Minnesota Works Progress Administration: Writers Project Research Notes.

Copyright Notice:

Version 3
August 20, 2018

Subm. - By: Charles Karson.

WATER RUNS UPHILL

A History Of the

DULUTH WATER AND LIGHT DEPARTMENT.

INTRODUCTION.

Earth, air, fire and water were regarded by ancient philosophers as the elements of life. As a rule, earth and air are freely available, but man has often had to tax his ingenuity to satisfy his need for fire and water. These twin opposites are intimately woven into the fabric of history and legend.

Before the development of agriculture, primitive man roamed the fields and forests, living by hunting and fishing. There was an abundance of woods and brush, affording an ample supply of fuel for his fires. Water was likewise plentiful. Springs, lakes and rivers were free of refuse and waste matter.

Then came the ancient civilizations with their great cities - Babylon, Jerusalem, Troy, Athens, Rome. Though these storied cities have left scant record of their water facilities and sanitary equipment, history and archaeology do tell of numerous attempts to solve these vital problems. Records of aqueducts and storage reservoirs extend back to remote times in Babylonia, Assyria and Egypt. Traces of these, as well as vestiges of tunnels cut through rock and of syphons built across whole valleys, have been found. Parts of the fourteen Roman aqueducts, the first of which dates back to 312 B. C., are still standing. A series of conduits, the earliest probably dating from the peroid of the kings of Judah, delivered water to Jerusalem.

Despite these great feats of hydraulic engineering, ancient and medieval cities were virtually helpless in the face of disease epidemics which were largely due to contaminated water. The dread scourges - plague, black death, cholera, typhus - took a terrible toll of life and health.

Nor were these pestilences confined to the cities of antiquity; they passed over into our own age and attacked our cities with disasterous results.

To combat these diseases, purification of the water supply was attempted. The most important method of ancient times seems to have been that of storage. It is not improbable that filtration was also tried at an early date. The Chinese, in very ancient times, used sulphate of alumina to improve the appearance of the water. In modern times, the system of filtration was first introduced in England in 1829. The value of filtration was dramatically demonstrated in 1892. While a cholera epidemic raged in Hamburg, Germany, the adjoining city of Altona escaped its ravages. Altona filtered its water - Hamburg did not!

The complete solution of the problem, however, was beyond the reach of man until the establishment of the germ theory of disease. The discoveries of the immortal Louis Pasteur and the work of Koch gave a new meaning to water purification. At last these microscopic, deadly enemies of mankind were brought into the open. When science stripped them of their mystery and made them visible, it won the decisive battle of the war against germ - carried disease.

Sanitation became the order of the day, and its vigorous attack on water-borne disease began to yield invaluable results. Cities everywhere investigated their water supplies in order to safeguard their populations. Purification of water became a major function of municipal government. Many communities had to overcome greater or lesser obstacles in the effort to secure pure water.

Today, we turn a small handle on our stove and a blue, hot flame bursts forth. Or, desiring water, we turn another handle and a stream of pure water gushes out of the faucet. We do not show the slightest surprise at the results we have thus easily obtained, for these are commonplace, taken-for-granted conveniences of the modern world. Yet it was not so long ago that our parents or grandparents could obtain these vital necessities only at the expense of much labor and inconvenience.

This is the story how Duluth, Minnesota, solved its problem of fire and water.

Subm. - By: Chas. Karson.

WATER RUNS UPHILL

A History of the

DULUTH WATER AND LIGHT DEPARTMENT.

When the treaty of La Pointe opened up the North Shore for settlement in 1854, the promise of vast mineral wealth bordering Lake Superior fired the imagination of many enterprising pioneers. They expected that the great copper deposits on the Michigan side of the lake would be duplicated on the Minnesota side. Reports of iron ore, much in demand in the industrial East, added to the attractiveness of this area. It was natural that Minnesota Point, at the mouth of the St. Louis River, should be selected because of its deep draft harbor as the site of a future shipping center to transport ore to the furnaces of the east. Here in the year 1855, a group of cabins appeared in the shadow of the hills, the beginning of the thriving city of Duluth.

The dash for the North Shore which assumed the proportions of a small scale Klondike Rush, caused this settlement to grow rapidly. In a short peroid of time Duluth was faced with many community problems, among them that of providing a dependable water supply.

Because of its unique topography, the city presents engineering difficulties of a sort seldom encountered elsewhere. In the early days, when it was just a village nestling on the low ground at the head of the lake, these difficulties were not serious. But later on, as newcomers poured in by hundreds and thousands, the problem of a municipal water supply began to grow acute.

A short distance back from the water's edge, Lake Superior is bordered at this point by a steep, rocky bluff which extends for miles along the North Shore. With the bluff on one side and the lake on the other, Duluth was squeezed out lengthwise, like toothpaste from a tube, under the pressure of its rapidly increasing population. Today, the city straddles the North Shore for almost 25 miles, a ribbon of population, which at some point is less than a mile wide.

The bluff, though an obstacle to homebuilding, was not an insurmountable one. Gradually houses and scattered business buildings crept up the face of the steep hill, as well as along its foot. It is a common saying now that the city is 25 miles long, a mile high, and about a foot wide.

The result, to a summer visitor, is unforgettably picturesque; to the hydraulic engineer, it is a nightmare. The efficiency of the present water plant is a tribute to the skill of those who have struggled with Duluth's water problem. In the course of 70 years, engineering miracles have been accomplished there.

In 1870 Camille Poirier began delivering water to the little settlement at the end of the lake. In his own words Poirier reports, "I claim that I was the first water corporation in Duluth. We had to go to the lake for our water, and, as the population increased it was very hard work. I had a large hogshead put on a cart, got a man to take charge, and started the first water delivery in Duluth."

This house-to-house business prospered until a trusted servant disappeared with four hundred dollars of Poirier's savings. Discouraged by his loss, Poirier sold out to the Collins brothers who carried on successfully for several years.

With the continued growth of the community the "hogshead method" proved inadequate and in 1871 the first water franchise was granted to what was known as the Wooden Pipe Water Company. This company built a wooden pipeline using Brewery Creek as its source of supply. It served only one house and was then discarded as impracticable.

The next water franchise was granted to the Holly System of Water Works. As was the case with the first franchise, this project was also absortive. In the course of digging, workmen came upon the remains of an old Indian burial ground. The possibility of pollution of the water supply aroused a storm of controversy. Investigation disclosed that there was too much risk involved and further activities of the company were abandoned.

The city remained without an adequate water supply and the twelve of fourteen thousand inhabitants obtained their water from wells and from carts filled at the lake. Serious fire hazards threatened the community, at that time housed mainly in wooden buildings. A volunteer fire brigade, orgnized in 1870, was greatly handicapped. The two wooden reservoirs built to supply the fire department, could not satisfy its needs. One on Second Avenue East below Second Street,

fed by a stream, was frequently empty when needed. The other, on Lake Avenue, was built at such a low ground level that the pumping engine could not raise the water. The street lighting system was similarly inadequate, few of the streets being illuminated and these by oil lamps which were lighted only on dark nights.

This situation was remedied in 1882 when the city granted a franchise to the Duluth Gas and Water Company.

This company was organized mainly by capital secured outside of Duluth. Its franchise was exclusive for thirty years as far as the water was concerned and five years for gas. The company guaranteed that the fire hydrants on Superior Street would throw six simultaneous streams through a one-inch nozzle to a height of eighty-five feet, through one hundred feet of two and one-half inch rubber hose.

Construction of an efficient water system was begun immediately. A pumping station was built at the foot of Fifteenth Avenue East and the lake shore, with a four hundred foot cast iron intake pipe and two one-million-gallon Blake pumps, and some residents of Duluth began to experience the convenience of water piped to their houses.

Operations of this company ran smoothly until the winter of 1887. Because of bad weather and the neglect of its equipment by the company, the reservoir could not be used during the winter months. Again the city was defenseless against the threat of fire. Despite the fact that it was unable properly to supply Duluth, the company

was laying pipe across the bay with the intention of supplying water to West Superior, Wisconsin. As a result of these conditions, citizens of Duluth demanded an immediate investigation by the city. The contention was that since the rates charged by the company for the extension of gas and water mains were unduly high, and since the city's water supply was endangered, the franchise should be annulled. The investigation ended in a compromise whereby the city guaranteed a rate of fifty cents per foot to the company for laying pipe, but the feeling grew that the municipality ought to establish its own water supply system.

The following year it was noticed that the quality of the water was rapidly deteriorating. An increasing death rate due to water-borne diseases culminated in a typhoid epidemic. The epidemic reached its peak in 1895 when an estimated two thousand five hundred casea appeared in the city. Citizens became incensed against the water company and renewed their demand for annullment of the franchise.

Thereupon the City Council ordered a complete investigation of the cause of pollution. It was found that city sewers were emptying into Lake Superior near the intake pipe and that streams running through the Forest Hill and Scandinavian Cemeteries drained into the lake in that vicinity. With these facts established, the city decided on a supplementary water system. The streams along the North Shore, Cloquet River, Grand Lake and currents flowing under Park

Point and even distant Lake Vermillion were considered, but in the end it was decided that Lake Superior was still the best available source.

A million-dollar issue of "Faith and Credit" bonds financed the project and in 1896 construction was began on a system to be operated in competition with the company plants. This system consisted of the present sixty-inch intake pipe; two five-million-gallon triple extension triplex crank and flywheel pumps with the necessary boilers; the pumping station at Lakewood; the 42 inch steel forcemain from Lakewood to Reservoir "A"; the ten-inch rider at Lakeside; and the 32 inch cast iron main from Reservoir "A" to Fourth Street and Fifteenth Avenue East.

Successful operation of this supplementary system convinced the people of the value of municipal ownership and operation of their water supply. Two years later, in 1898, the city purchased the Duluth Gas and Water Company's plants for $1,250,000,000, two and a half times its physical valuation. With the purchase of the West Duluth plant in 1902 for a price of $140,006,00, the city acquired complete control of water and gas distribution.

SUBMITTED BY: CHARLES KARSON.

WATER RUNS UPHILL SECTION II.

A History of the

DULUTH LIGHT AND WATER DEPARTMENT.

THE GAS SYSTEM. *

Of the total sum paid the Duluth Gas and Water Company, about one-fourth, or $363,000.00, was the purchase of the gas system. This consisted of a water-gas generating plant, a 200,000 cubic ft. gas holder at Garfield Avenue, property on Third Street and 29.6 miles of mains.

The rapidly increasing demand for gas called for improvement and extension of the system. The plant was rebuilt and up-to-date equipment installed, including a Lowe generator with a capacity of 18,000 cubic feet per hour. New mains were laid, chiefly those across the bottom of the Duluth Ship Canal. This work was done during the lull in the navigation season and proved an ardous and hazardous task. Swift currents in the canal caused considerable difficulty in the maintainance of these new mains. Construction on the Aerial Bridge in 1912 permitted the abandonment of the canal mains in favor of new ones laid over the bridge.

In 1902 yearly gas consumption increased from fourteen to sixty million cubic feet. The overworked gas plant was then aug-

---

* All facts in this section taken from material sent in by Duluth Writers Project.

mented by a new station, generator, blower and meter which resulted in a 50 % increase in production. Some twenty thousand feet of new gad mains were laid during this year.

On January 1, 1904, gas rates were reduced from one dollar to ninety cents per thousand cubic feet and on July first, a further reduction of fifteen cents per 1,000 cubic feet was effected. Later, rates for heating premises and for operation of engines were reduced to 50 cents per thousand cubic feet.

Despite the increase in production, the city was unable to satisfy the constantly growing demand for gas and a contract was negotiated with the Zenith Furnace Company, a unit of the Interlake Iron Corporation. This company undertook to provide the city with gas at the rate of Fourty-five cents per thousand for the first hundred million cubic feet and fourty-two and a half cents per thousand for the following twenty five million cubic feet. The company began delivery of gas on August 1, 1904 and the city promptly discontinued production.

The many years of business relationship between the city and this company have not been marred by any serious controversies. This does not mean, however, that the city has not been watchful on behalf of the gas consumers. When, in the winter of 1911-12, the attention of the Department was called to the inferior quality of gas, the Board served notice on the producer, demanding that it live up to the specffications of the contract. To ensure that this would be done at all times,

arrangements were made for a daily gas analysis to determine its chemical make-up and its heat value. Up to 1921 the Department received the reports of analysis from an outside source. Since then this has not been necessary as the Department employ a full-time chemist in its own laboratory.

At first the city measured the volume of gas purchased from the company by totalling consumers' meter readings. This method was unsatisfactory, however, as it placed the burden of leakage losses upon the company. To remedy this situation, a master meter was installed in 1929, at a point where the gas enters the city mains.

The essential scheme of distribution from that point consists of a line of high pressure mains extending from Commonwealth Avenue, at the northern edge of Gary, to 40th Avenue East and London Road. Branches extend from this main transmission line, up 40th Avenue East, to the Jay Street gas holder and to the Hunters Park and Woodland Districts, terminating at Woodland Avenue and Wabasha Street. Another branch runs down Garfield Avenue to the Garfield Gas Plant. The pressure in these main lines fluctuates between one and twenty pounds and is too high for low pressure distribution. Consequently the various district supplies are tapped off the transmission main through district governors or pressure-reducing valves which transform the higher, irregular pressures in the transmission mains to a

low and uniform pressure suitable for distribution to consumers. Low pressure feeder mains receive the supply from the district governors and convey it to the distribution mains of the districts.

The producing company furnishes the gas to the city's system at approximately uniform pressure rates throughout the day and night. The sharp drop of consumption during the night creates a surplus which is stored in gas holders at the Garfield and Jay Street plants. This enables the city to augment the company's supply during the day when consumption reaches its highest levels.

The Interlake Iron Corporation continues to furnish the city with a desirable quality of gas which is indicated in the following analysis: -

CO_2	(Carbonic Dioxide)	2.5
III.	(Illuminates)	3.8
CO	(Carbon Monoxide)	5.3
.O	(Oxygen)	3.0
H.	(Hydrogen)	45.9
C_nH_n	(Methane)	24.30
N.		Difference.
Spec. Grav.		.44

SUBMITTED BY: CHARLES KARSON.

WATER RUNS UPHILL

SECTION III.

A History of the
DULUTH LIGHT AND WATER DEPARTMENT.

THE WATER SYSTEM. *

Development.

The city's newly acquired water system was in poor condition. Insufficient, antiquated, steam driven pumps of limited capacity had to be replaced. Of the forty-five miles of mains, some ten and a half miles were of kalamein, a very light-weight galvanized steel pipe, and a constant source of trouble. Construction of new mains was very costly as excavation was mostly through solid rock and pipes had to be laid at an unusual depth to prevent freezing.

Despite these difficulties, the Water and Light Department plunged into its work with enthusiasm and determination. Its activity was reflected in the remarkable growth of the water system. Accomplishments of the first year included a new pumping station at Lakewood, about twenty-five miles of new water and gas mains, repair and replacement of approximately eleven miles of old mains as well as reduction in water rates to consumers.

In 1900-1901 a pumping station was built at 16th Avenue East and 6th Street, including a tank and 12,658 feet of mains. In 1902 the Woodland Extension, costing $27,189.47, was completed and an additional 21,385 feet of mains was laid.

---

* All facts in this section based on material sent in by Duluth Writers Project.

An important court decision in 1903 permitted Duluth to install water meters and become one of the first cities in the country to abandon flat water rates. The excessive cold weather of the winter of 1903-04 materially increased the cost of operating the department and made necessary the purchase of electric thawing apparatus.

In 1905 a series of accidents occured. They were: (1) the bursting of the sixteen inch main on Michigan Street and 8th Avenue West; (2) the bursting of the thirty-six inch main in East 2nd S treet; (3) the failure of a pipe joint in the thirty-six inch force main at 33rd Avenue East and 1st Street; (5) the failure of a ten inch rider connecting the forty-two inch steel force main at 63rd Avenue East and Superior Street; and (6) the partial destruction of the Department's only gas holder by an explosion.

The department weathered this stormy year in good style and progress continued steadily.

Purification.

More important than quantity, is the quality of a water supply for human consumtion. For such use, the prime requisite is that the water be pure. The tramsmission of such diseases as cholera, typhoid fever, dysentery, and anthrax by polluted water, is universally recognized. The value of a pure water supply, therefore, cannot be overestimated.

A few years after the construction of the Lakewood station, built to avoid earlier sources of pollution, typhoid fever was again on the increase. With the growing number of sewers emptying into the lake and its tributaries, the area of pollution spread to the Lakewood intake.

The city requested the State Board of Health to investigate and make the necessary recommendations. A preliminary survey was conducted by Mr. H. A. Whittaker, Assistant Director of the Laboratory Division of the Minnesota State Board of Health. His report, dated June 27, 1912, recommended that daily water samples be taken at the intake and at three of the distributing reservoirs, and that a portable hypochlorite plant be installed at the Lakewood pumping station so that chlorination of the water could be carried out when necessary.

The first attempt at chemical treatment of the water was made through the use of a small home-made apparatus in which hypochlorite was mixed with water. The mixture was then fed directly into the intake well. Results of this method were satisfactory and the department constructed a permanent hypochlorite dosing plant consisting of three concrete tanks. In one, a set of motor driven paddles mixed the solution which was stored in the other two tanks. This method was used until 1916 when liquid chlorine was substituted for the hypochlorite.

In 1920 the Department established its own laboratory for bacteriological examination of the water. With the help of this laboratory, the Department, in cooperation with the City Engineer

and the State Board of Health, conducted a number of surveys of water supply sources during the following ten years.

In the year of 1930, the water acquired a disagreeable cod-liver-oil taste. Numerous complaints resulted in an investigation which revealed that a considerable growth of algae, a vegetable organism, had formed on the surface of Lake Superior. This growth was induced by a prolonged peroid of hot weather and little wind. When strong winds later became prevalent, the algae was brought in contact with the intake pipe and at the point of chlorination, a reaction occured between the chemical and the algae, causing the disagreeable taste. On the advice of the State Health Department, ammonia was used in conjunction with the chlorine. While this method of sterilization, called chloramine, eliminated the objectionable taste and odor, a new problem arose. It was found that chloramine required a longer peroid of contact before the water was safe for drinking purposes. The use of ammonia was then abandoned until plans could be developed for construction of a detention basin. Such a basin with a capacity of 2,842,800 gallons was completed in 1931. Its ability to hold the water for a minimum peroid of four hours before discharge into the city's system, permitted the use of ammonia for sterilization. A further health measure was taken by covering all reservoirs. Recently the department expanded its laboratory facilities by establishing a research laboratory at the Lakewood pumping station.

From Lake To Faucet.

To understand the extensive water system, let us undertake to follow the course the water pursues in its journey from the lake to the faucet. The source of supply is, of course, Lake Superior which provides Duluth with an unlimited amount of desirable water. As it is pumped at the main intake, the water is almost entirely free of turbidity; its temperature ordinarily ranges between 32 and 34 degrees F., although for short peroids it rises as high as 65 degrees F. It is very close to being entirely free of tastes and odors, is comparatively soft and especially adaptable for boiler feed purposes. Its total hardness is less than half in comparison with bay water and still less than that of water from local deep wells. Its chemical analysis in parts per million is as follows:

Free Ammonia	None
Albuminoid	None
Ammonia	.006
Organic Nitrogen	.611
Nitrites	None
Nitrates	None
Alkalinity	56.0
Total Hardness	38.8
Chlorine	.8
Iron	.07
Dissolved Oxygen	13.4
Biochemical Oxygen Demand	.5

Total Residue ---------- 27.0

Color ---------- none.

Odor hot ---------- none.

Odor cold ---------- none.

Total solida ---------- 54

Sulphates No. 4 ---------- 6.0

Sodium and Potassium, as Sodium Na-1.4

Iron, FO ---------- .10

Calcium, Ca ---------- 17.3

Magnesium, Mg ---------- 2.7

Albuminoid, Ammonia NH3 ---------- .072

Oxygen consumed ---------- 2.7

The water begins its journey by entering the flaring elbow of a sixty inch steel intake pipe laid sixty feet below the surface of the lake and fifteen hundred feet from the shore. This pipe lies partly on the bottom of the lake and partly in a rock tunnel trench where it is anchored by five stone-filled cribs. An octogonal timber crib, anchored by stone, supports the intake pipe at its outer opening. Upon entering the elbow which faces the surface of the lake, the water is strained through a s creen and flows into the intake well.

Here, the water receives its first chemical treatment by the admixture of liquid chlorine. Upon passage through a fine, rotary screen, the water is now ready for delivery to the detention basin by two low-lift electric pumps with a twenty million gallon daily capacity. The water remains in the basin for not less than

four hours. During this peroid the chemicals have sufficient time to perform their work. The water is then tested and additional chemicals may be added as it flows by gravity from the detention basin to the high-lift pumps. Propelled by these pumps the water enters a 42" steel force main or a parallel 36" cast iron main leading to Reservoir "A" at Thirty-fourth Avenue East and Fourth Street. This, the "feed" reservoir, has an elevation of 290 feet, is 27 feet deep and holds 13,500,000 gallons of water. From this reservoir, some of the water flows by gravity to a booster station at Forty-fifth Avenue West and Grand Avenue. Here two electrically driven centrifugal pumps of 1,872,000 gallon daily capacity lift the water into the West Duluth reservoir at Sixty-third Avenue West and Huntington Street. This ten million gallon reservoir, together with Resvervoir "A", serves the area known as the lower zone. From an elevation of 290 feet the water pours into the underground mains leading to the homes and business places of that part of the city which lies below the 200 foot contour line. This system covers a distance of twenty-two miles.

Because of wide differences in elevation throughout the city, a zoning system was established to allow control of water pressure. Water for the area known as the middle zone flows from Reservoir "A" to the Middle System Pump Station at Fifteenth Avenue East and Sixty Street. Here two gas-driven pumps with a combined capacity of 17,000,000 gallon per day and two electrically driven

pumps with a daily capacity of 7,324,000 gallons lift the water to the Middle System Reservoir. The water in this reservoir, at Second Avenue East and Fourteenth Street, rises to an elevation of 560 feet above lake level and serves that part of the city which lies between the 200 and the 470 foot contour lines.

Water for the Woodland zone which lies between the 470 and the 720 ft. contour lines, is pumped from Reservoir "A" by two electrically driven centrifugal pumps with a capacity of 1,051,000 gallons per day each. The water if forced up to the Woodland Reservoir on Minneapolis Avenue and to the Arlington Avenue Reservoir on Duluth Heights, as well as to the Piedmont Tank at Piedmont and Chambersburg Avenues. The combined capacity of the reservoirs in this zone is 1,311,490 gallons; their elevation is 806 feet.

From the Woodland Reservoir, the Orphanage Pumping Station, consisting of one gas driven pump and two electrically driven pumps with a combined capacity of 915,000 gallons per day, lifts water to the two Orphanage tanks. These tanks, at an elevation of 916 feet, supply the fourth zone comprising that part of the city which lies above the 720 contour line.

Fond Du Lac, at the extreme western end of the city, is supplied with water from flowing springs with pressure maintained by gravity.

Fire Hydrants.

Fully as important as the provision of water for domestic

use, is the maintenance of a sufficient supply and pressure to fire hydrants. Although the cities of today are not as vunerable to destructive fires as were those of the past, the danger is by no means eliminated. Occasionally the public is shocked by news of some great conflagration and a resultant loss of life and property. Tragedies of this sort, however, are few as compared with the not distant past.

Modern cities maintain organized fire departments equipped with up-to-date fire-fighting apparatus. At the first sound of an alarm, men move in swift precission and, in a twinkling, the engines are speeding toward the zone of danger. The flash of red fire-trucks accompanied by the urgent wail of their sirens, is not an uncommon sight to a city dweller. The observer, however, seldom experiences a feeling of trepidation for he knows that the flames, wherever they are, will soon be under control.

On arrival at the scene of a fire, the firemen's first concern is the location of the fire-hydrant. Without this essential fixture and the assurance of a steady flow of water at the required degree of pressure, our vaunted fire-fighting organizations would be helpless. Few people realize the important role of the water department in this connection, but every victory of firemen over flames is also a triumph for the water department.

The Duluth Water and Light Department may justly pride itself on its excellent record in the vital job of safeguarding the city from fires. In addition to the abundance of strategically placed

hydrants throughout the city, the Department maintains not a few of them outside of populated districts. To Duluth, especially, this is a necessary and important precaution. There are those who still remember the dreaded days of the "forest fires of 1918" when many neighboring towns were completely destroyed by a blazing inferno. The fierce, wind-driven flames raced toward Duluth but were stopped at its very gates by relentless streams of water pressured to sufficient force to uproot burning trees and turn smouldering leafy mold into a saturated protective band along the endangered, woody fringe of the city.

Citizens of Duluth need have no anxiety over the protection of their homes from the threat of fire. Today, 1,352 hydrants, like alert sentinels, stand guard over the city's safety. Efficient workers, directed by the Water and Light Department, are ever on the job, determined that every one of the thirteen hundred and fifty odd hydrants is supplied with the necessary quantity and pressure of water at all times.

Subm. by: Charles Karson.

WATER RUNS UPHILL SECTION IV.

A History of the

DULUTH WATER AND LIGHT DEPARTMENT.

Management.

Upon the acquisition of the water and gas plants, the city created a Board of Water and Light Commissioners to administrate the affairs of its Water and Light Department. The board consisted of five members appointed by the mayor for terms of five years, one new member being appointed each year.

The first Board of Water and Light Commissioners, appointed by Mayor Henry Truelson, consisted of Charles F. Leland - President, Giles Gilbert - Vice President, Charles A. Duncan, Erastus S. Upham, Hansen evesmith and L. N. Case - Manager and Secretary.

In the spring of 1913 the city adopted its present commission form of government. The charter provides that the Commissioner of Public Utilities be responsible to the City Council for the affairs of the Water and Light Department.

The first Commissioner of Public Utilities was Leonidas Merritt, one of the famous brothers who discovered and opened up the Mesaba Iron Range. He held office from 1913 to 1917.

The first manager of the Department under the new charter was D. A. Reed, who served until his death on July 17, 1929. He was succeeded by E. W. Kelly, who managed the Department until he died on January 30, 1934. The present Manager and Superintendent of the Pumping Station, Felix Seligman, was appointed April 2, 1934.

In the Department Managers, the city was fortunate in finding competent and devoted public servants. Many are the accomplishments of each of these men but it is hardly necessary or possible to go into the details of all the achievements. The present status of the Department is sufficient evidence of the ability of its managers. In a letter to Mayor Snively, dated January 8, 1937, Manager Seligman reveals a unique method used by the Department in coping with the problem of unpaid bills due to unemployment. This is but a sample of the resourcefulness of the men who have headed the work of the Department since its establishment. Mr. Seligman states, "After reviewing the situation in which most of the industries found themselves during the depression years, wherein they had to lay off employees, decrease wages, and, in many cases, entirely close their plants, we can point with justifiable pride and satisfaction to our Water and Light Department and its accomplishments, for the Department, an industry controlled by the City Council, not only carried on without laying off men, but hired thousands of men during the depth of the depression for the purpose of permitting them to pay off their obligations to the Department. In other words, in place of curtailing its activities, as most industries had to do, it increased all of its activities, and regardless of many problems with which it was faced, was able to pay its own way, paying interest on indebtedness and payments on bonds when they became due." Thousands of unemployed took advantage of the Department's offer and worked off their bills to their own and the Department's benefit.

In conformity with the wish of the people of Duluth for an efficient and non-political Department, personnel is selected from city civil service lists.

The success of this policy is testified to by Manager D. A. Reed who, in 1915, had the following to say concerning the employees of the Department:

"The excellent financial condition and the large reduction in number of customers' complaints indicates a better service generally, credit for which is due the Department employees. Too little appreciation is tendered the average employee for his faithful and untiring efforts to maintain efficiency and good service. Not alone is it a question of labor which terminates each work-day's service, but often the addition of several hours into the night to place some trouble service into commission, not operating possibly, because of the customer's own negligence; or to find some leak, or lack of adjustment that explains a high bill. A break in the water main, which may imperil and inconvenience a whole neighborhood, might require twenty to thiry hours continual labor in the cold and wet to repair. The field force have their physical discomforts and the office employees have their mental troubles in dealing with the customers. They find amply opportunity to cultivate such commendable personal traits as patience, cheerfulness, self-restraint and a forgiving disposition.

Subm. by: Charles Karson.

WATER RUNS UPHILL SECTION V.

A History of the

DULUTH WATER AND LIGHT DEPARTMENT.

ORGANIZATION.

The offices of the Department are housed in several buildings. The main building which includes the offices of the manager, the Division of Customers' Accounts and Collections, the Meters Inspection Division, the Accounting Department, the Engineering Division, the Laboratory, the Sales Pormotion Division and the Home Service Bureau, is located at 414-16 West First Street. The Distribution Division functions from its office in the Department Garage Building at 600 Garfield Avenue. A branch office of the Department is located at 330 North 57th Avenue West, where water bills can be paid and applications made for service and meters. Another branch office at 1023 Second Avenue West, serves the customers in Gary and New Duluth.

Emergency service is provided by the Division of Meters and Inspection and the Distribution Division. The Department can be reached at any hour of the day or night by telephoning Melrose 6100.

Upon the receipt of an emergency call, the attendant on duty transmits the message to the person in charge of the interested division. He, in turn, details the appropriate subordinate or subordinates by telephone and issues the necessary directions for meeting the situation. In the Division of Distribution, for example, either the superintendent or his deputy is required to be within reach of the

telephone at all times. This division functions through a system of districts each of which is provided with a responsible foreman. Every foreman or his deputy must be constantly within telephone reach outside of working hours. All of the employees enumerated have prompt access to motor transportation so that it is always possible to have men at the site of an emergency within a half hour or less from the time of the first notice.

Subm. by: Charles Karson.

WATER RUNS UPHILL

A History of the

DULUTH WATER AND LIGHT DEPARTMENT.

CONCLUSION.

Municipal ownership of the gas and water utilities has proved benefical to the people of Duluth. The water supply is pure, cheap and abundant. At their last inspection, the Fire Underwriters rated the Duluth Water Works higher than any other in Minnesota from the standpoint of fire protection. Gas rates are lowest in the United States for manufactured gas. They compare favorably with those charged by private companies handling either natural gas or mixed gas (part manufactured and part natural). Salaries and wages, too, stand up under comparison. During the entire history of the city's ownership of the gas and water plants, all monies required for payment of interest and retirement of bonds have been secured from the funds derived from operation. No taxes have ever been collected for the maintainance of the Department. In 1938 the physical valuation of the gas and water plants was approximately $9,405,011.00, and the bonded indebtedness was only $1,781,000.00.

At the present time the gas and water plants are in good physical condition.

The growth of the business may be summarized as follows: In 1898 there were 941 water consumers; on January 1, 1939 there were 18,817 meters in service. In 1898 there were 1,111 gas consumers; on January 1, 1939 there were 23,052 meters in service.

Judged from every sngle the Water and Light Department has been a success. Duluth has amply cause to be proud of its publicly owned public utilities.

DULUTH WATER AND LIGHT DEPARTMENT.

COMPARISON OF GAS RATES IN THE THREE LARGEST MINNESOTA CITIES.

MINNEAPOLIS (Minneapolis Gas and Light Co.	ST. PAUL (Northern States Power Co.)	DULUTH (Municipal)
1st 400 Cu. ft. or less per mo. ---- $1.00	1st 600 Cu. ft. or less per mo. - $1.00	1st 1000 Cu. ft. or less per mo. --$1.00
Next 1100 " " ---------- .99	Next 1600 " " --------- .74	Next 1000 " " ---------- .75
" 2000 " " ---------- .97	" 2800 " " --------- .72	" 1000 " " ---------- .60
" 3100 " " ---------- .93	" 4500 " " --------- .70	"
Excess ---------- .92	Excess ---------- .69	Excess ---------- .57
Minimum monthly bill - $1.00 (net)	Minimum monthly bill - -$1.05 (net)	Minimum monthly bill ------ .25
Residential heating ------ $.72	To commercial and industrial users consuming 60% during day:	To consumers with combination capacity for commercial, heating and residential use - 45¢ per M cu. ft., minimum monthly bill--.75¢
Additional 10% on bills not paid within discount peroid.	1st 500,000 cu. ft. - $325.00 net per mo.	To industrial establishments with capacity in excess of all requirements for domestic, commercial and space-heating consumers:
	Next 500,000 cu. ft. -$ .60 per M. ft.	1st 25,000 cu. ft. -- $14.50
	" 500,000 " " - 55¢ per M. ft.	All over 25,000 cu. ft. -- 40¢ perM.
	" 500,000 " " - 50¢ per M. ft.	
	Minimum monthly bill - $325.	

ELY - map ①

Reid. 11/12/36

ZENITH MINE: On Highway #1 into Ely from Illgen City, follow Highway #35 from its junction with #1, and continue north about 7 blocks to [redacted] where mine road branches off from the left, follow mine road, which is 2 blocks long, to mine.

[redacted]

PIONEER MINE: On Highway #1 (Sheridan Street---main business thoroughfare), turn right (north) on Central Avenue, cross railroad tracks, 2 blocks north of Sheridan Street, and keep to the right on Sandy Point Road to fork of roads; then turn right (south) on road to mine. This is the B-shaft of

[redacted]

of the Pioneer Mine. It is approximately one-half mile to the shaft from the railroad crossing.

To reach the A-shaft of the Pioneer Mine, continue on #1 west to Eighth Avenue, turn right (north), cross railroad tracks, and continue to mine shaft. It is about one-quarter of a mile from Sheridan Street (#1) to the shaft.

SIBLEY MINE: Take the same road (Sandy Point) as when going to B-shaft of Pioneer Mine, continuing straight ahead (east) from the fork of the roads, where road turns right (south) to B-shaft, to mine. It is approximately one-half mile to the Sibley Mine from the place where continuing on State Street approximately three-quarters of a mile to mine. On the way to the mine you pass under a Great Northern railroad bridge. (Not operating at present.)

The road to the B-shaft of the Pioneer mine. Turn left.

SOUDAN - map ②

SOUDAN MINE: On Highway #1 from Ely, turn right (north) on road at east end of town, continuing straight ahead to mine. It is about 5 blocks to the mine from Highway #1. Men work below sea level.

Page 2.

EVELETH – Map (3)

FAYAL MINE: Approaching Eveleth from Duluth on Highway #53, after the highway makes turn west, turn left (south) at the intersection of Highway #53 and mine road, where there is a building known as Fayal Apartments. Follow the road to the mine, which is about a mile from Highway #53. (The mine is now abandoned.)

ADAMS-SPRUCE MINE: On Highway #53 from Duluth, instead of turning right on Grant Ave. into Eveleth, keep on straight ahead (west) on Fayal Road until at mine. It is 5 blocks west of the intersection of Fayal Road and Grant Avenue, where Highway #53 makes the turn into the city.

LEONIDAS MINE: On Highway #53 from Duluth, follow the same way as going to the Adams-Spruce Mine past the intersection of Fayal Road and Grant Avenue, turning left (south) when 3 blocks west of the intersection. Continue to the mine, which is about 2 miles from the intersection of Fayal Road and Grant Avenue.

VIRGINIA – Map (4)

MISSABE MOUNTAIN MINE: On Highway #53 from Eveleth or Duluth, turn right on Chestnut Street (the main business street in Virginia), and go 3 blocks to the end of the street, where there is a tourist reviewing stand. The mine is at the foot of Chestnut Street.

MOUNTAIN IRON — map (5)

MOUNT IRON MINE: Going west to Mountain Iron on Highway #169, turn to the right (north) on Mountain Avenue, at the intersection of which is the Village Hall and Public Library, and continue for two blocks till at pit. (This open pit was abandoned many years ago.)

WACOOTAH MINE: Going west to Mountain Iron on Highway #169, turn left (south) off the highway when approximately one-half mile from town, in the vicinity of which there are a few houses, continue for about 3 blocks, and then turn left (east), and go about one block to mine. The road into the mine is the first one branching off the highway when approaching Mountain Iron from the east.

BUHL — map (6)

WABIGON MINE: Going into Buhl from the east on Highway #169, known as Pennsylvania Avenue in the city, continue straight ahead on Pennsylvania Avenue to State Street, turn right (north), continuing on State Street approximately three-quarters of a mile to mine. On the way to the mine you pass under a Great Northern railroad bridge. (Not operating at present.)

GRANT MINE: Coming into Buhl on Highway #169 from the east, continue straight ahead, instead of turning on Forest Street where Highway #169 turns south, on Pennsylvania Avenue, till at mine. It is about one-half mile to the mine from the intersection of Pennsylvania Avenue and Forest Street.

CHISHOLM — map (7)

SHENANGO MINE: Going toward Chisholm from the east on Highway #169, when about one-half mile west of Fraser, and approaching highway bridge over railroad, turn right (north) on first road off the right, go 5 blocks to end of auto road, and walk one block to mine. (There is an observation platform at the pit, and also a stairway into the pit.)

HIBBING - map (8)

HULL-RUST-MAHONING MINE: On ~~U/S~~. Highway #169 from Virginia into Hibbing (Howard Street---main business thoroughfare), turn right (north) on Third Avenue, cross Great Northern Railroad tracks, one block north of Howard, and continue along Third Avenue Boulevard until at open pit. At the end of Third Avenue Boulevard turn left (west) to get to observation tower. It is

approximately one and one-half miles to the open pit from the intersection of Highway #169 (Howard Street) and Third Avenue Boulevard.

KEEWATIN – map (9)

MESABI CHIEF MINE: Going west from Keewatin on Highway #169, continue for about a mile, and turn right (north) on mine road just before getting to overhead bridge, continuing straight ahead to the mine, which is approximately one-half mile off the highway.

SARGENT MINE: After turning off Highway #169 to go to the Mesabi Chief Mine, turn right (east) after about one-quarter of a mile from the highway, and follow road, almost three-quarters of a mile, to mine.

MESABI CHIEF WASHING PLANT: Continuing west on #169 past Keewatin, turn left (south) after passing under overhead bridge, which is a little over a mile from town, and continue to plant; it is about one-quarter of a mile off highway. (Tourists are taken through washing plant.)

NASHWAUK – map (10)

HAWKINS MINE: Going through Nashwauk on Highway #169 (Central Avenue---main business thoroughfare), instead of turning on highway, intersection of Central Avenue and First Street, continue to mine, which is at the extreme west end of Central Avenue. It is a couple of hundred feet to the open pit from the intersection. (The mine can be partly viewed from the street.)

CALUMET – map (11)

HILL-ANNEX MINE: Going west on Highway #169 through Calumet, turn right (north) on Gary Street (main business street), at the intersection of which there are two filling stations, continue for 2 blocks, turn right (east), go 2 blocks, and then turn left (north), continuing one-quarter of a mile to the pit. (The whole pit can be seen from an automobile.) (The Hill-Annex is all-electrified, the biggest electrical shovels---10 cubic yard buckets---on the range being in use there.)

HILL-ANNEX WASHING PLANT: Going west on Highway #169 through Calumet, turn left (south) on Gary Street, continue for about 3 blocks, then turn left (east), continuing on road for about a mile to the plant.

HILL-TRUMBULL WASHING PLANT: Turning off Gary Street in Calumet, as when going to Hill-Annex Washing Plant, continue straight ahead (south) to the plant, which is about 5 blocks south of Highway #169.

MARBLE — map (12)

HILL-TRUMBULL MINE: Going west on Highway #169, turn right (north) on road just east of Marble, and continue straight ahead for approximately one-half mile to the open pit.

ARCTURUS MINE: Going west on Highway #169, turn right (north) on ~~road~~ road just east of Marble, continue for 4 blocks, turn left (west), and continue on road for about 2 miles to pit.

BOVEY — map (13)

WALKER-DANUBE MINE: Going west on Highway #169, turn right (north) on main business street in Bovey, and continue ~~north~~ for about one-half mile to the Walker-Danube Mine.

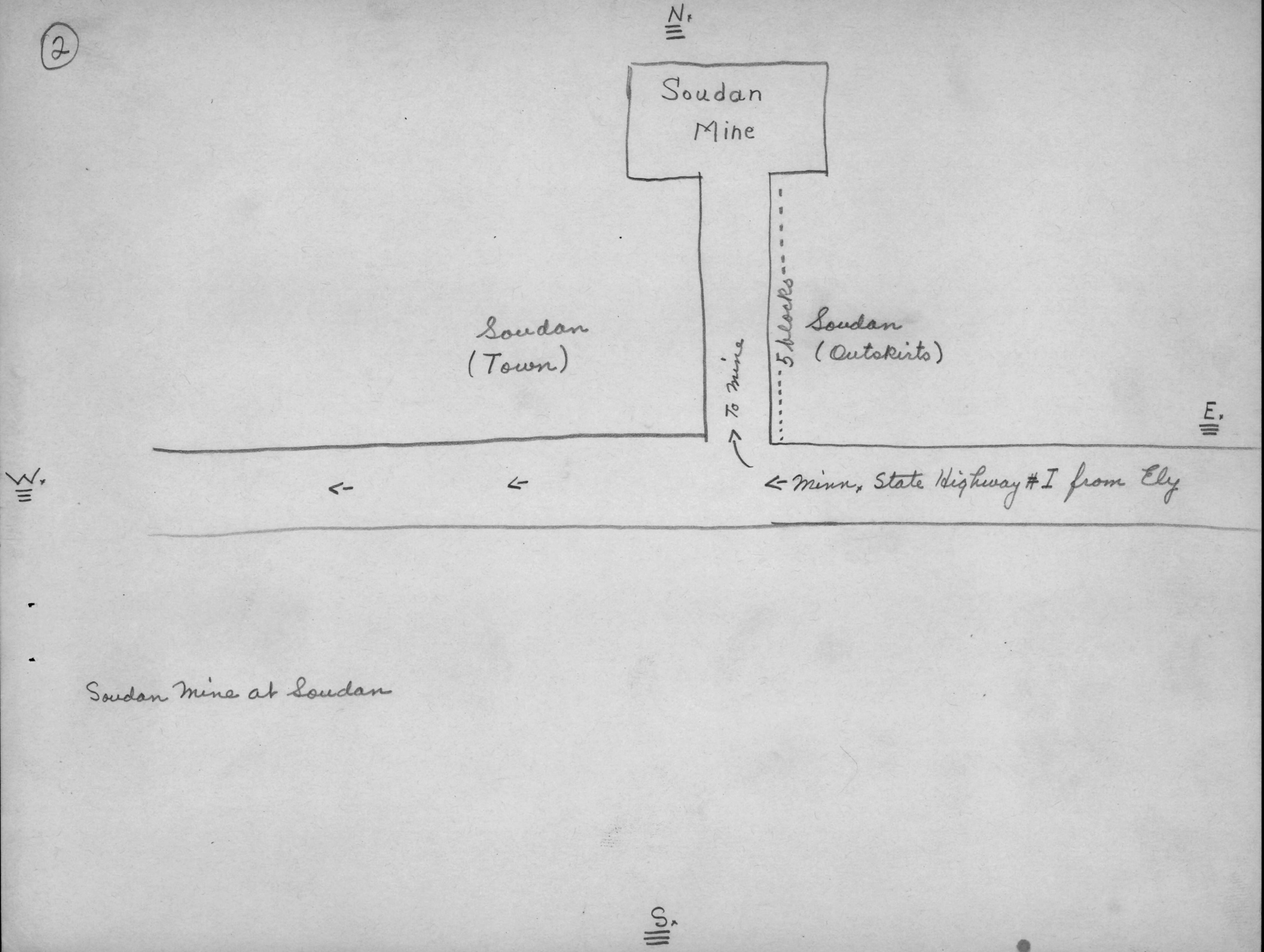
COLERAINE — map (14)

TROUT LAKE WASHING PLANT: Going west on Highway #169, after leaving Bovey, instead of turning right on highway to go into Coleraine, turn left (east), and follow road to plant. It is approximately one and one-quarters of a mile to the plant from Highway #169. (It is the largest iron-ore washing plant in the world.)

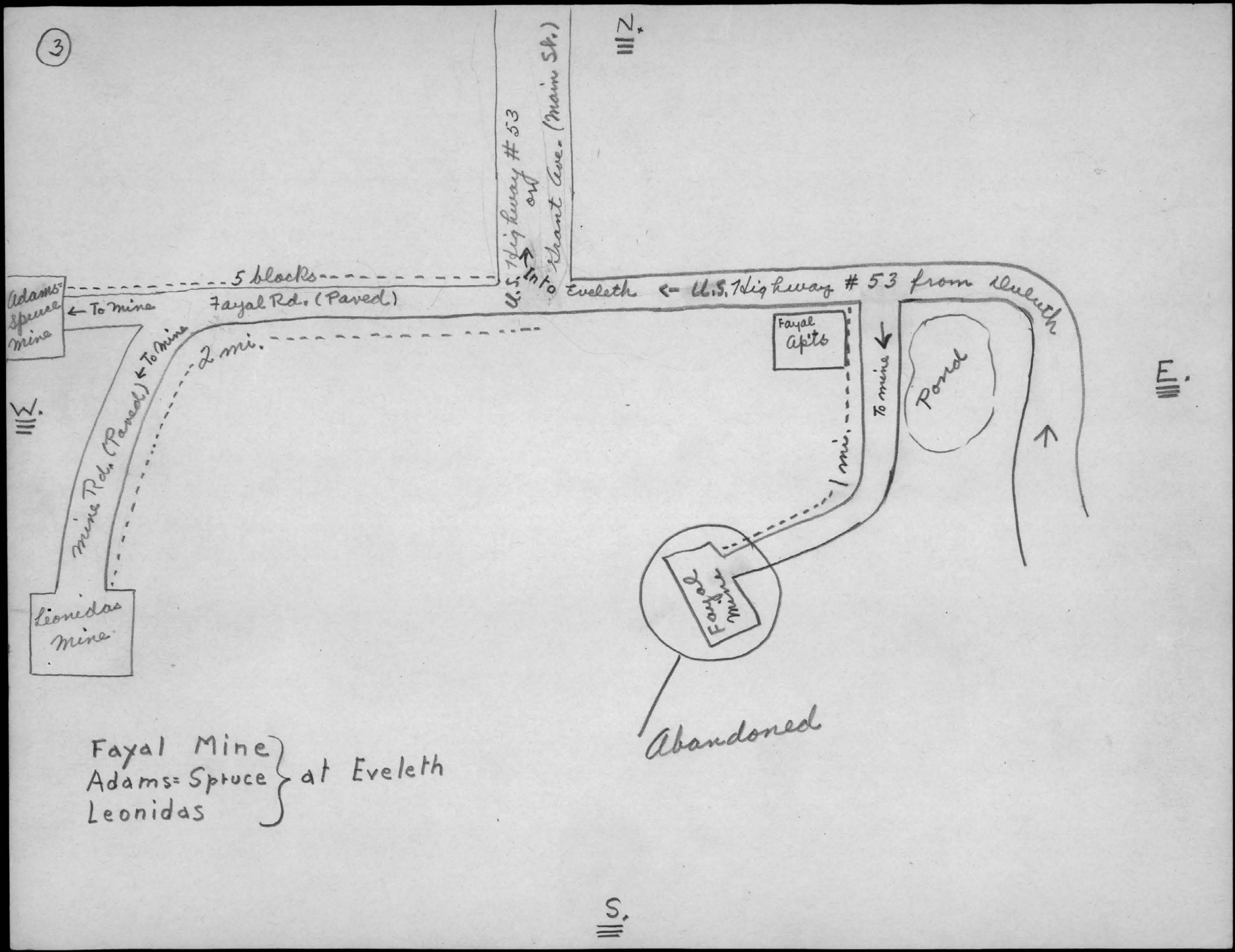
GRAND RAPIDS — map (15)

GREENWAY MINE: Going into Grand Rapids from Hibbing on Highway #169, turn right (north) on Third Avenue East, 3 blocks past Sixth Avenue East, where Highway #2 intersects with Highway #169, continue 7 blocks, turn right (east) on Eleventh Street and follow one block, turn left (north), continue one block to Twelfth Street, turn right (east), go about one-quarter of a mile, then turn left (north), and continue for about 2 miles to the mine, which is at the end of the road. It is approximately 3 miles to the open pit from Highway #169.

(2)

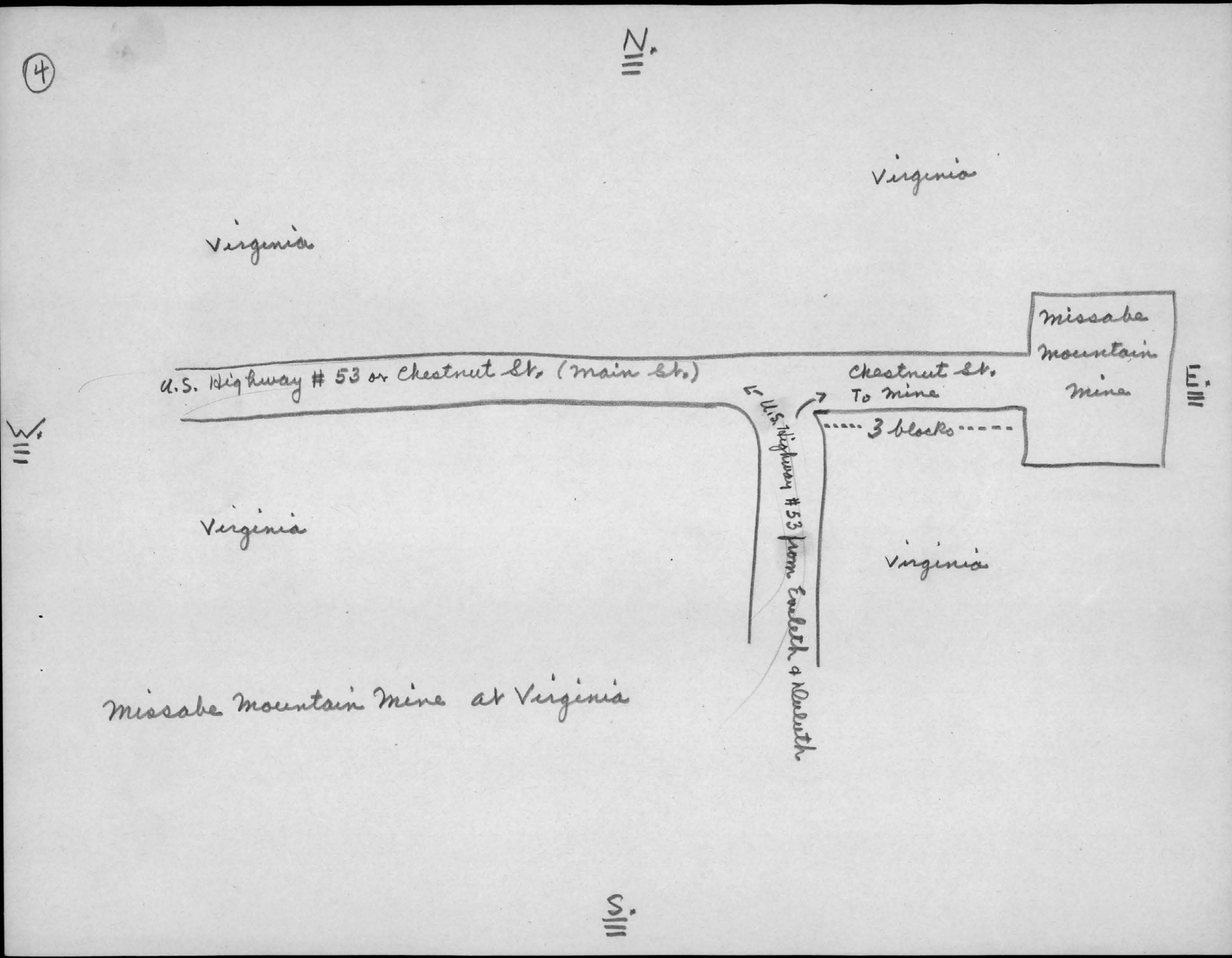


Soudan Mine at Soudan



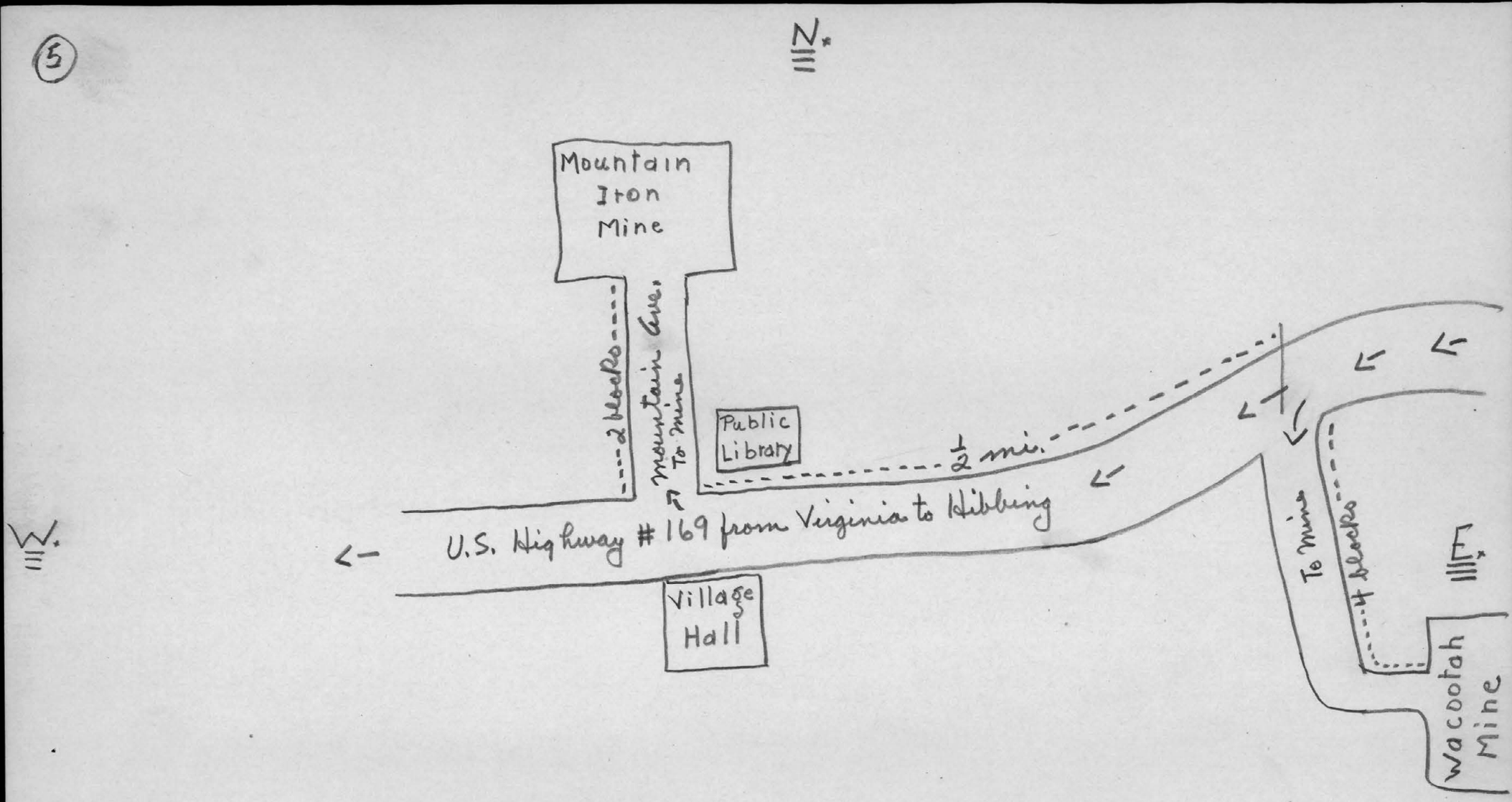
Fayal Mine
Adams-Spruce
Leonidas
} at Eveleth

(4)



Missabe Mountain Mine at Virginia

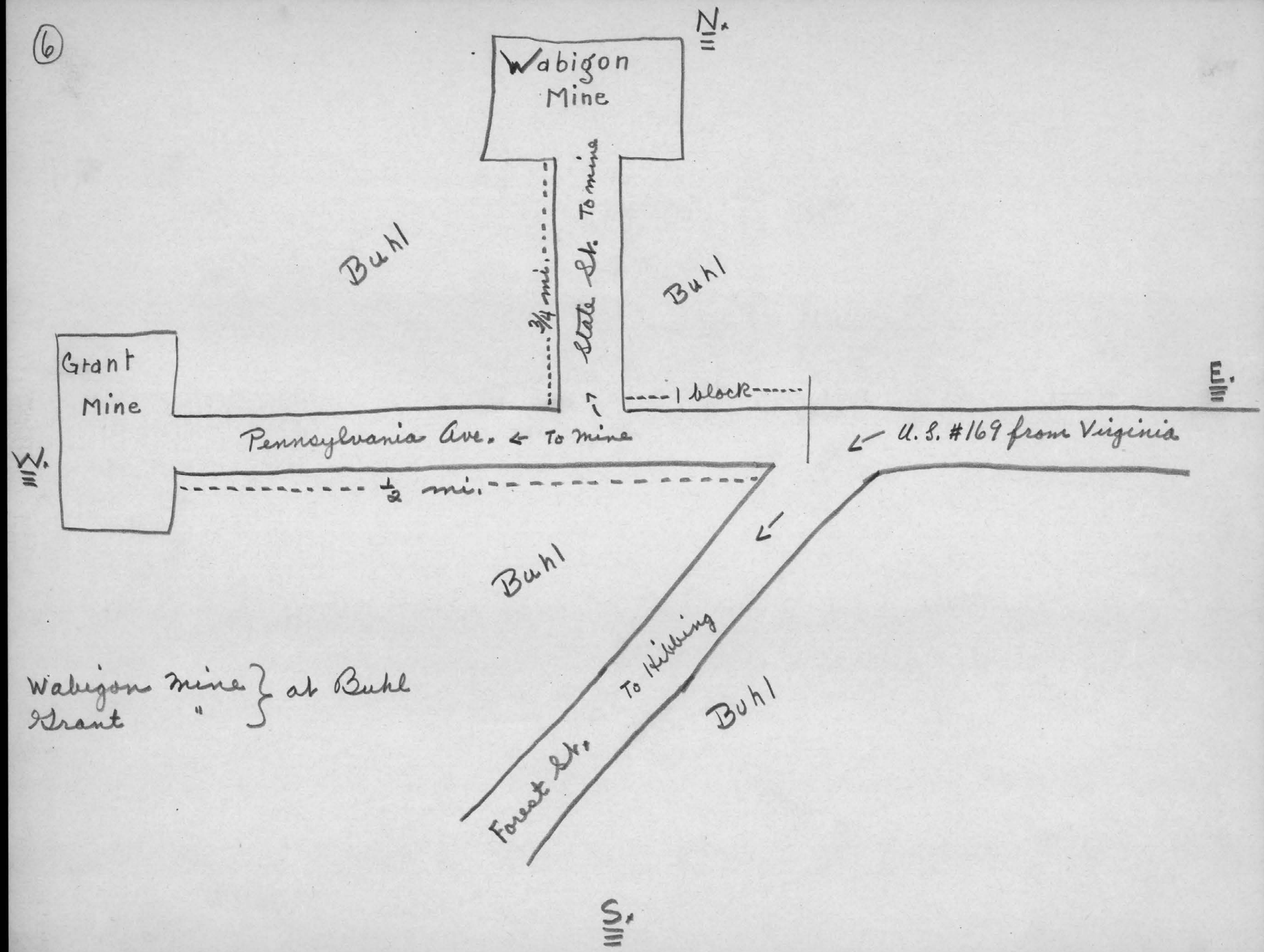
(5)



S.

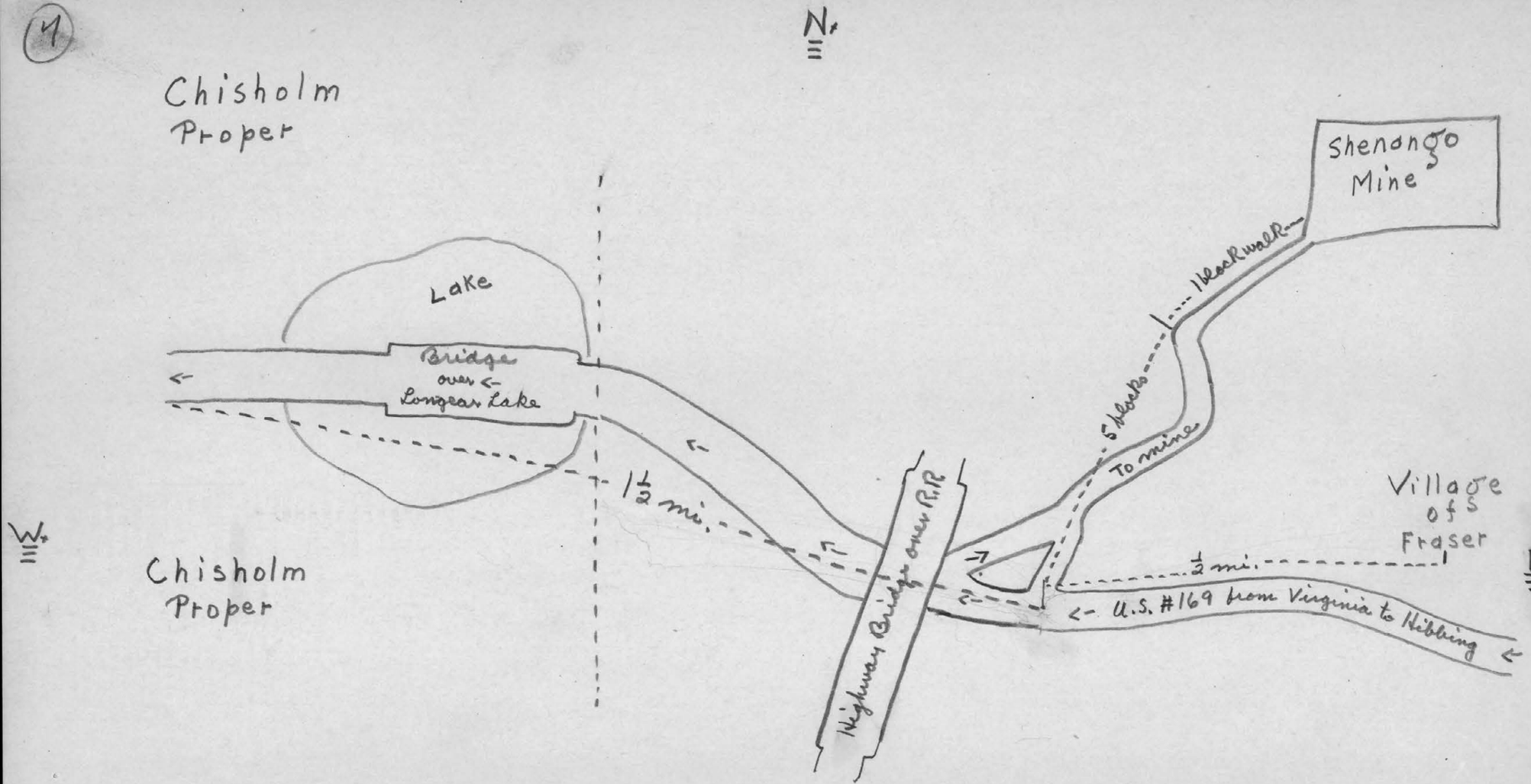
mountain Iron Mine } at Mountain Iron
Wacootah " }

(6)



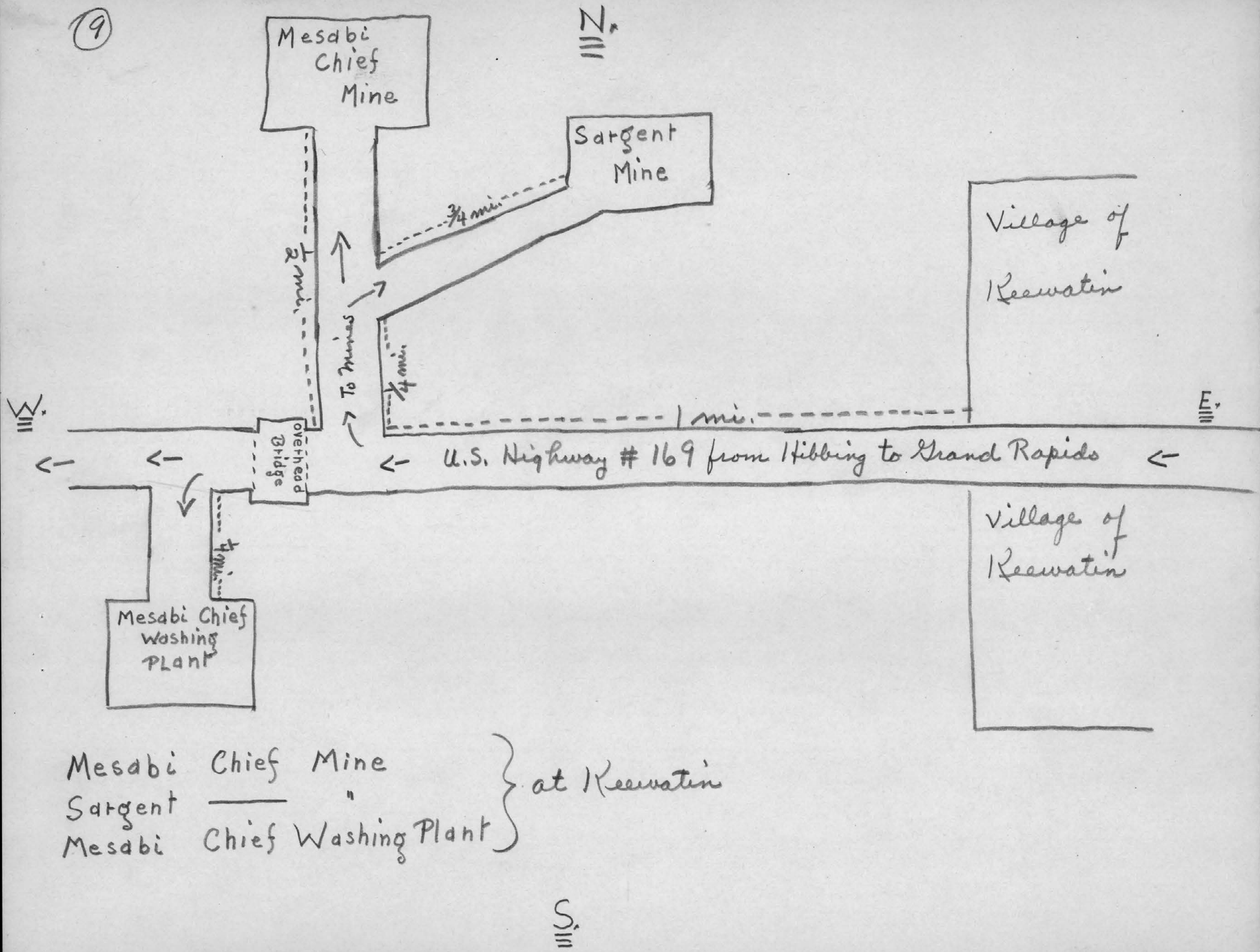
Wabigon mine } at Buhl
Grant " }

(4)



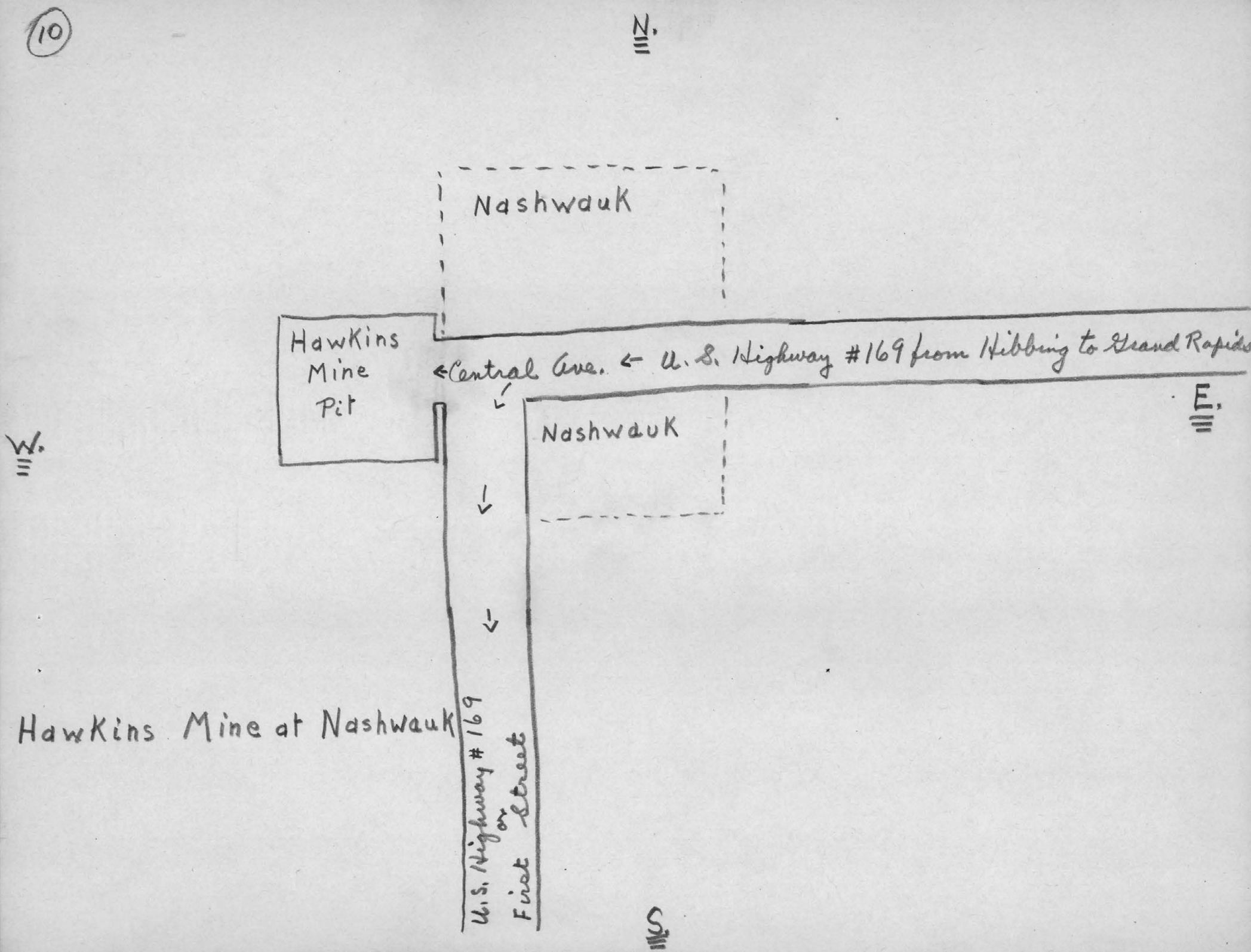
Shenango mine at Chisholm

(9)

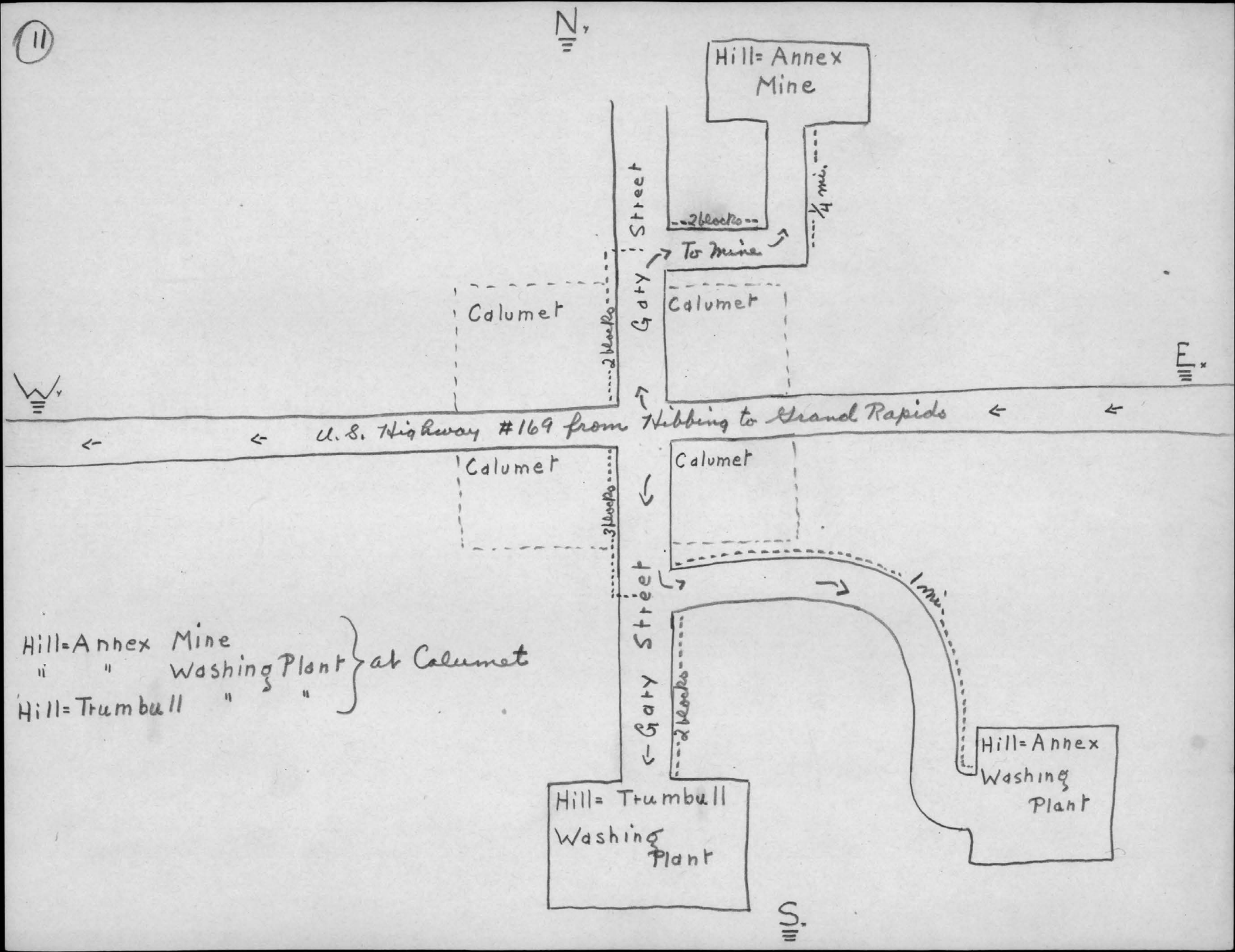


Mesabi Chief Mine
Sargent " } at Keewatin
Mesabi Chief Washing Plant

(10)

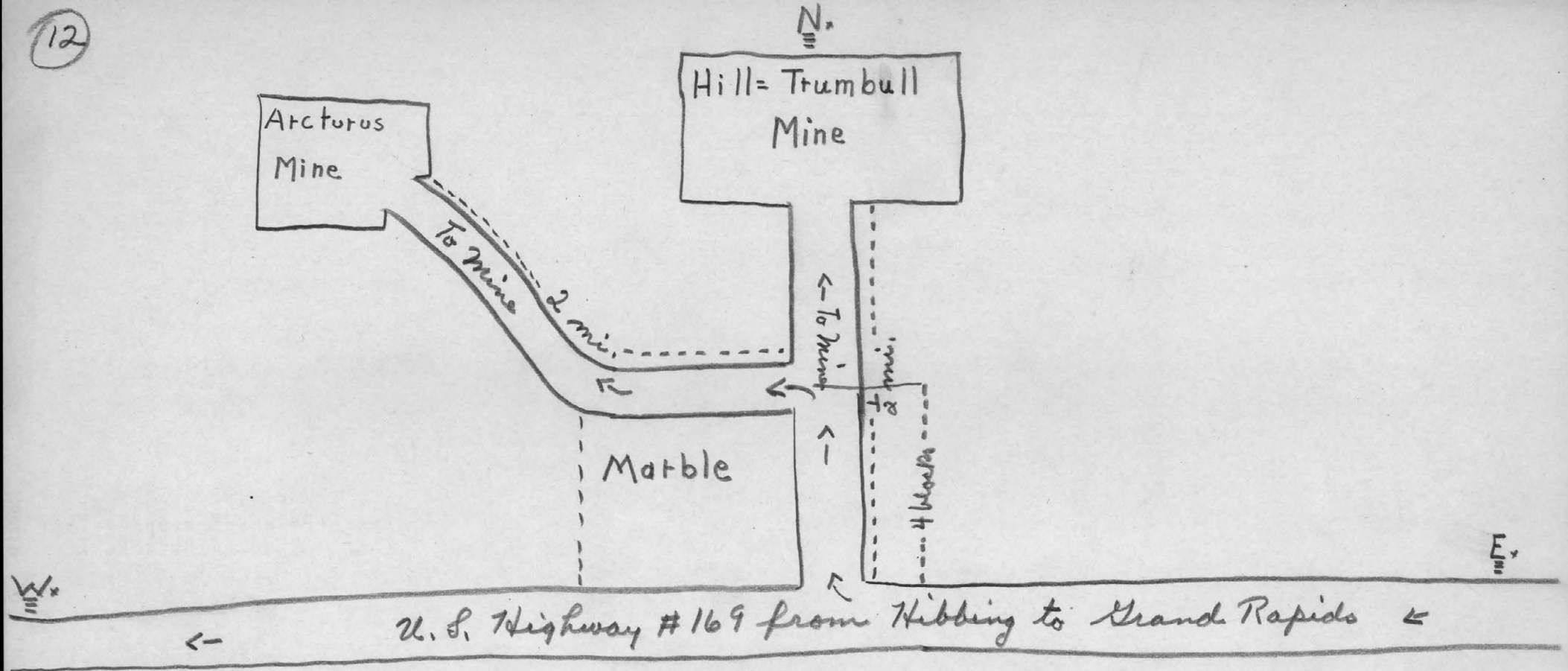


Hawkins Mine at Nashwauk



Hill-Annex Mine
" " Washing Plant } at Calumet
Hill-Trumbull " "

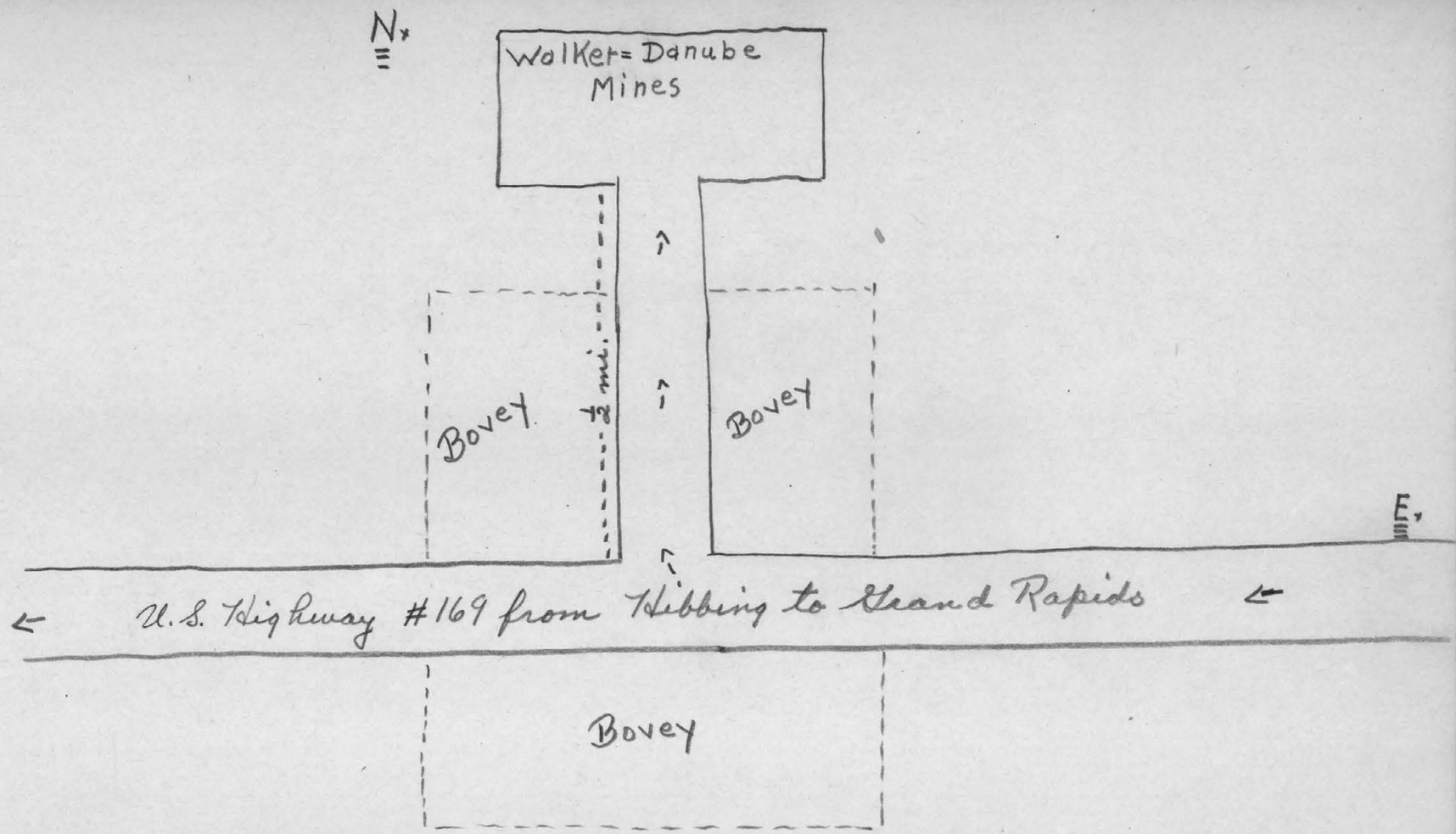
(12)



Hill-Trumbull Mine } at Marble
Arcturus "

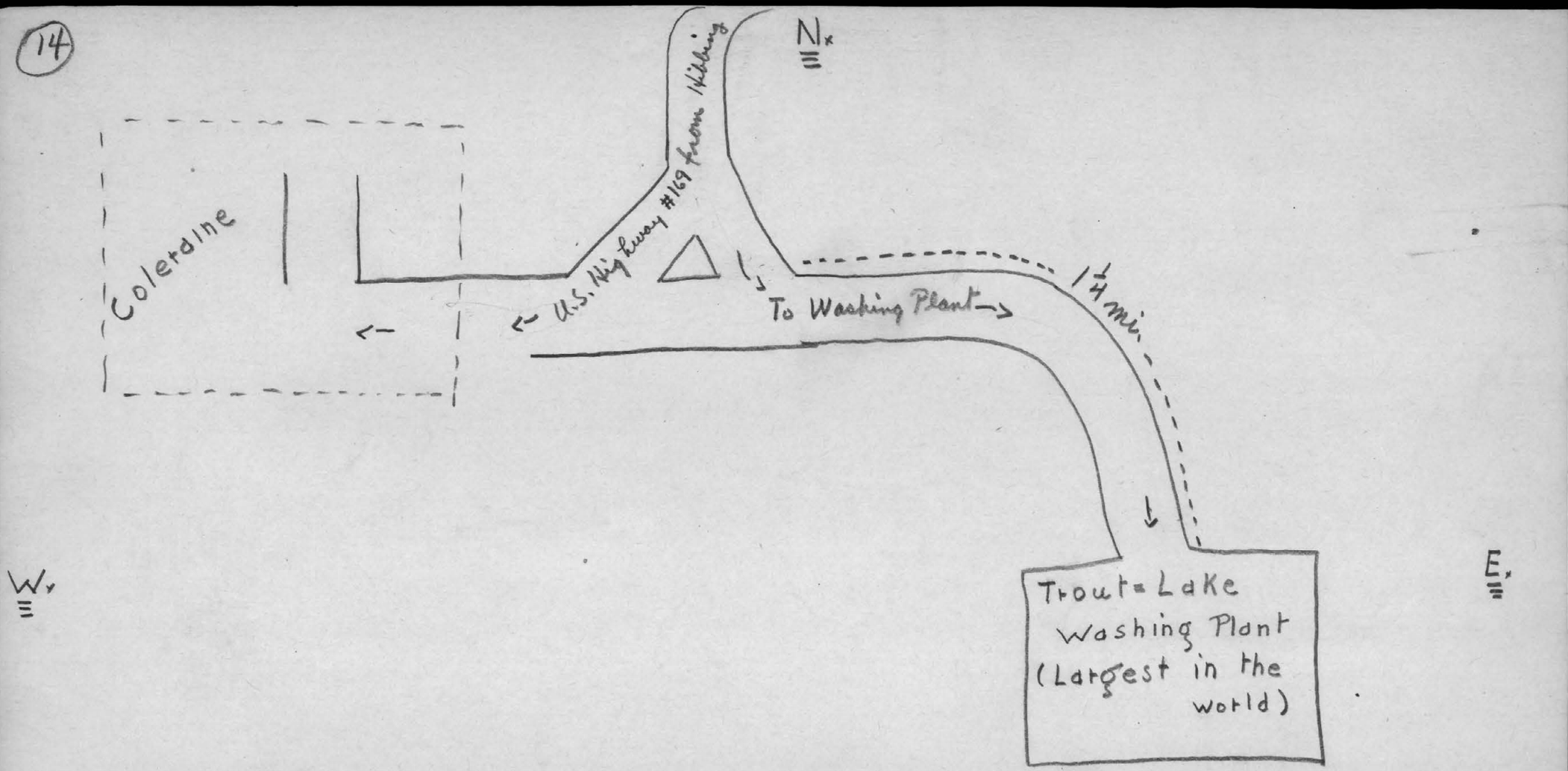
Sin

(13)



Walker-Danube Mines at Bovey

(14)



Trout-Lake Washing Plant at Coleraine
(Largest in World)

15

Greenway Mine at Grand Rapids