, is now scheduled to be mined. The pragmatic realities of this unimpeded industrial growth also provide a unique opportunity to not only observe, but also truly ***experience***, large scale displacement as it actually happens.

Mining of the existing overlook site will be done using a process called a pushback, a mining technique that will sequentially remove the site’s ore from the top down in a series of 50’ terraces or ‘benches.’ Each bench will be exhausted of its ore before work on the next bench

Fig. 6.2: Blast Damage near Hull-Rust Overlook.

begins. Since taconite is a hard flint-like rock, it cannot be extracted without first being subjected to a series of blasts. These blasts, which routinely register as seismically significant events, are essential to the entire mining process. Without their destructive yet controlled force, which fragments the rock into pieces small enough to be hauled back to the plant, the vast veins of taconite found across the Mesabi Range would be valueless.

The exceptional force of these blasts, however, is the very thing that prevents any form of site experience, other than distant observation, from taking place. In addition to the obvious dangers associated with debris fallout from the blasts themselves, the steep slopes that ring the open pits are in constant danger of collapse. While mine engineers carefully calculate slope angles and bench widths to minimize the possibility of slope failure, the constant forces of erosion, both man-made and natural, ensure that the risk of collapse is always present. As a result, virtually all (legal) public vantage points from which one can, in any way, experience both the mines of the Mesabi Range have avoided (most) safety hazards simply by way of distancing the public from potential dangers. Remote perches guarded by chain link fences and barbed wire high above the pit floors discourage

Fig. 6.3: Geobrugg Rockslide Barrier.

anything but a top down view and warn of the possible dangers associated with trespassing.

While simply distancing people from potential hazards of the site is certainly a valid approach to ensuring the safety of life and limb, it is far from the only option. In fact, one must look no further than the mining industry itself for inspiration. In recent years, several innovative approaches to slope stabilization and rock-slide protection have emerged out of Europe for use not only in mines, but also along mountain passes and alpine highways prone to slope failure. Geobrugg, a Swiss company at the forefront of rock-fall barriers and slope protection, has developed a revolutionary product made of interlocking rings of steel cable proven to be virtually indestructible in recent tests.[1] Though such products have been used primarily, if not entirely, to protect mine workers, equipment, and access roads, their potential use in providing safe and expanded access for visitors at mining sites is quite compelling.

The proposed introduction of these barriers at the Hull-Rust site will not only allow for stable, usable slopes, but also serve as landscape elements that, over time, will collect loose rock and soil. These mesh-like fences will

Fig. 6.4: WWII Bunker on the Norwegian Coast.

become organic gabion walls that are formed in-situ and will, ultimately, evolve into intensities of flora and fauna. Accompanying the rock-slide barriers will be a series of concrete blast shelters. These structures, inspired by the hauntingly beautiful military installations of the mid-20th century, will introduce the possibility of being on-site during a blasting cycle.

While each of the blast shelters will be constructed in an identical fashion, the lag time between each structure's construction will ensure a varied appearance and experience. Since each structure can only be built on a working bench, and each bench will take between 1.5 and 2.5 years to complete, the degree of weathering, crumbling, and vegetation growth on, in, and around each installation will differ greatly. By the time the concrete for the last structure is poured, the first to be built (some 550' feet above) will have withstood nearly 16 years of continuous blasting, weathering, and staining, creating a varied spatiotemporal experience as one moves through the site from top to bottom.

While the mining of the Hull-Rust overlook site will take only 15-16 years, a relatively short time in the lifespan of any project, the site and the way one experiences it will continue to change. In order to mine so deeply below the surface level, water has to be continuously pumped out of the pit. Once the eventual certainty of complete ore body depletion occurs and there is no longer a need to drain the site, it will quickly begin to fill back in, reaching an ultimate depth of 250'-300.' The rate at which water will flow back into the pit will take away access to the site's shelters at a rate nearly identical to that with which access was expanded during the 'pushback.' As this process occurs, the experience of the site will begin to shift yet again, allowing for public access to the newly formed 'pit lake.'

PRESENTATION LAYOUT MOCK-UP

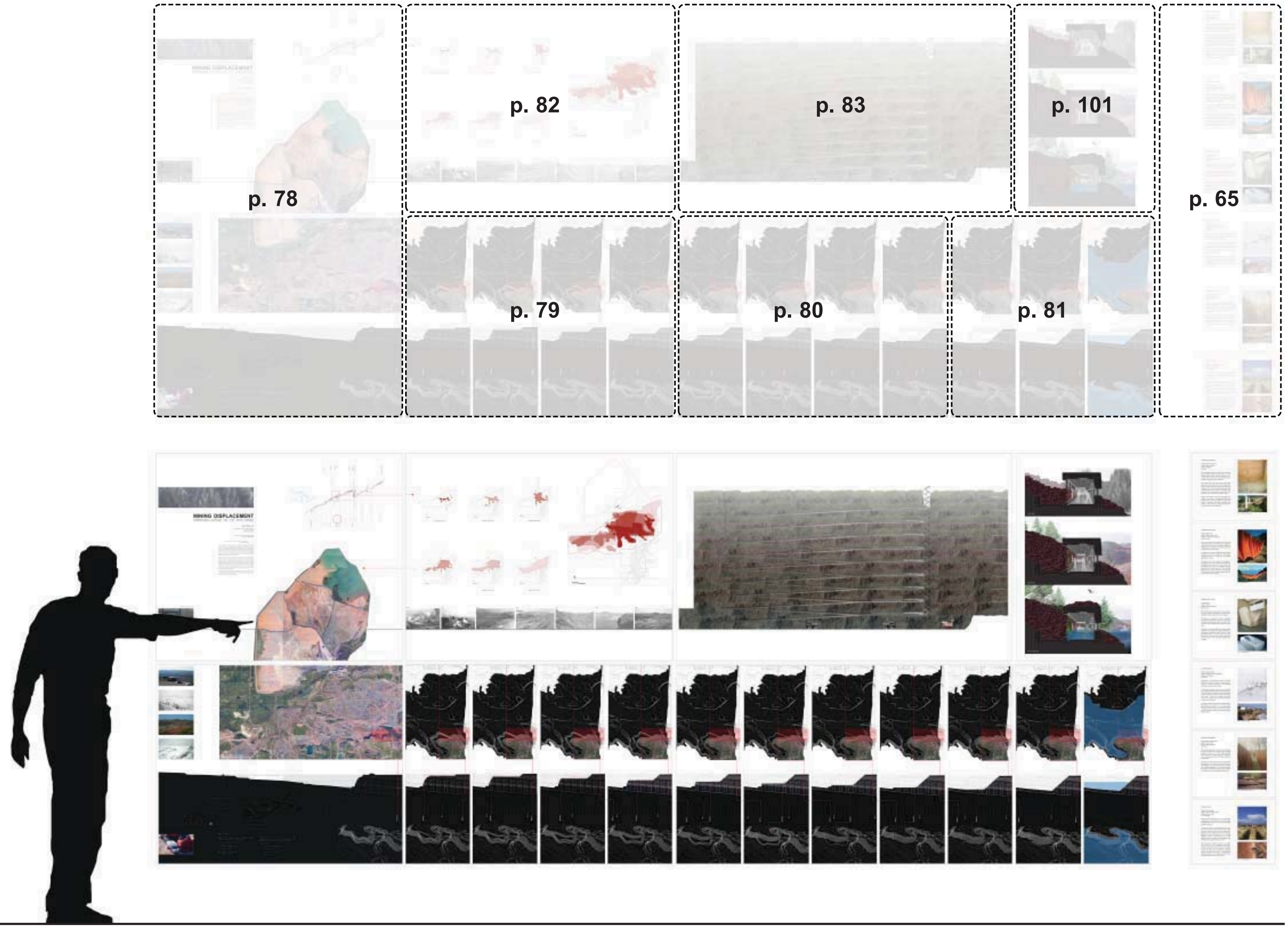


Fig. 6.5: Presentation Mock-Up.

Fig. 6.6: Presentation Boards, Existing Site.

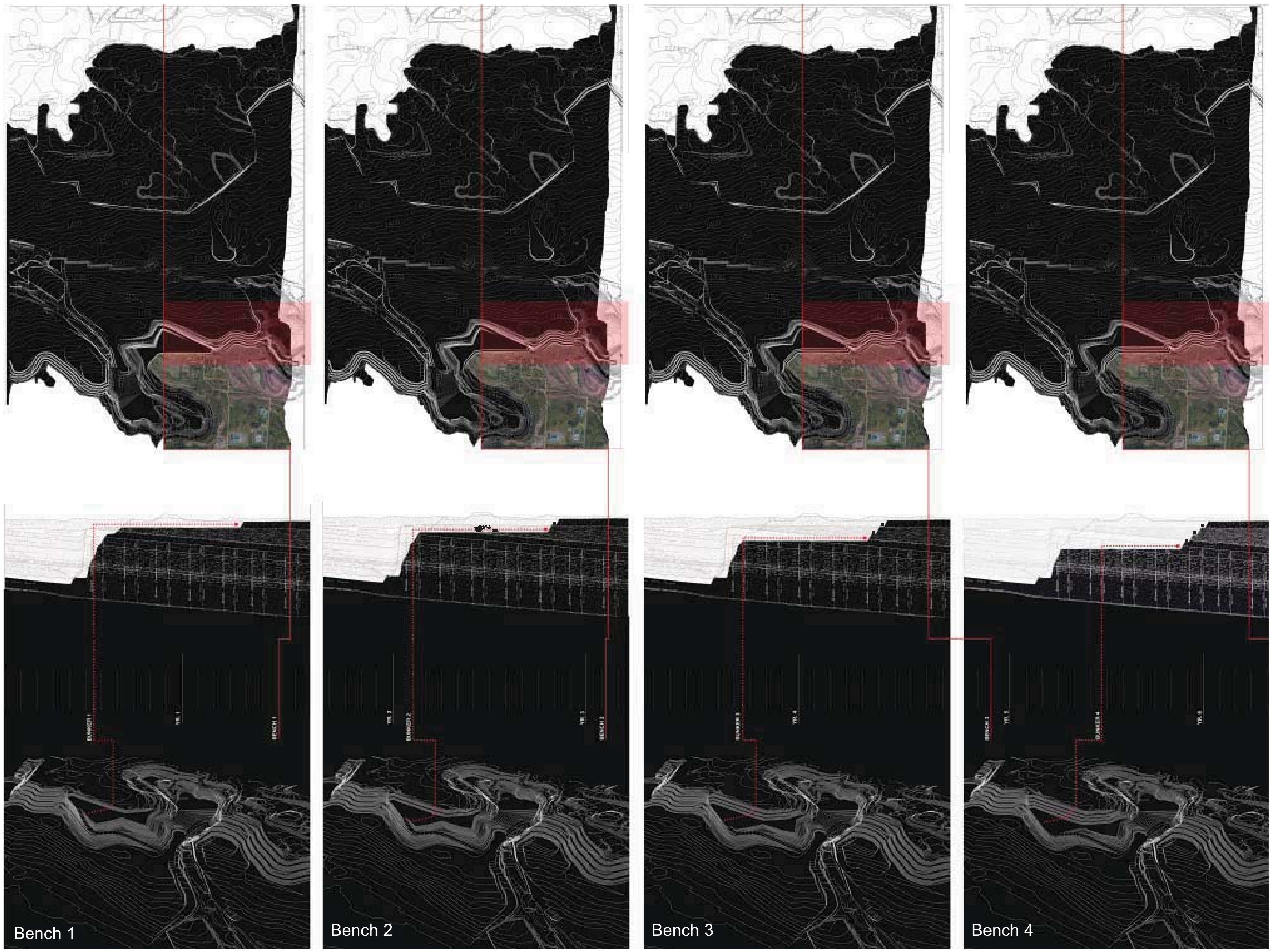


Fig. 6.7: Presentation Boards, Site Change Analysis, Benches 1-4.

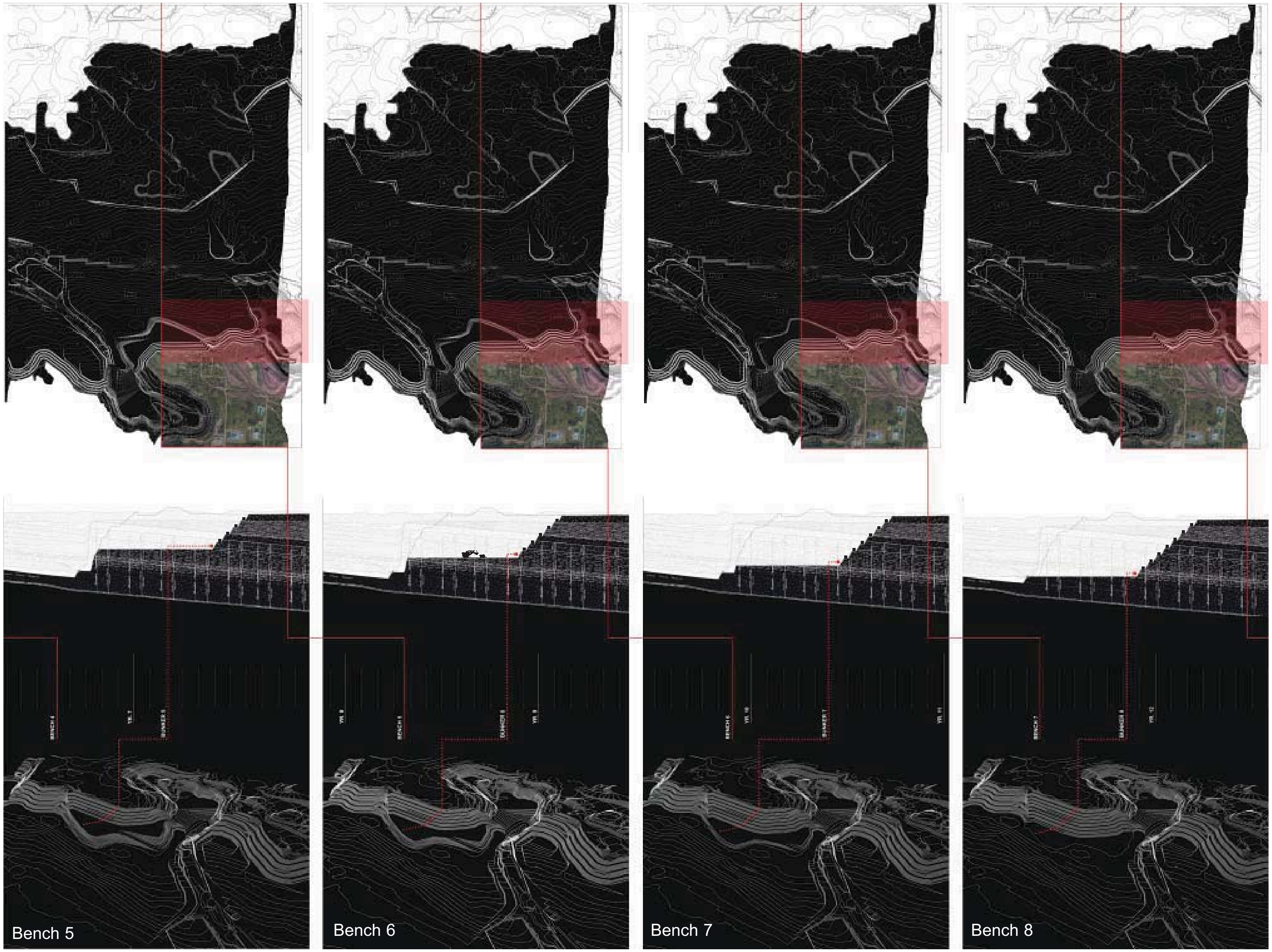


Fig. 6.8: Presentation Boards, Site Change Analysis, Benches 5-8.

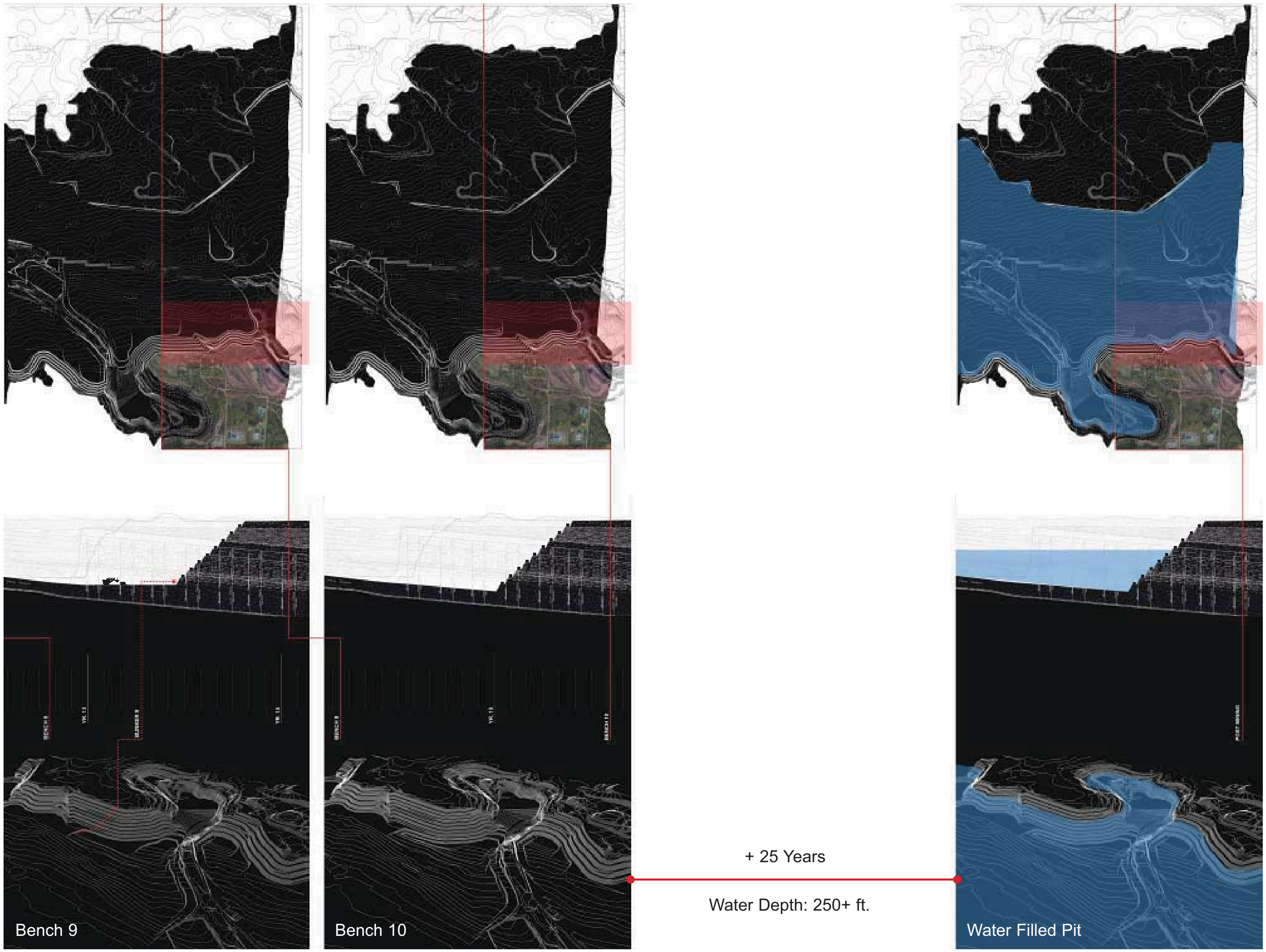


Fig. 6.9: Presentation Boards, Site Change Analysis, Benches 9-10+.

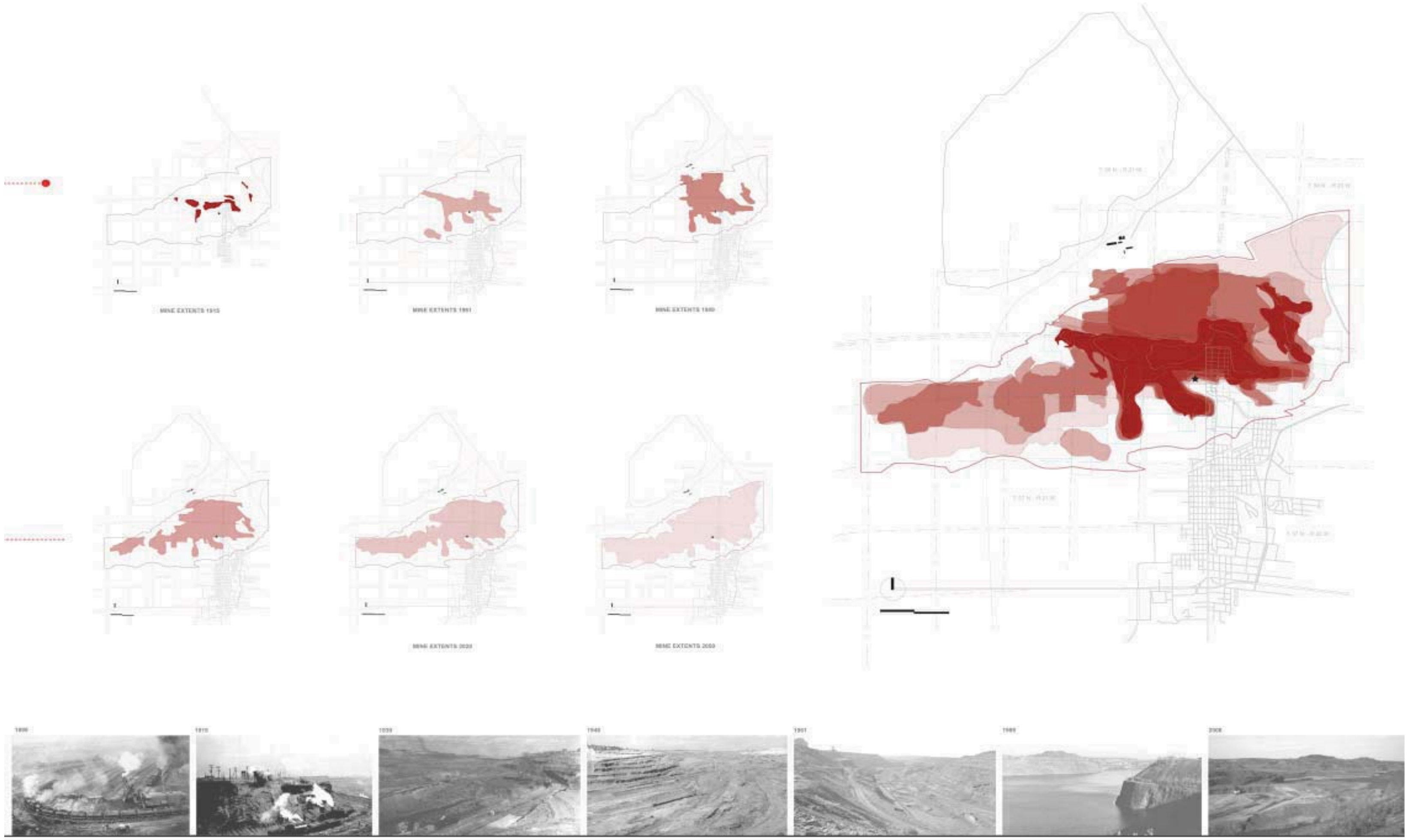


Fig. 6.10: Presentation Board, Historic Site Change Analysis.

Fig. 6.11: Presentation Board, Final Elevation Including Proposed Blast Shelters and Access Ramps.

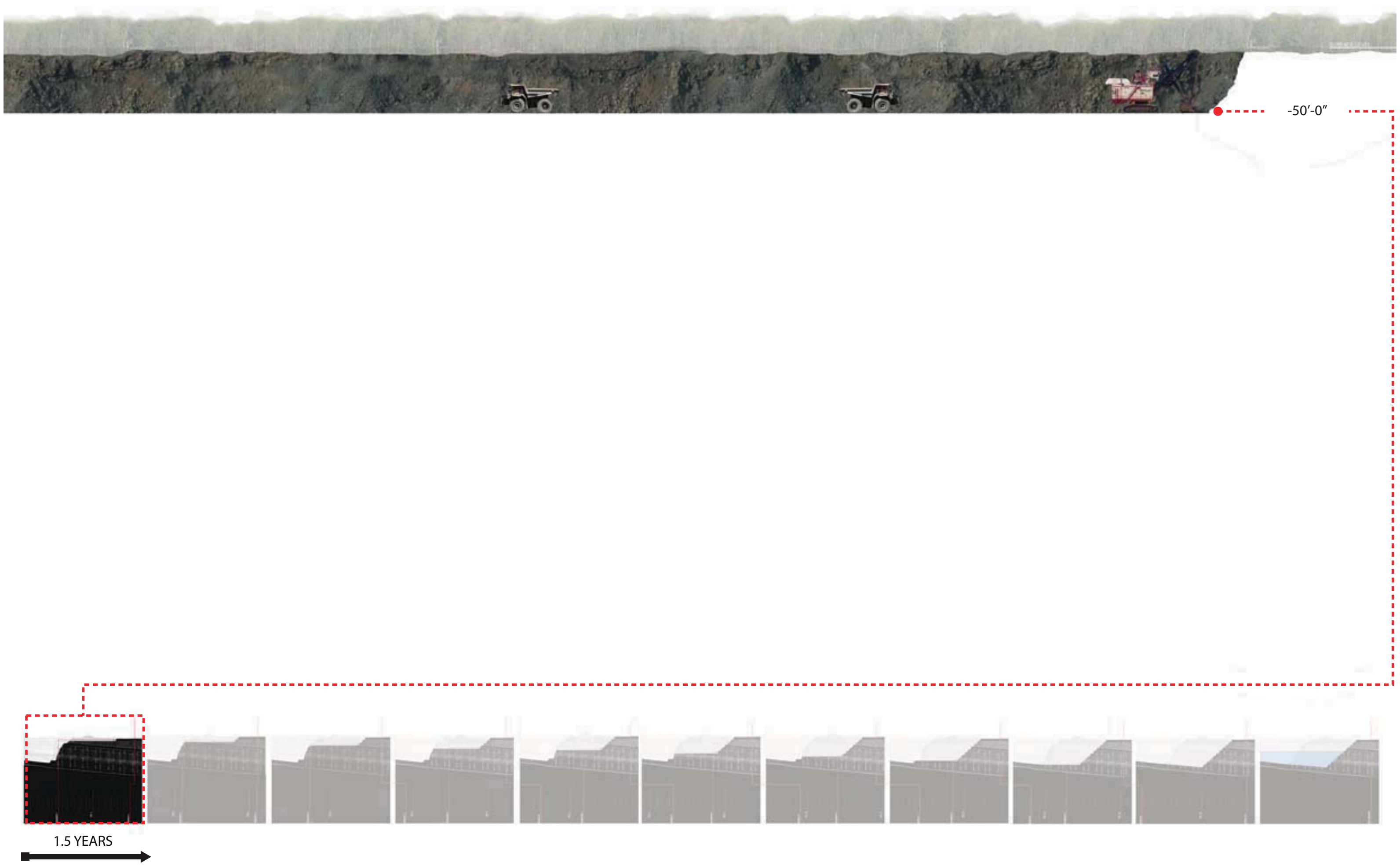
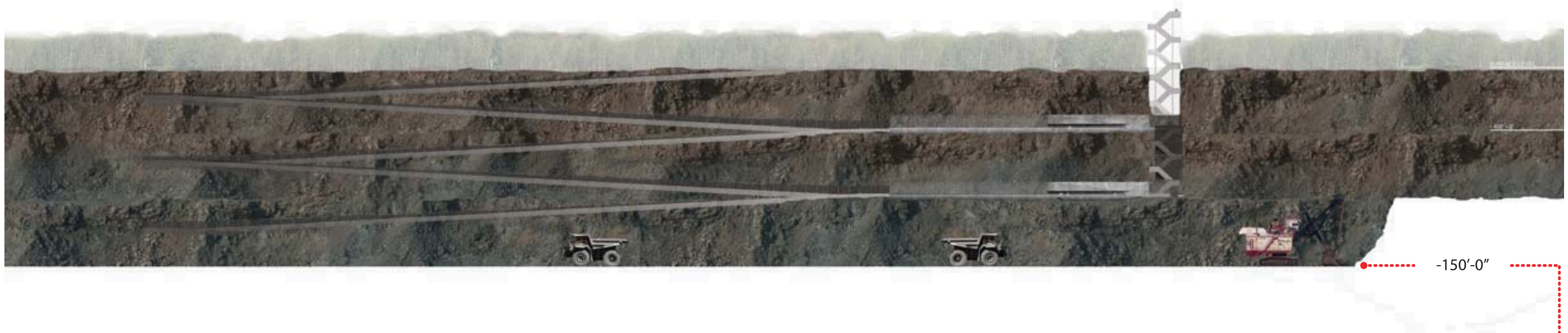


Fig. 6.12: Elevation and Section of Site Change Sequence, Bench 1.

Fig. 6.13: Elevation and Section of Site Change Sequence, Bench 2.



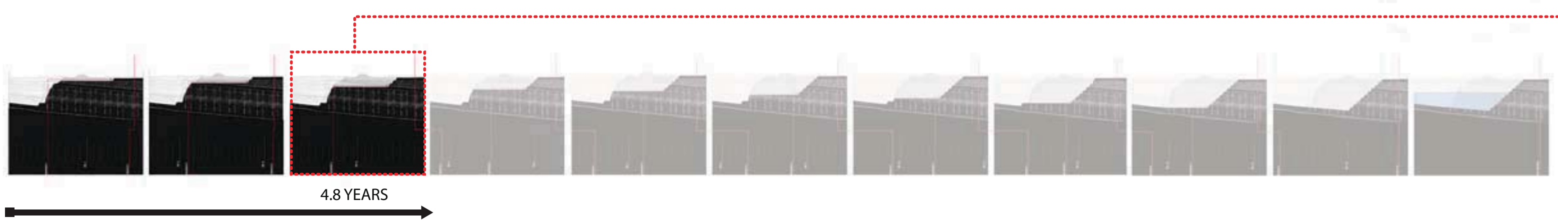


Fig. 6.14: Elevation and Section of Site Change Sequence, Bench 3.

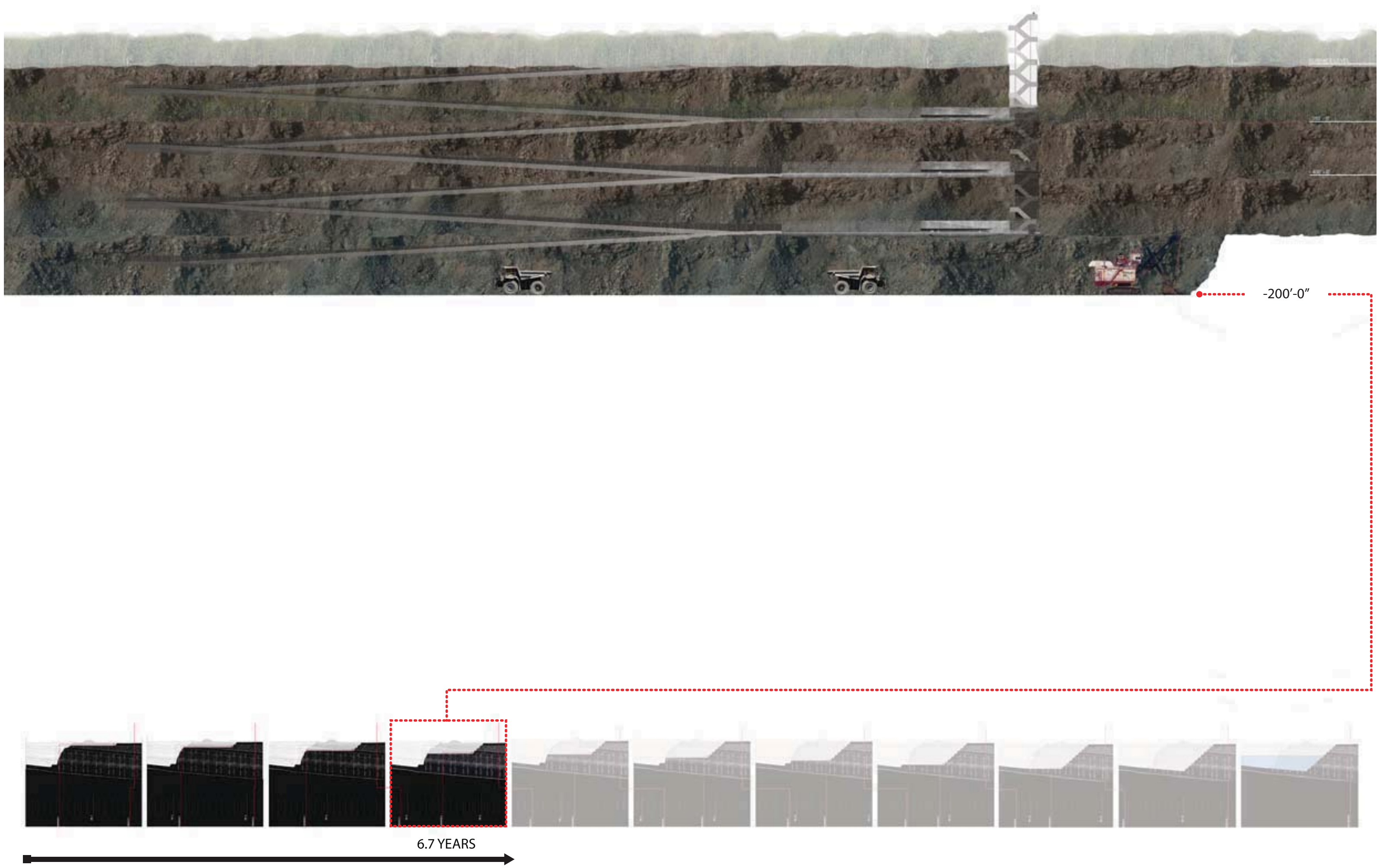


Fig. 6.15: Elevation and Section of Site Change Sequence, Bench 4.

Fig. 6.16: Elevation and Section of Site Change Sequence, Bench 5.

Fig. 6.17: Elevation and Section of Site Change Sequence, Bench 6.

Fig. 6.18: Elevation and Section of Site Change Sequence, Bench 7.

Fig. 6.19: Elevation and Section of Site Change Sequence, Bench 8.

Fig. 6.20: Elevation and Section of Site Change Sequence, Bench 9.

Fig. 6.21: Elevation and Section of Site Change Sequence, Bench 10.

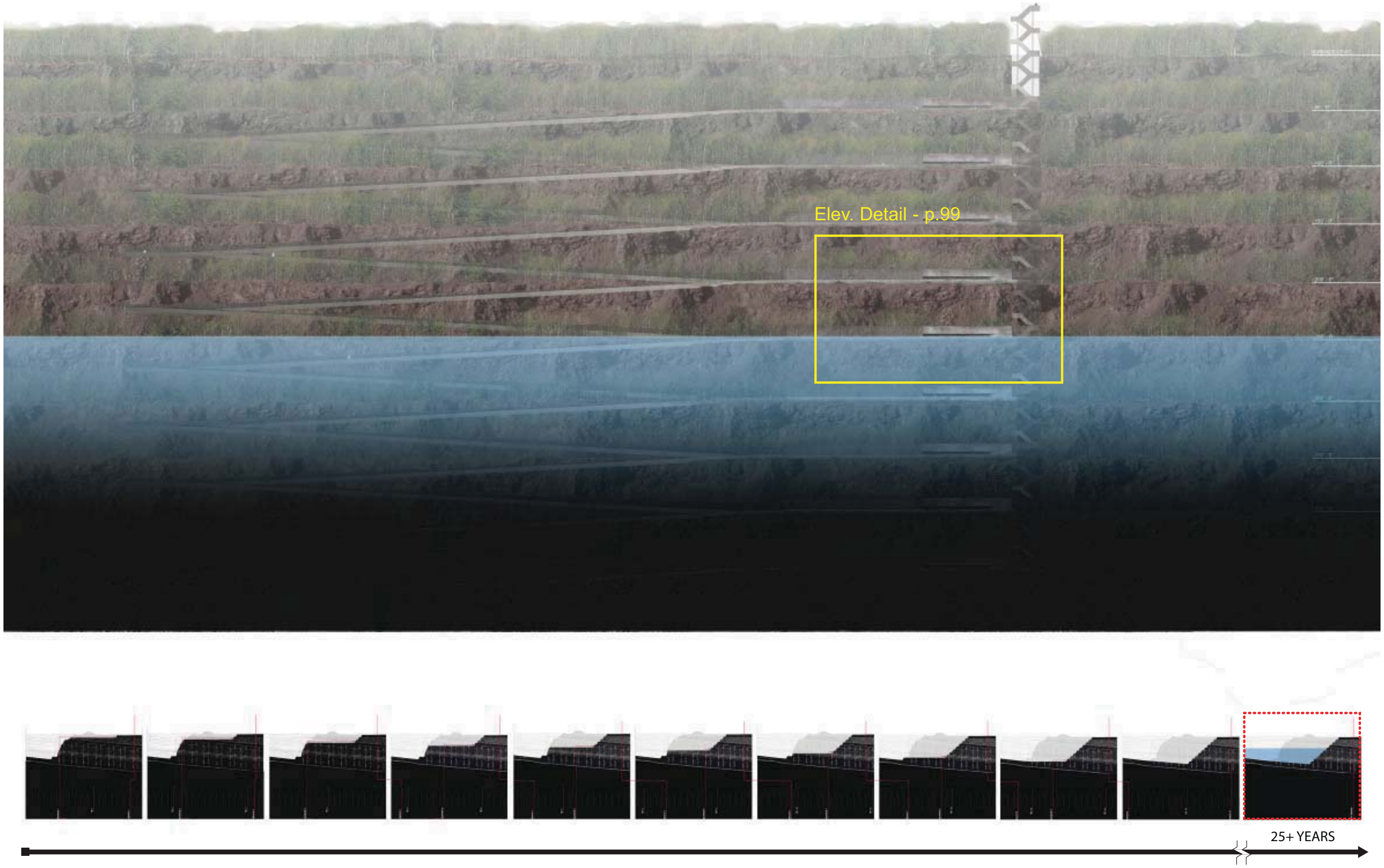


Fig. 6.22: Elevation and Section of Site Change Sequence, End of Mining Activity.

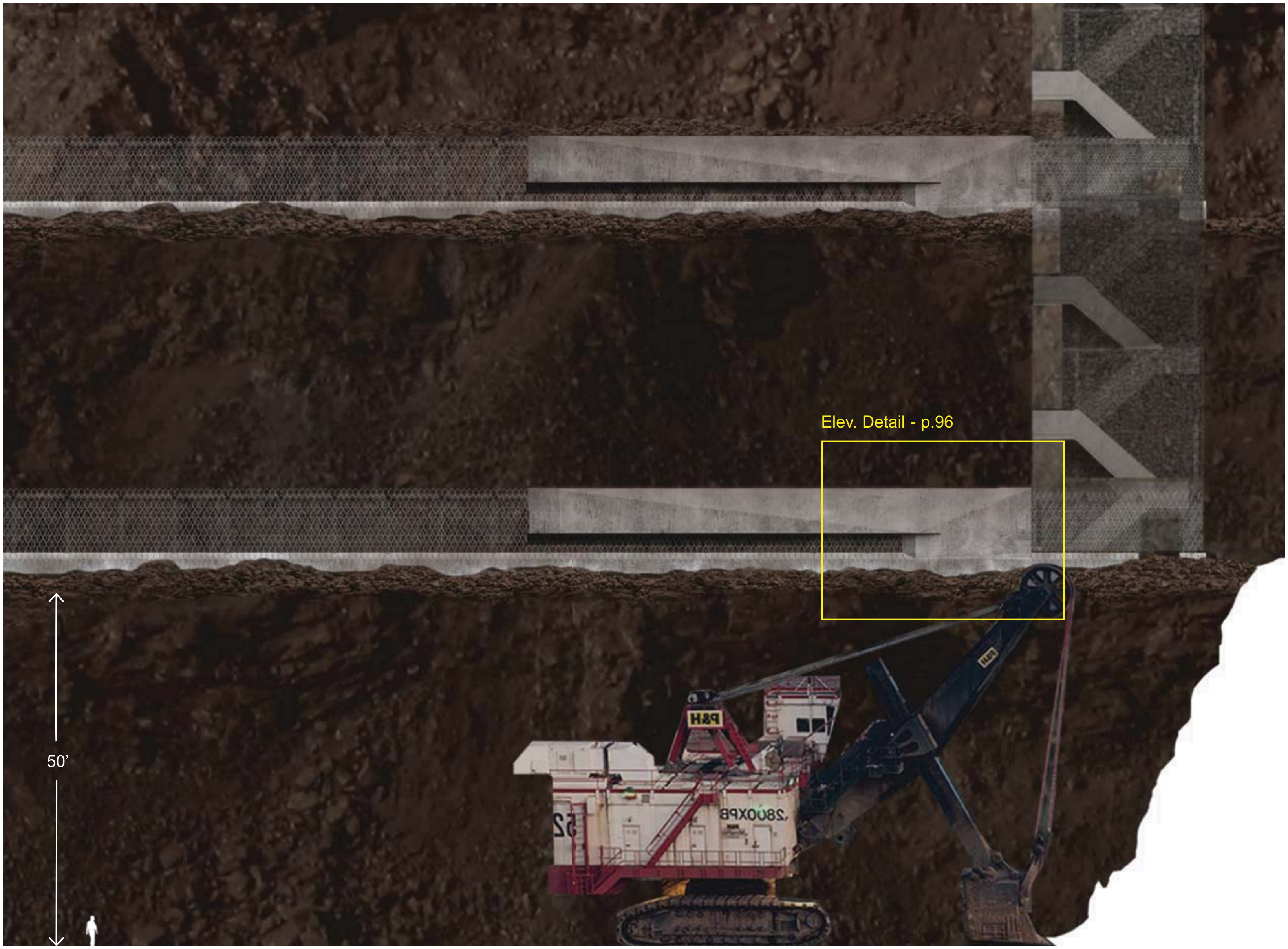


Fig. 6.23: Partial Elevation Showing Site and Material Change during Initial Mining Activity.

Fig. 6.24: Elevation Detail Showing Site and Material Change during Initial Mining Activity.

Fig. 6.25: Partial Elevation Showing Site and Material Change after Several Years of Mining Activity.

Fig. 6.26: Elevation Detail Showing Site and Material Change after Several Years of Mining Activity.

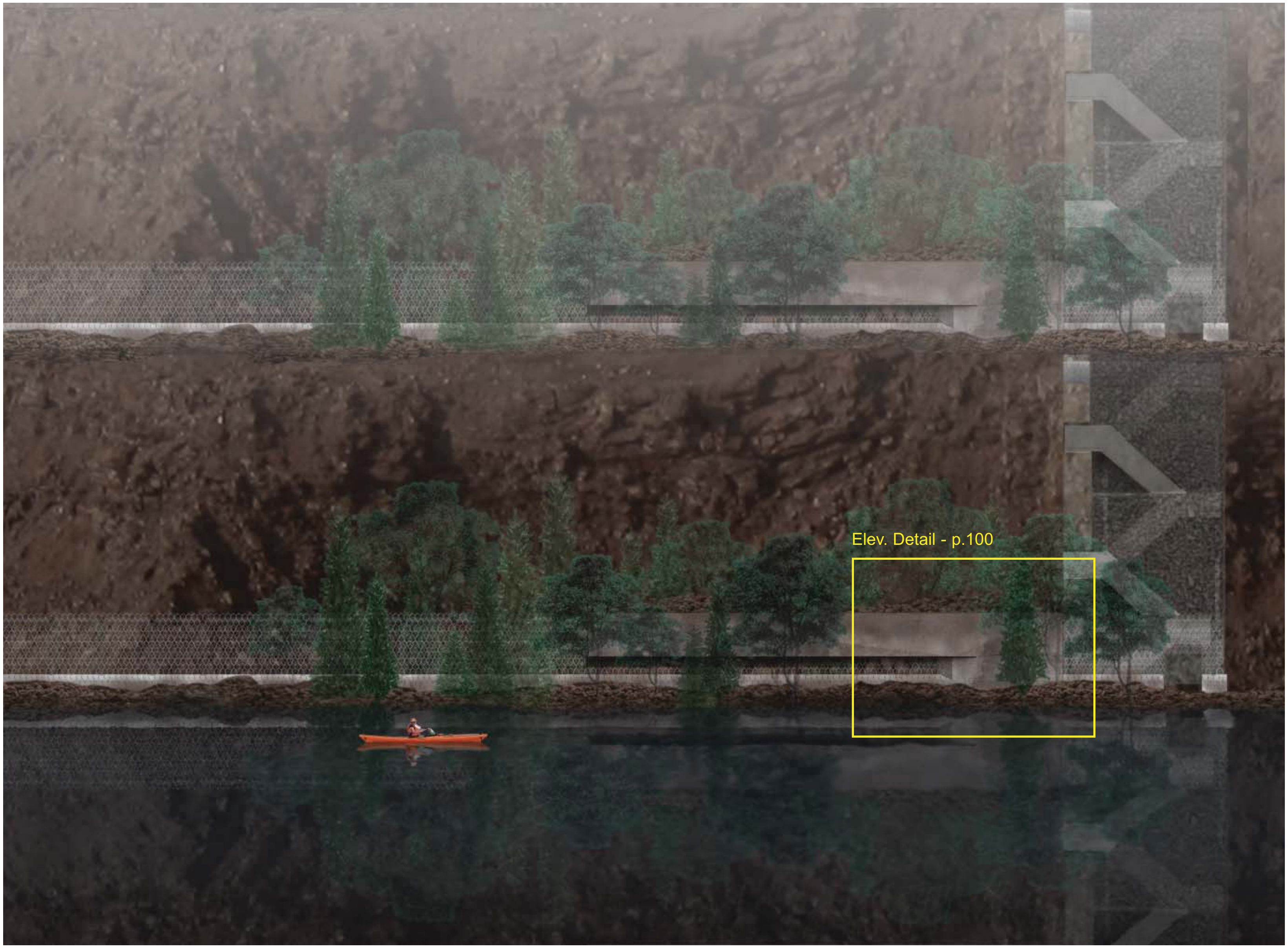


Fig. 6.27: Partial Elevation Showing Site and Material Change after Mining Activity has Ended.

Fig. 6.28: Elevation Detail Showing Site and Material Change after Mining Activity has Ended.

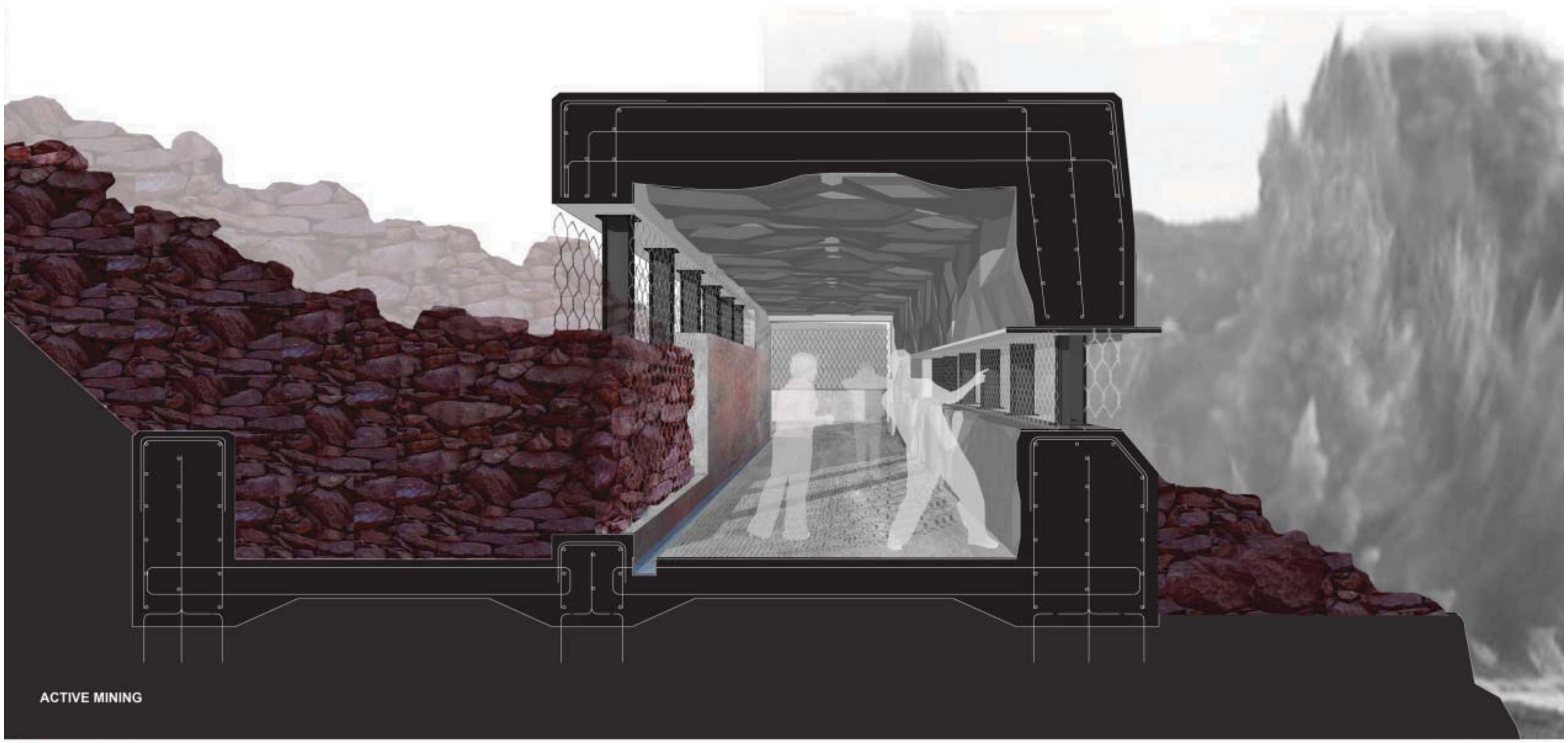


Fig. 6.29: Blast Shelter Section During Active Mining Operations.

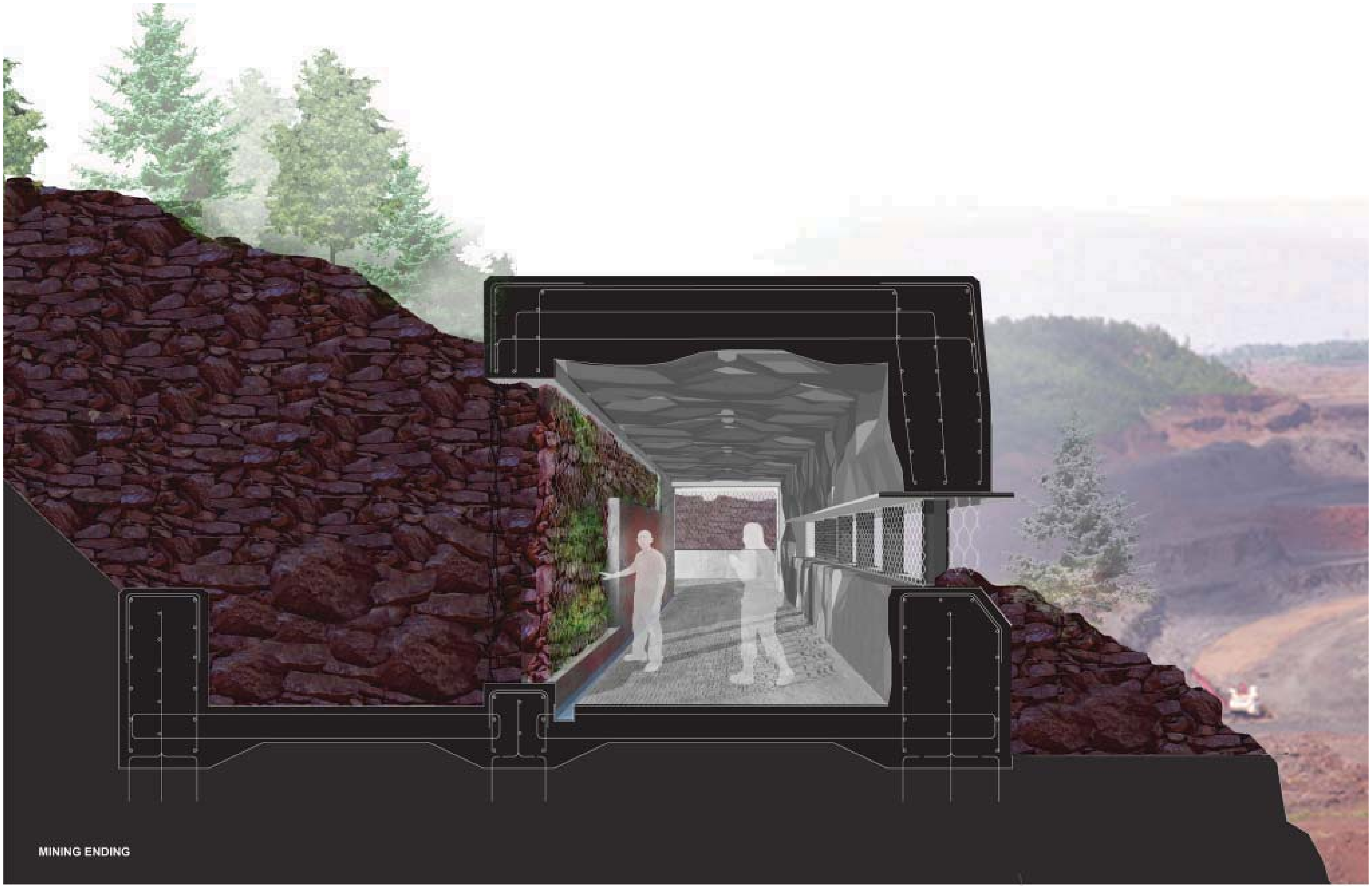


Fig. 6.30: Blast Shelter Section After Several Years of Mining Activity.

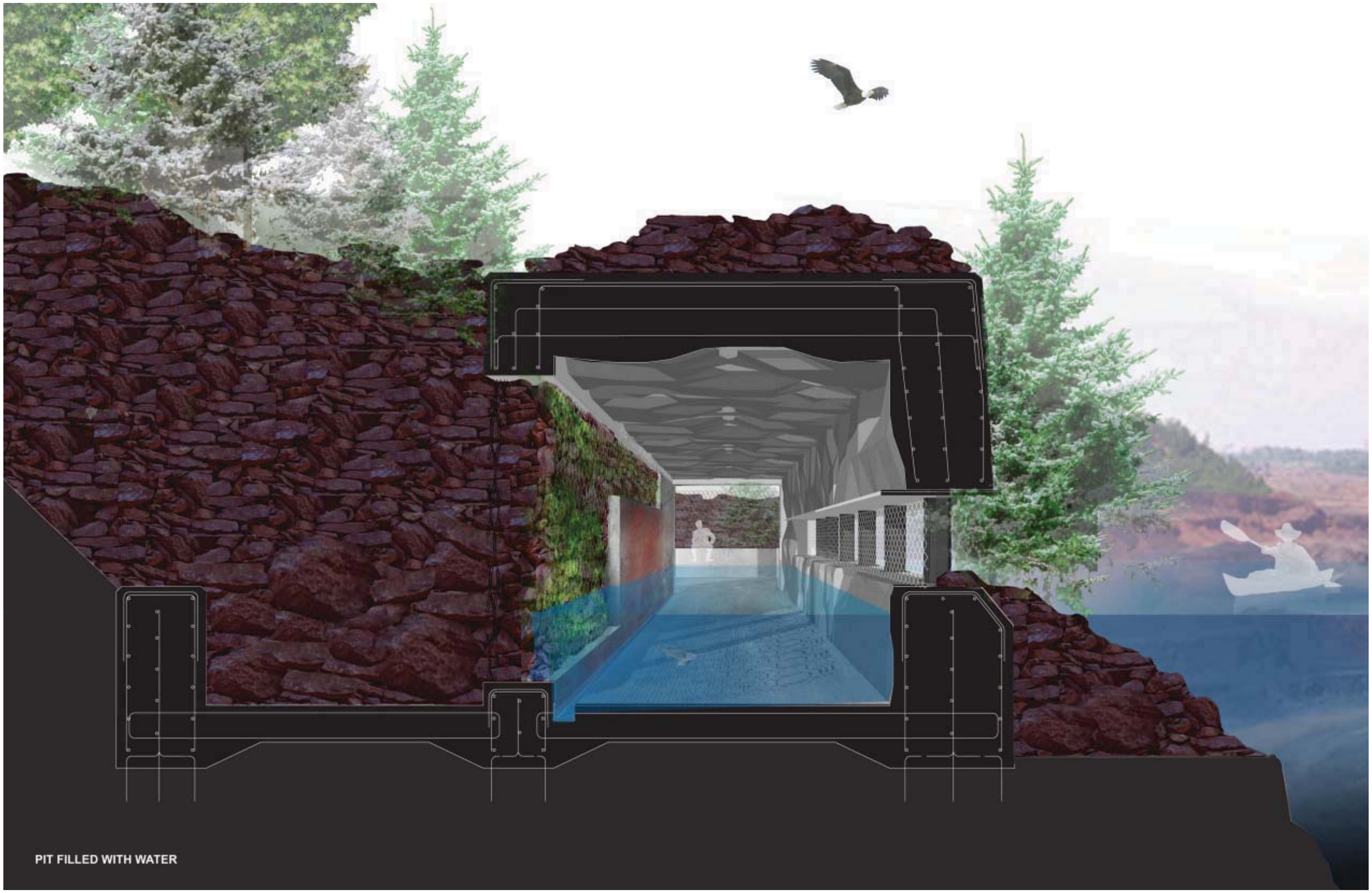


Fig. 6.31: Blast Shelter Section After Mining Activity has Ended.

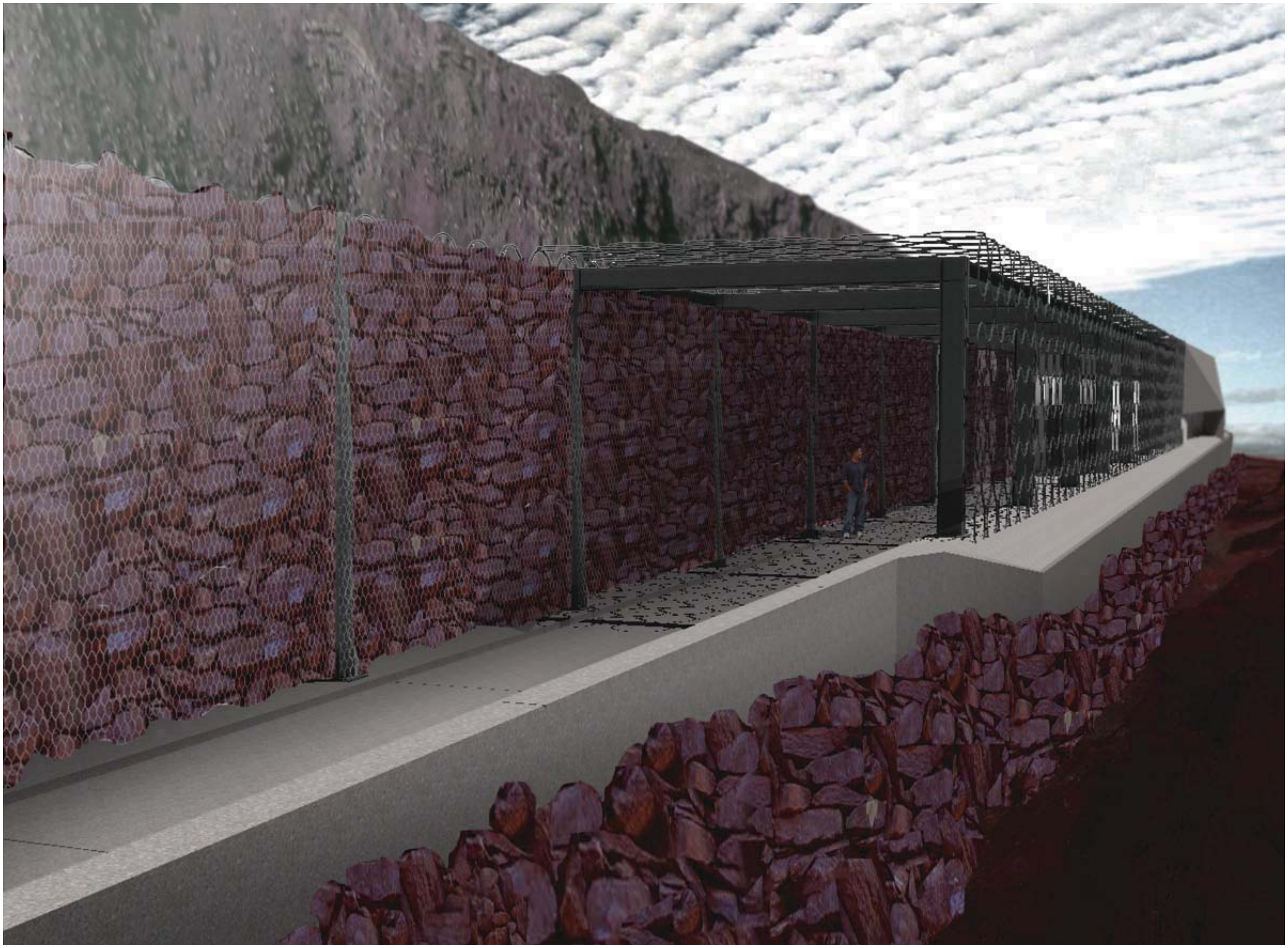


Fig. 6.32: Blast Shelter Exterior Perspective During Active Mining Operations.

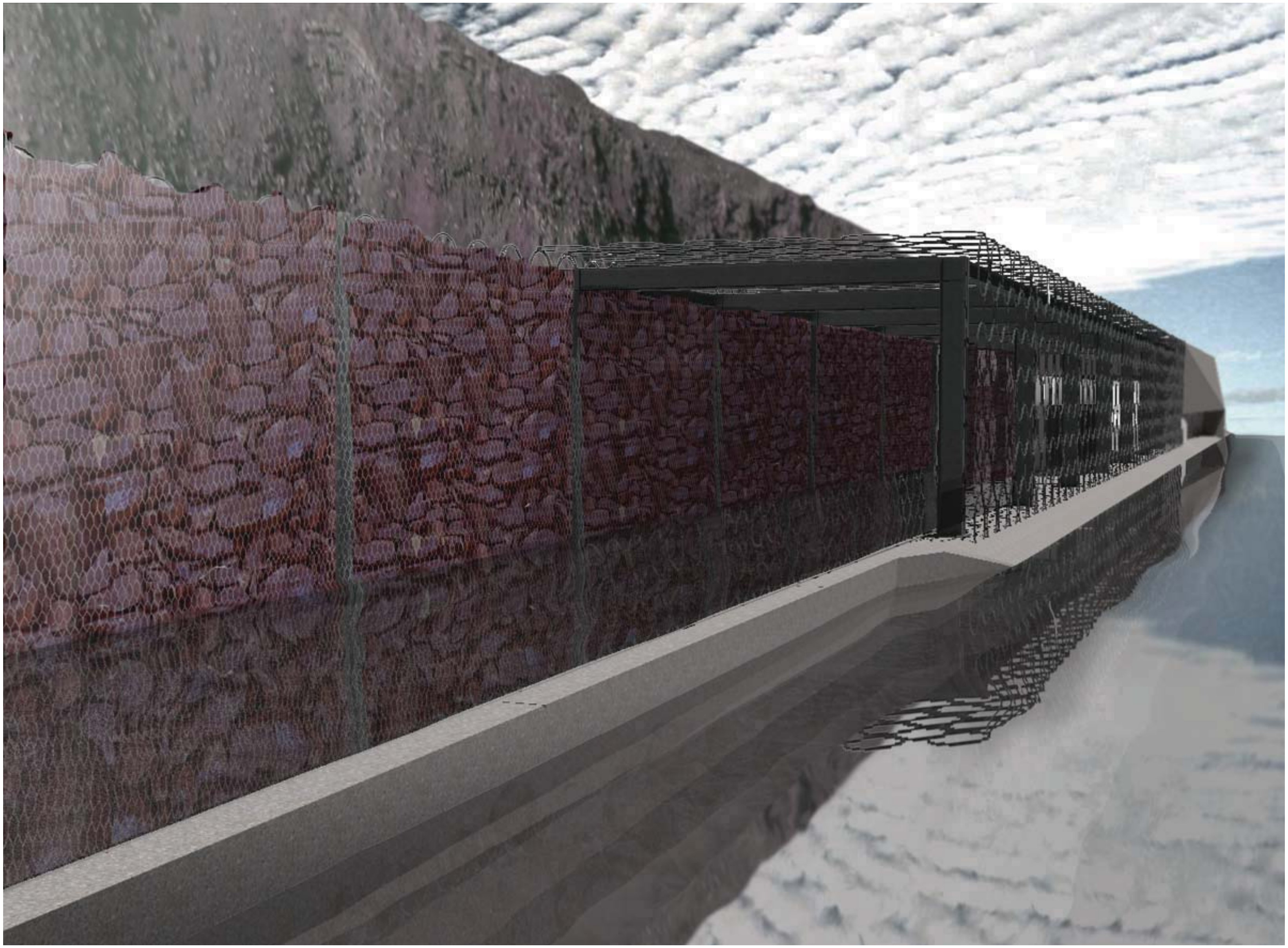


Fig. 6.33: Blast Shelter Exterior Perspective After Mining Activity has Ended (Summer).

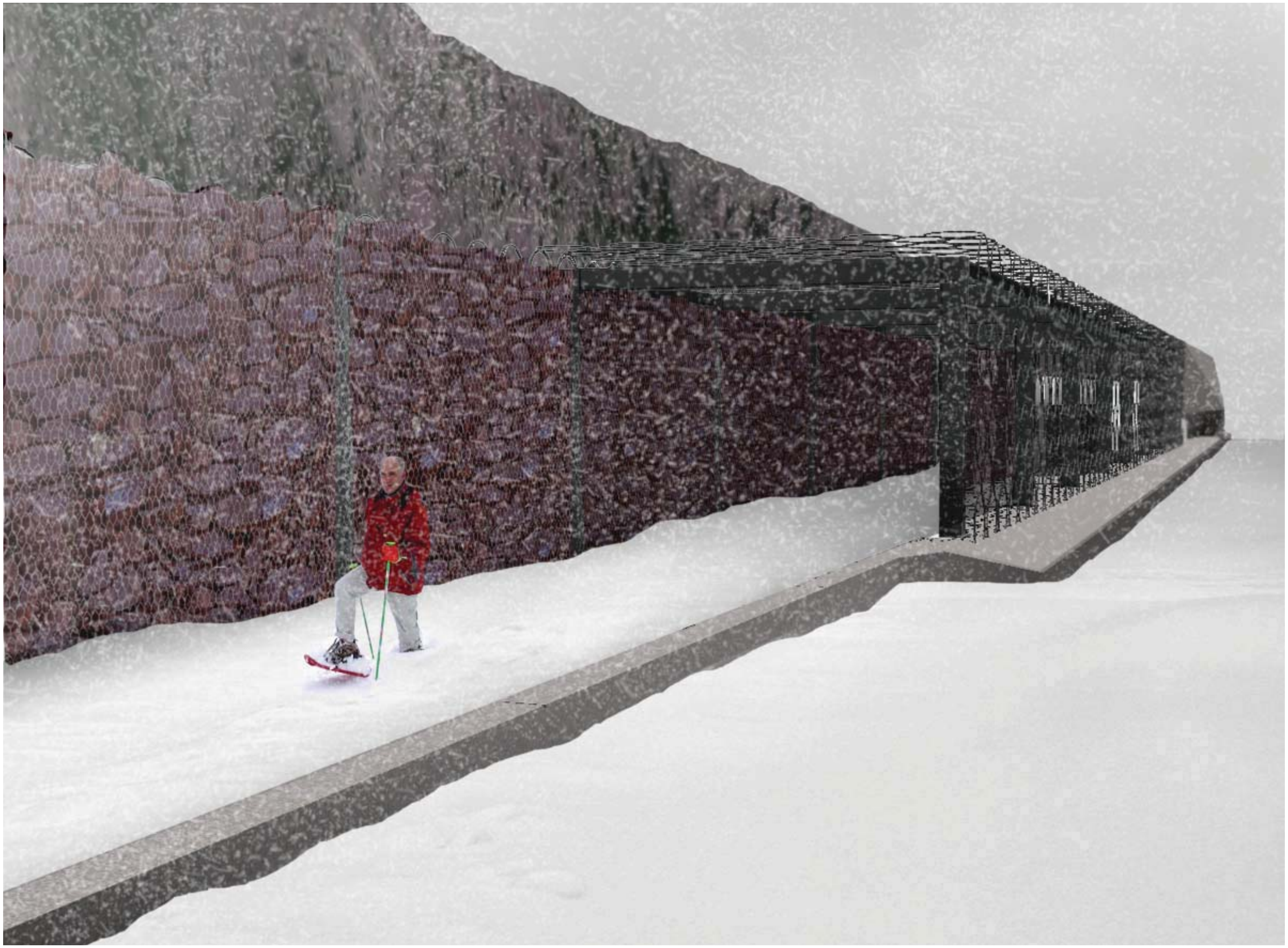


Fig. 6.34: Blast Shelter Exterior Perspective After Mining Activity has Ended (Winter).

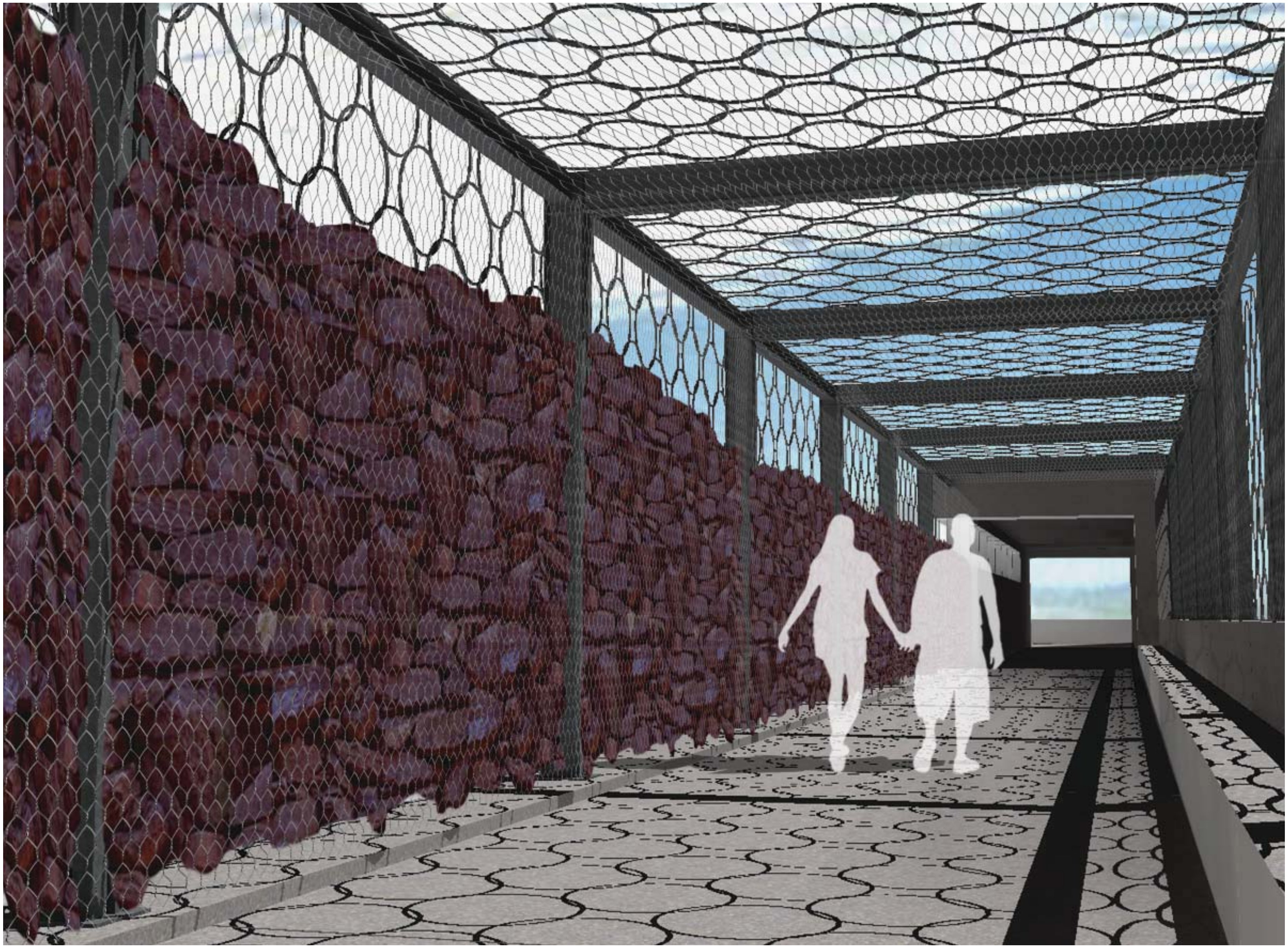


Fig. 6.35: Blast Shelter Interior Perspective During Early Stages of Mining Activity.

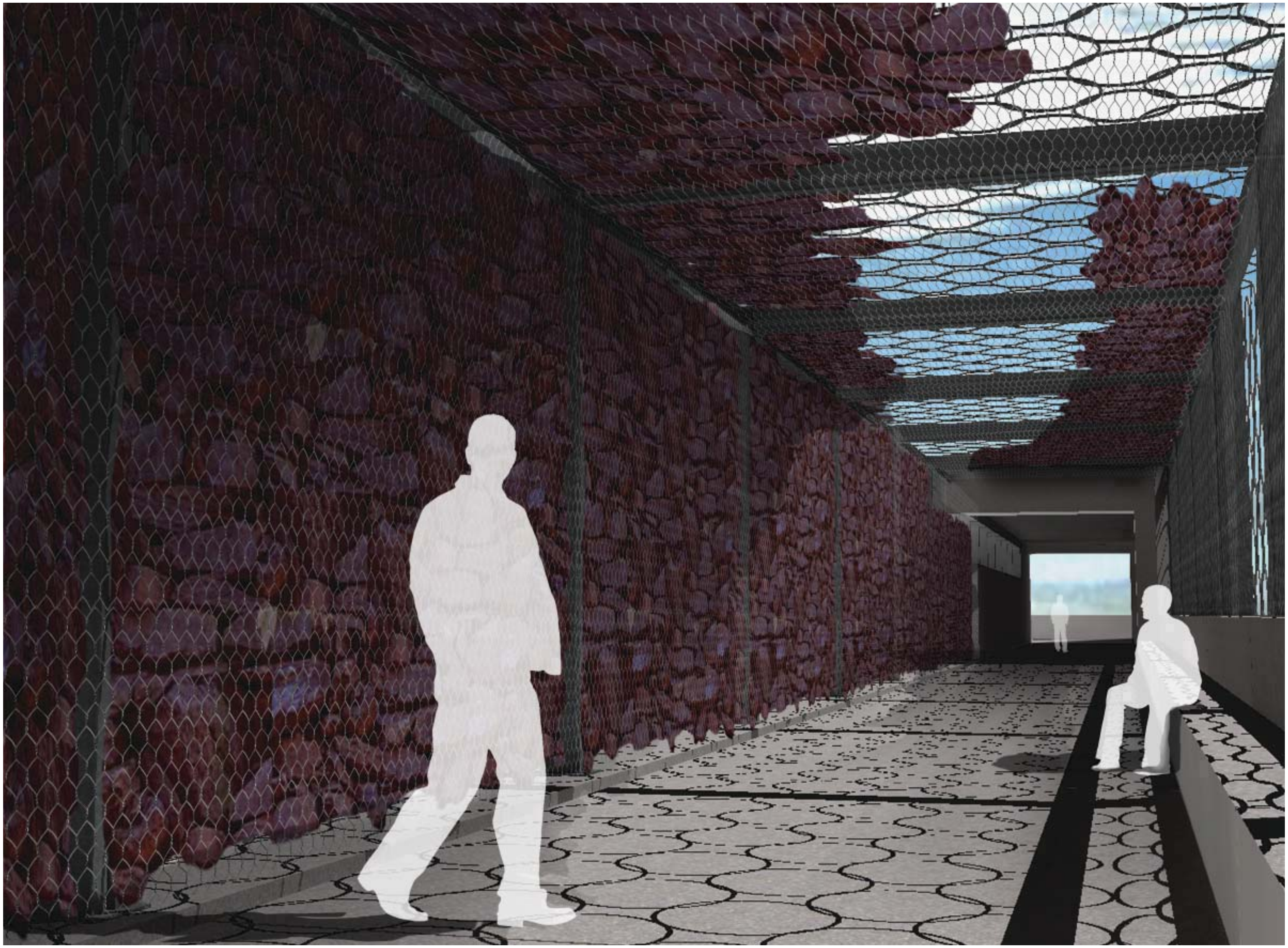


Fig. 6.36: Blast Shelter Interior Perspective After Several Years of Mining Activity.

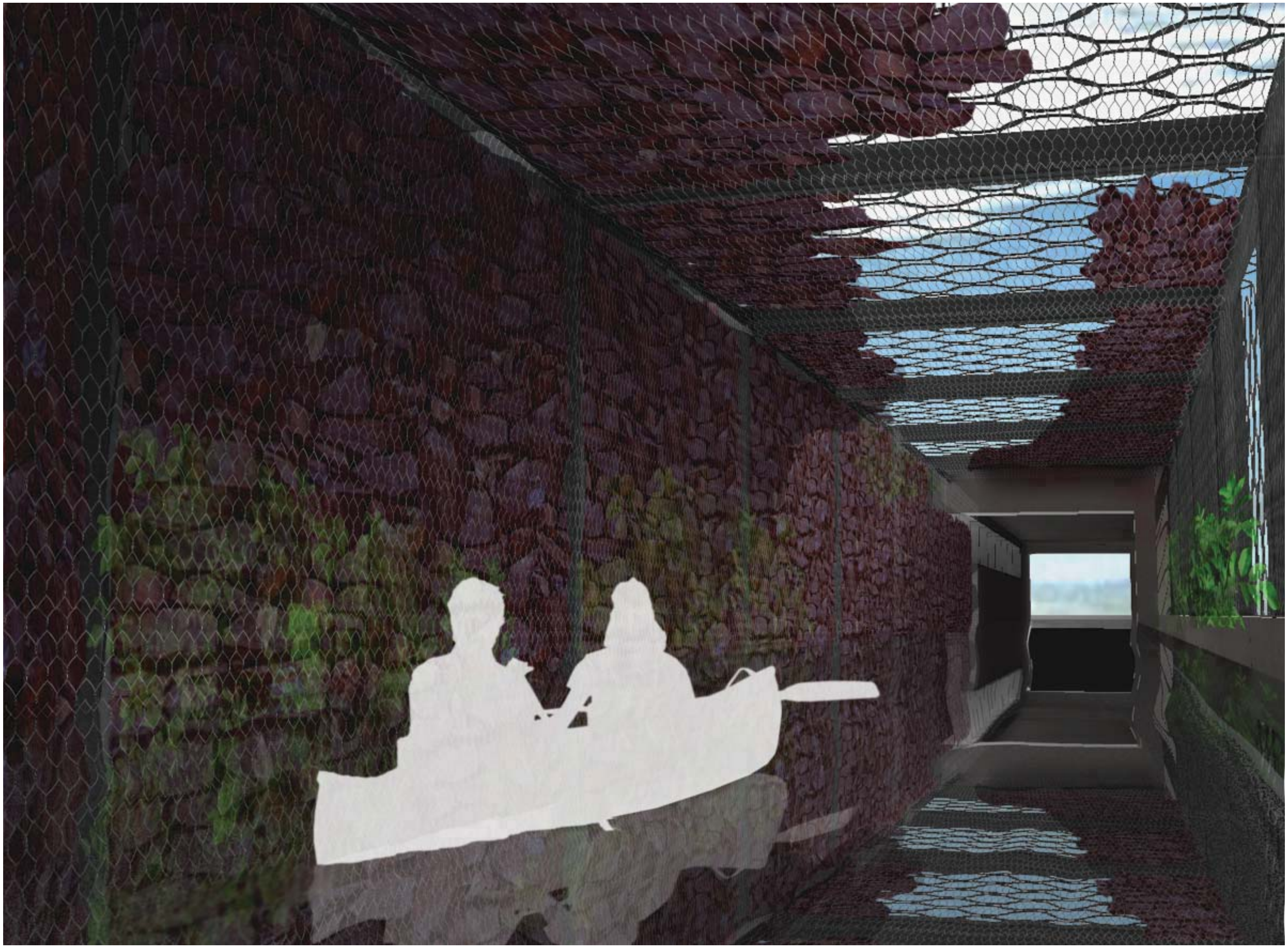


Fig. 6.37: Blast Shelter Interior Perspective After Mining Activity has Ended.

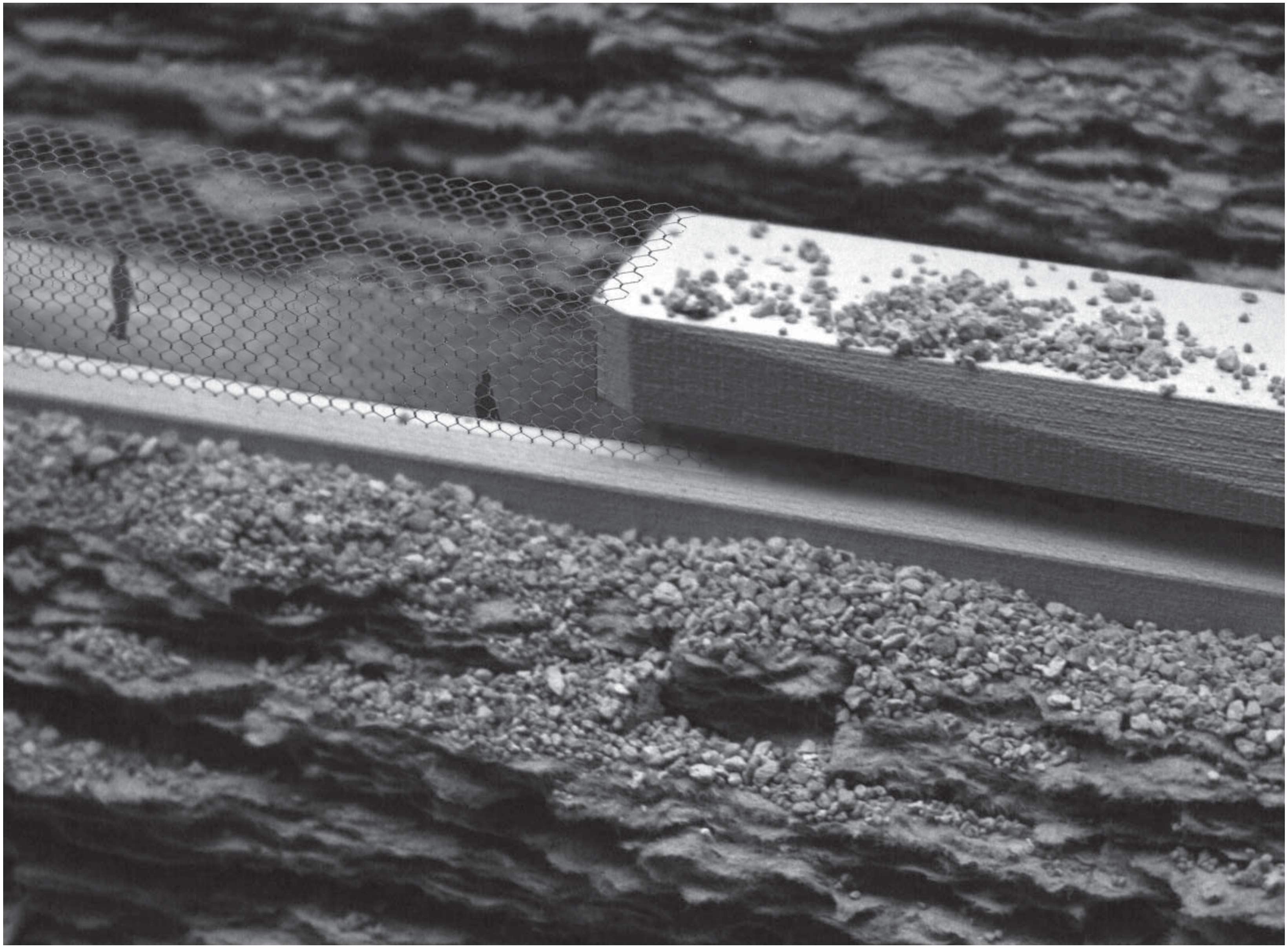


Fig. 6.38: Physical Model of Blast Shelter and Site Context.

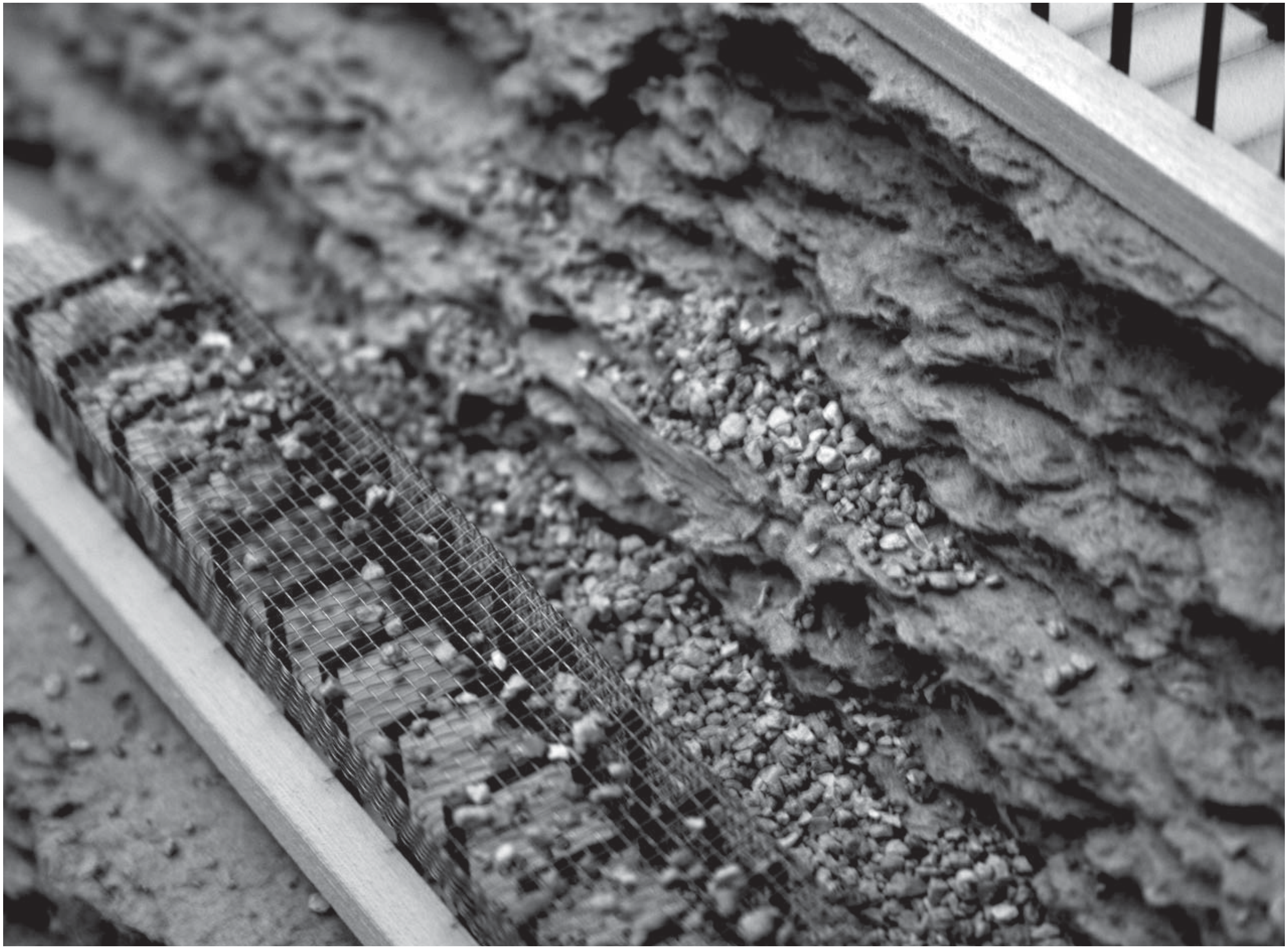


Fig. 6.39: Physical Model of Blast Shelter and Site Context.


Fig. 6.40: Physical Model of Access Ramps and Site Context.

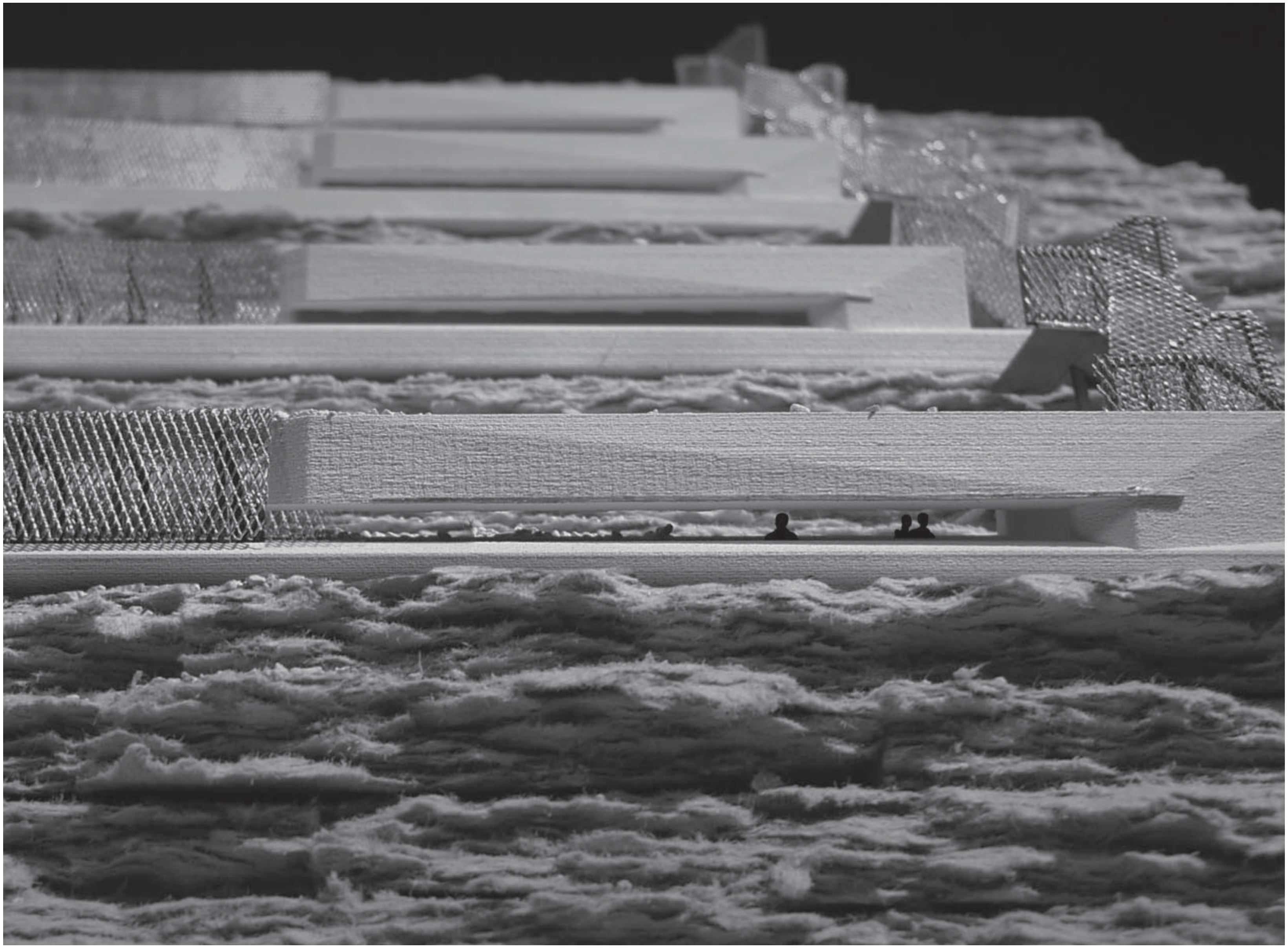


Fig. 6.41: Physical Model of Blast Shelter and Site Context.

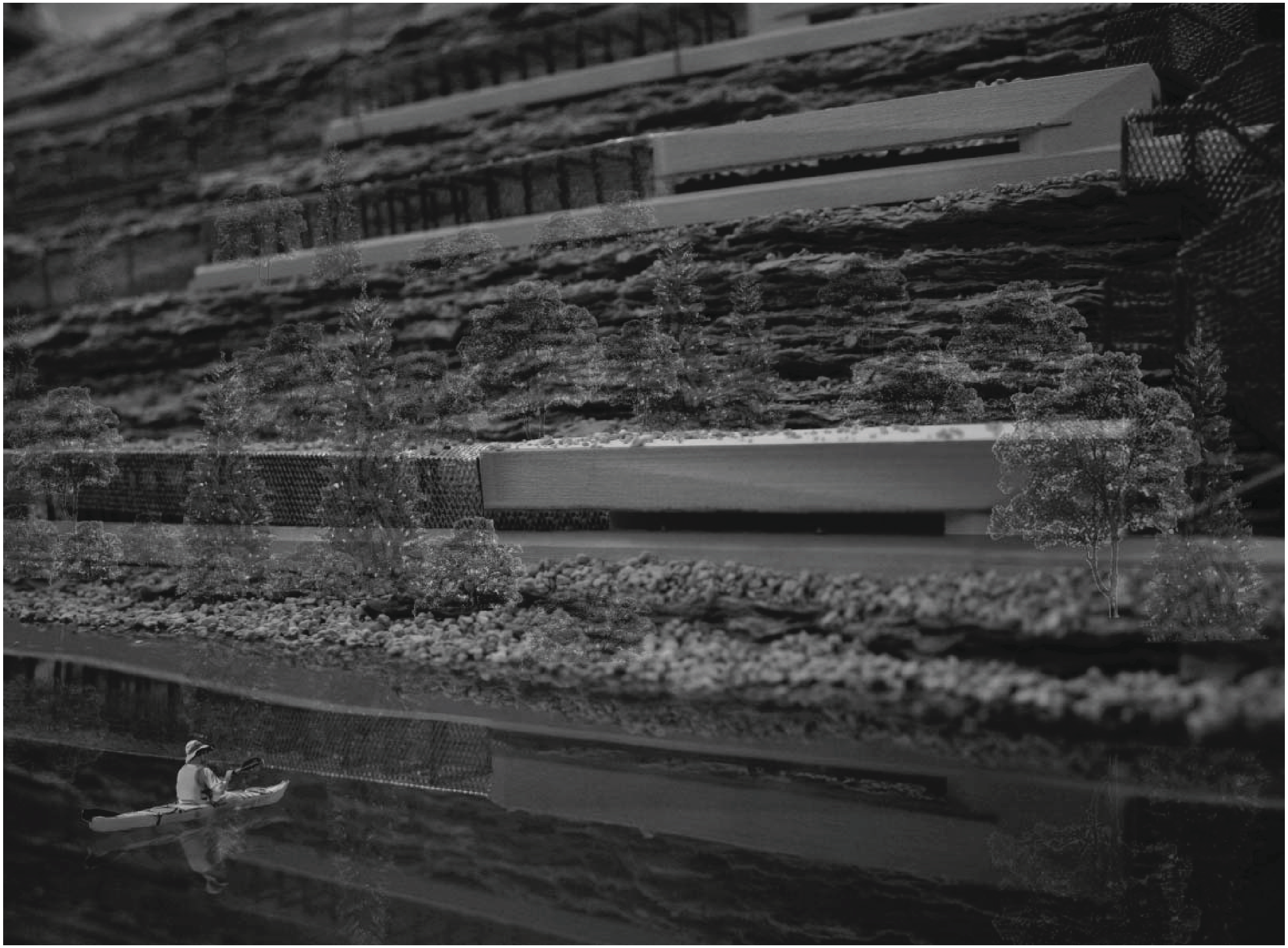


Fig. 6.42: Physical Model of Blast Shelter and Site Context (Post-Mining Activity).

NOTES

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IMAGE SOURCES

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