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NORTH DAKOTA STATE AGENCY
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Seventh Biennial Report

OF THE

State Engineer

TO THE

Governor of North Dakota

For the Biennial Period Ending
June 30, 1916

WATER COMMISSION
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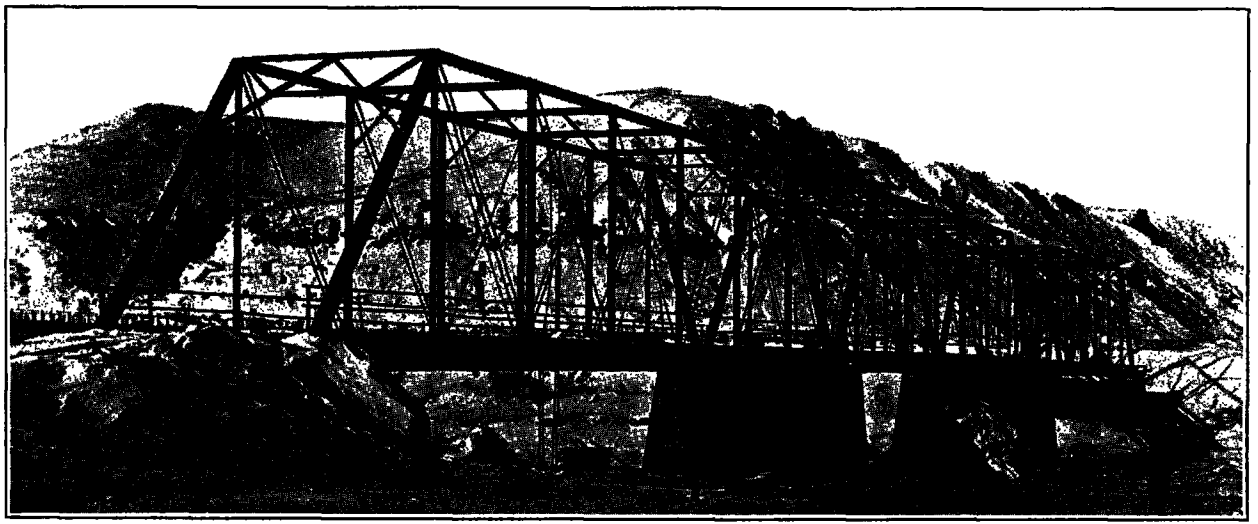


Bridge Over the Little Missouri River at Medora. Desig ned by the State Engineer's Office. Built by the Illinois Steel Bridge Company of Minneapolis. Length 405 Feet. Total Cost of Bridge and Approaches, $20,000.

Courtesy of Doubleday & Myers, Dickinson, N. D.

LETTER OF TRANSMITTAL

Bismarck, North Dakota, September 1, 1916.

HONORABLE L. B. HANNA, Governor.

Sir: In accordance with the provisions of our statutes I have the honor to transmit herewith a report of the transactions of the department of the state engineer for the biennial period, July 1, 1914, to June 30, 1916.

Very respectfully yours,

JAY W. BLISS,
State Engineer.

PERMANENT OFFICERS AND EMPLOYEES, JULY 1, 1916

Jay W. Bliss.....State Engineer
Harris Robinson.....Assistant State Engineer
K. P. Senstad.....Assistant State Engineer
Ruby Schumann .....Stenographer

LIST OF OFFICERS AND EMPLOYEES IN THE STATE ENGINEER'S OFFICE DURING BIENNIAL PERIOD

Jay W. Bliss.....State Engineer
W. B. Stevenson (July 1, 1914, to May 3, 1916)..Assistant State Engineer
Harris Robinson (Nov. 15, 1914 to June 30, 1916)....Coal Mine Inspector
W. H. Robinson (Dec. 8, 1914, to Feb. 13, 1915).....Coal Land Inspector
J. M. Hansen (Dec. 16, 1914 to Feb. 18, 1915).....Coal Land Inspector
J. M. Hansen (Mar. 1, 1916 to Mar. 27, 1916).....Draughtsman
Lorenzo Belk (Feb. 17, 1916, to April 14, 1916).....Field Man
L. W. Burdick (May 29, 1916, to June 27, 1916).....Instrument Man
J. H. Moore (June 19 to 30, 1916).....Field Man
Benjamin Cloud (April 8 to May 22, 1915).....Stenographer
Hazel Arnold (July 24 to Aug. 15, 1915) .....Stenographer
Ruby Schumann .....Stenographer

INTRODUCTION

The state engineer was appointed to his present position following the resignation of Mr. T. R. Atkinson, April 7, 1913, until the convening of the 1915 legislature. He was reappointed state engineer by Governor L. B. Hanna, for a period of four years from April 1, 1915.

The state engineer has at all times endeavored to adminster the affairs of his office economically and efficiently, and with this end in view has co-operated with the United States Geological Survey, the State Geological Survey, the United States Office of Public Roads, the United States Reclamation Service, the United States Bureau of Mines, the College of Mining Engineering, and the various county and township road officials.

Particular efforts have been directed toward making the office of service to the various counties in their road and bridge work, and the state engineer has endeavored to take advantage of every opportunity open to him to promote interest in the building and maintaining of better roads.

ACKNOWLEDGMENTS

The state engineer wishes to acknowledge the special credit due to the various county auditors and county surveyors who have frequently furnished the office with much valuable information.

Also to extend the thanks of the office to the various mine owners and operators for the prompt and complete mine reports they have furnished on request, and for courtesies met with during the inspection of the mines;

Also to thank the United States Office of Public Roads, the United States Reclamation Service and the United States Bureau of Mines for valuable suggestions, aid and information;

To acknowledge special credit due to E. F. Chandler, Assistant Engineer of the United States Geological Survey, who has supplied a valuable unit of this report; to E. J. Babcock, Dean of the College of Mining Engineering, for valuable suggestions relative to mine inspection work, and for analyses of cement, sand and gravel; and to A. J. Becker, Professor of Mechanical Engineering at the State University, for tests made of samples of concrete;

To express the appreciation of the department to the officers of the state highway commission of Minnesota for plans furnished, aid in road and bridge work, and information given to a representative of this office who spent several days in their offices.

The state engineer wishes to express his sincere appreciation of the services of his office and field assistants, and of their loyalty and interest in the work of the office.

FINANCIAL STATEMENT.

July 1, 1914, to June 30, 1915.

Balance in fund July 1, 1914	$3,634.81
Credit by appropriation	3,000.00
Credit by receipts for field notes	415.07
Credit by transfer	26.00
	$7,075.88
Less expenditures	6,903.08
Balance in fund June 30, 1915	$172.80

NOTE.—A bill of $216.29 for office supplies from July 1, 1913, to July 1, 1915, and for postage stamps from March 1, 1914, to July 1, 1915, furnished from the Maintenance of Capitol Fund, should have been transferred to the fund for the Promotion of Irrigation had there been a sufficient balance to take care of it.

Total receipts of office	$697.53
Less receipts for Surveyor General's records	415.07
Credited to General Fund	$282.46

July 1, 1915, to June 30, 1916.

Credit by appropriation	$16,200.00
Credit by collections	258.90
	$16,458.90
Less expenditures	7,770.83
Balance in fund June 30, 1916	$8,688.07

Total receipts of office	$568.20
Less receipts for Surveyor General's records	258.90
Credited to General Fund	$309.30

FINANCIAL STATEMENT IN ACCORDANCE WITH THE SUBDIVISIONS OF THE APPROPRIATION FOR THE STATE ENGINEER'S OFFICE UNDER THE BUDGET BILL.

July 1, 1915, to June 30, 1916.

SALARY—STATE ENGINEER.

Credit by appropriation	$5,000.00
Less expenditures	2,499.96
Balance	$2,500.04

SALARY—ASSISTANT STATE ENGINEER.

Credit by appropriation	$3,600.00
Less expenditures	1,309.19
Balance	$2,290.81

SALARY—FIELD MEN.

Credit by appropriation	$1,000.00
Less expenditures	756.70
Balance	$243.30

SALARY—STENOGRAPHER.

Credit by appropriation	$2,000.00
Less expenditures	1,048.35
Balance	$951.65

POSTAGE.

Credit by appropriation	$175.00
Less expenditures	98.18
Balance	$76.82

OFFICE SUPPLIES.

Credit by appropriation	$750.00
Less expenditures	467.12
Balance	$282.88

FURNITURE AND FIXTURES.

Credit by appropriation	$75.00
Less expenditures	57.20
Balance	$17.80

TRAVELING EXPENSE.

Credit by appropriation	$2,100.00
Less expenditures	946.44
Balance	$1,153.56

PRINTING.

Credit by appropriation	$500.00
Less expenditures	65.27
Balance	$434.73

TELEPHONE AND TOLL.

Credit by appropriation	$100.00
Less expenditures	42.70
Balance	$57.30

TELEGRAMS.

Credit by appropriation	$20.00
Less expenditures	3.40
Balance	$16.60

FREIGHT, EXPRESS AND DRAYAGE.

Credit by appropriation	$80.00
Less expenditures	19.33
Balance	$60.67

CO-OPERATION—U. S. G. S.

Credit by appropriation	$800.00
Less expenditures	456.99
Balance	$343.01

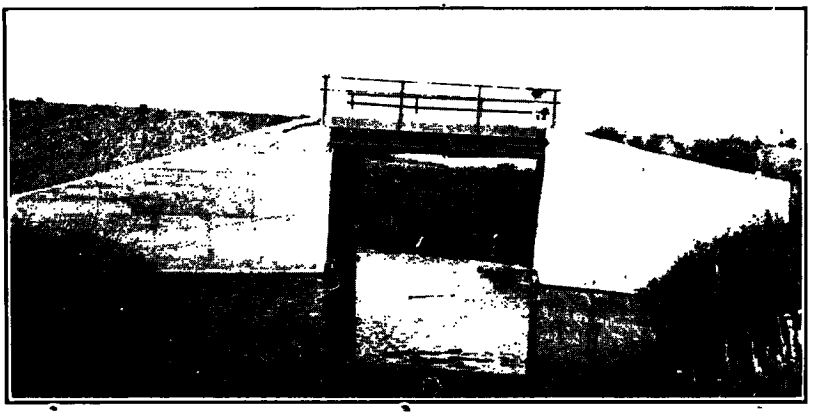
STATEMENT OF SUCH SALARIES AND EXPENSES AS HAVE BEEN PAID TO EMPLOYEES OF THE STATE ENGINEER'S OFFICE BY STATE DEPARTMENTS, COUNTIES AND OTHER ORGANIZATIONS FOR WHOM WORK HAS BEEN DONE:

July 1, 1914, to June 30, 1915.

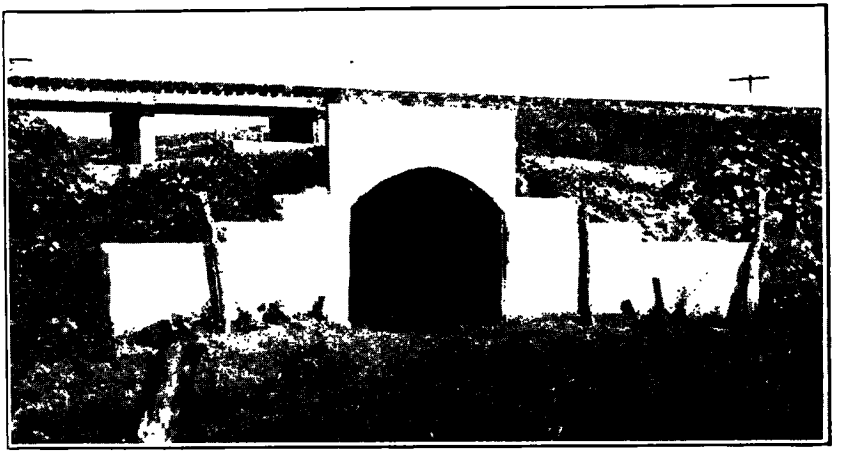
Name.	Description of Work.	Time	Rate	Salary	Expense
	JULY, 1914.				
Paul Grambs	Land Commissioner's Map	23½ days	$1.29	$30.32	
W. B. Stevenson	Pembina County Drainage	12 days	2.75	33.00	$41.39
W. B. Stevenson	Icelandic Coulee Drainage	2 days	2.75	5.50	3.70
Jay W. Bliss	Mayville Bridge Inspection				11.35
O. D. Patterson	Wells County Bridge Inspection	27 days	2.42	65.32	
	AUGUST, 1914.				
W. B. Stevenson	Pembina County Drainage	8 days	2.75	22.00	
W. B. Stevenson	Logan County Bridge Work	10 days	2.75	27.50	5.15
W. B. Stevenson	Mercer County Bridge Work	8 days	2.74	21.92	6.05
O. D. Patterson	Land Commissioner's Map	5¾ days	2.42	13.90	
Paul Grambs	Land Commissioner's Map	1 month	50.00	50.00	
P. W. Thomas	Land Commissioner's Map	4 days	3.00	12.00	
P. W. Thomas	Tracing for State Fire Marshal	14 hours	.35	4.90	
R. C. Spalding	Tracing for State Fire Marshal	18 hours	.75	13.50	
	SEPTEMBER, 1914.				
W. B. Stevenson	Kidder County Road Work	24 days	3.33	80.00	6.00
W. B. Stevenson	Mercer County Bridge Work	1½ days	3.33	5.00	
Thorn Dickinson	Mercer County Bridge Work	3 days	10.00	30.00	
Jay W. Bliss	Mercer County Bridge Work				11.30
	OCTOBER, 1914.				
W. B. Stevenson	Mercer County Bridge Work	7 days	3.23	22.61	33.65
	NOVEMBER, 1914.				
W. B. Stevenson	Mercer County Bridge Work	2½ days	3.34	8.35	
	JANUARY, 1915.				
W. B. Stevenson	Mercer County Bridge Work				10.60
	APRIL, 1915.				
H. Robinson	Inspecting proposed road in Sec. 16-143-104 for Land Department				27.75
W. B. Stevenson	Mercer County Bridge Work				9.05
W. B. Stevenson	Mercer County Bridge Work				11.67
W. B. Stevenson	Mercer County Bridge Work				14.40
W. B. Stevenson	Mercer County Bridge Work			32.43	

	MAY, 1915.				
W. B. Stevenson	Mercer County Bridge Work			54.84	54.92
	JUNE, 1915.				
W. B. Stevenson	Mercer County Bridge Work	5 days	3.85	19.25	15.35
W. B. Stevenson	Pembina County Drainage	1½ days	3.85	5.78	
Total				$558.12	$262.33
	JULY 1, 1915, TO JUNE 30, 1916				
	DECEMBER, 1915.				
W. B. Stevenson					3.00
Jay W. Bliss					28.15
H. Robinson					3.00
	MAY, 1916.				
H. Robinson	McLean County Court House—Improvement of grounds	25 days		80.64	28.85
H. Robinson	City of Washburn	1 day		3.23	
	JUNE, 1916.				
H. Robinson	McLean County Court House—Improvement of Grounds	1 month		100.00	19.60
H. Robinson	McLean County Court House—Improvement of Grounds				50.39
L. W. Burdick	Lakota Township Road Work	13 days		43.87	
Total				$227.74	$132.99

NOTE.—The employees of the office received no compensation from the state for the time given in the foregoing tables. No expense bills shown in these tables have been presented to the state.



Burleigh County Bridge on Road North of Bismarck. Cracks in Abutments Due to Settling and to the Pressure of the High Bank. Reinforced Concrete I Beam Type.



Reinforced Concrete Culvert and Cattle Pass Near Baldwin, Burleigh County.

SUMMARY OF STATE ENGINEER'S DUTIES AS PRESCRIBED BY LAW

The state engineer's office was created by the 1905 Legislative Assembly by the adoption of the Irrigation Act. The important work of the office for several years was the making of preliminary investigations of water supply and of irrigable lands in the western part of the state.

Under Section 8301 of the Compiled Laws of 1913, it is required of the state engineer to co-operate with such counties as may request engineering assistance in drainage work, since the state is so located that while irrigation is beneficially practiced in the western part, drainage is essential in many eastern counties.

Section 8239 of the Compiled Laws of 1913 makes the state engineer ex-officio state coal mine inspector, and under his direction the inspection of lignite coal mines is made. At the request of the board of university and school lands he shall examine any lands belonging to the state by virtue of the Enabling Act and report as to whether they are coal bearing or not within the meaning of the constitution.

Article 7, Chapter 6 of the Compiled Laws makes the state engineer custodian of the township plats, field notes and maps of the surveys of the public lands of the state and authorizes him to furnish such copies as may be required, charging such fees as may be prescribed by the governor, secretary of state and attorney general.

Section 1990k of the Compiled Laws requires that the state engineer shall furnish any county superintendent of highways, upon request, any information or bulletins on road construction or maintenance that he may have at his command, and it is his duty to attend road institutes in each county whenever possible.

Sections 602 and 603 of the Compiled Laws provide for a state highway commission consisting of the governor, the state engineer and one other member appointed by the governor, the state engineer to be secretary of the commission. It is required of the state engineer that he shall have prepared maps of the various counties of the state, showing the locations of all roads and the various bridges and culverts.

Sections 1983 and 1984 of the Compiled Laws make it the duty of the state engineer, whenever requested by any board of county commissioners or any board of township supervisors, to prepare plans for bridges or culverts or to examine and report on existing structures, and to charge for such work a fee of ten dollars per day and traveling expenses.

RECOMMENDATIONS

State Aid for Roads

The Federal aid bill, adopted by Congress, and made a national law by the President's signature on July 11, 1916, brings the subject of state aid squarely before the State of North Dakota. The Federal aid bill contemplates co-operation on the part of the various states and requires that half of the cost of the construction of roads be paid by the states or counties. It further provides that in those staes where the constitution does not prohibit the granting of state aid, that fifty per cent of the cost of construction be paid by the state, and provides that the work shall be under the direction of the state highway commissions of the various states. North Dakota, then, must take a definite position on this issue and at the coming session of the state legislature appropriate a sufficient sum of money to meet the Government's co-operative plan half way, and to provide funds to enable the state highway commission to secure the necessary engineering assistance and to pay for the various surveys that the Government will require. North Dakota cannot afford to refuse to co-operate with the U. S. Government in this matter, which means more than a million dollars of federal aid money to the state in a period of five years.

The principal advantages of an active state highway department are as follows:

The primary object of a state highway department is to afford to the counties and townships within the state that specialized knowledge and training in highway and bridge construction and maintenance which cannot be supplied by the counties and townships themselves. A great majority of counties can not afford to employ highly efficient engineers and road superintendents, and it is manifestly the part of wisdom and economy for the counties to obtain jointly, through the agency of the state, this very necessary factor in the solution of their road problems. In this connection it should be borne in mind that a century and a quarter of local road management has resulted in a lack of progress which has been most striking, and this in spite of the fact that during the past ten years the average annual expenditure has probably exceeded $150,000,000.

A secondary object of very great importance in the establishment of a state highway department is to obtain a correlation of highway work throughout the state. County and township boundary lines are arbitrary and are not established with reference to the trend of traffic. It follows, therefore, that a number of counties acting independently may, in spite of a large expenditure of energy and money, provide a patch work of highway improvement radically unfit for traffic needs. A centralizing influence such as would be obtained through a state highway department would tend to work out improvements in all parts of the state in accordance with some general plan and system.

Another important advantage obtained through the granting of state aid to highway improvement by means of the appropriation of state funds is the equitable distribution of cost burdens for such improvement. The county road is not a mere local convenience, for the product

of the farm is necessary to the existence of the city population and the prosperity of the country is reflected largely in the prosperity of the city and of all industries throughout the state. Furthermore, the rapid development of the motor vehicle has enormously increased the radius of travel, so that owners of automobiles frequently traverse roads that are hundreds of miles away from the point where the automobile owner pays taxes. It is evident, therefore, that to place the entire burden of constructing and maintaining the highways upon the counties and townships is to relieve to a large extent the cities and the great industries of the state from the payment of their just proportion of this burden. Only through the establishment of a state highway department and the appropriation of state funds can this situation be met. Automobile revenues obtained from registration fees should be collected by the state and expended on the highways through the agency of the state. Another form of state aid which, in some cases, is proving quite efficient is convict labor. Whatever measure of aid the state grants, it plainly tends to equalize burdens and accelerate progress in highway improvement.

A further advantage of state supervision, where the supervision is sufficiently extensive and pronounced, is a tendency to eliminate local politics and selfish private interests in the distribution of improvement. Unfortunately it is true that even in state highway management political considerations have, in some of the states, hampered the work, but it must be apparent that in highway work generally throughout the state the absence of petty local control would prove beneficial. State officers can not be swayed in the same manner as township or county officers, and consequently their decision is much more likely to be unbiased and for the best interests of the county.

That state participation is effective is proven by the fact that only in those states which have adopted this policy has there been real marked progress in highway construction. There are now between 35,000 and 40,000 miles of state highways and it is a distinct evidence of the strength of this policy that not a single state having once adopted it has permanently reverted to the old plan of local management.

As to the most effective lines along which state participation should be developed, it should be borne in mind that as a primary object is skilled supervision it follows that state supervision should extend over any and all highway work in the state involving an expenditure sufficient to warrant the obtainment of engineering advice. This result could be obtained by providing that all bridges should be approved by the highway department as to type and design before contract is awarded and should be subject to inspection by the department, and that all highway improvement involving an expenditure in excess of $500 per mile should be first approved by the highway department and subject to inspection by that department. In order that a simple and systematic method of handling road funds should replace the present confusing lack of system, the highway department should be empowered to prescribe forms and methods for keeping account of highway receipts and expenditures, and the law should compel local officials to follow such methods and

use such forms as the highway department prescribes. The highway department should further be instructed to indicate such a system of highway improvement as will provide for the traffic needs of the state, and toward the improvement of such a system the state should contribute annually in such proportion as seems most equitable after a careful study of prevailing conditions. Such work should, of course, be under the direct supervision of the state. All automobile revenues should go into the state fund and consideration should be given to the feasibility of using convicts.

Road Laws

It is recommended that the state engineer's office be given authority to have the road laws of the state published in pamphlet form.

Standard Plans for Bridges and Culverts

It is recommended that a law be passed requiring the state engineer's office to prepare standard plans and specifications for bridges and culverts, to be distributed for free use by counties and townships. A special appropriation providing for the expense of such work should be granted.

Drainage

Under the heading of "drainage" there is a short discussion of the present drainage laws and a copy of a proposed amendment which is intended to facilitate drainage work within the state. The past season having an unusual amount of snow and rainfall, has made the drainage question in the Red River Valley very acute. At the previous session of the legislature the proposed amendment mentioned was ill-advisedly rejected by the committee on drainage laws, without apparent justifiable reason. It is recommended that the 1917 session of the state legislature give this very important and vital subject the consideration it deserves. A review of the information set forth under the head of "drainage," and the experiences of Nelson County show the pressing need for the proposed amendment.

Coal Mining

The state engineer, as ex-officio state coal mine inspector, recommends that suitable legislation be adopted in regard to the ventilation and the timbering of lignite coal mines, and giving the state coal mine inspector authority to enforce such laws where the health and safety of the employees require it.

Hydrogaphy

The U. S. Geological Survey has been carrying on within the state of North Dakota a fairly complete hydrographic survey and has established stream gaging stations on most of the larger streams. During the past biennial period the state engineer's office has been co-operating with the U. S. Geological Survey to the extent of paying the salaries of the stream gagers, which run between $5.00 and $8.00 each per month. Eight hundred dollars was appropriated for the work during the last biennial period. Owing to the fact that these records are of value to the state as well as to the state engineer's office in a number of different ways (see unit of this report headed "river records"), the state engineer

recommends that a similar amount be appropriated to carry on the work during the ensuing biennial period.

Examination of State Lands for Lignite Coal

The constitution prohibits the sale of any state lands bearing lignite coal. Therefore statutory provision has been made for the classification of such of the state lands as lie within the lignite coal area, or approximately the western half of the state. The state engineer is required by law to make the necessary investigations to enable him to classify these lands, those classified as "coal land" being indefinitely withheld from sale.

The western portion of the state has become well settled, with the result that there is a constantly increasing demand for state lands, and owing to the almost universal presence of lignite coal, an immense acreage much of which is excellent agricultural land, cannot be sold.

The state engineer therefore recommends that the legislature give due attention to the advisability of amending the constitution giving the state the authority to dispose of the surface right only of those lands owned by it and lying within the lignite coal field. The state should of course retain title to all lignite coal, gas or oil that might be found, together with the privilege always of entrance to the land for prospecting or mining purposes. Such an arrangement would obviate the necessity of costly inspection by drilling that will in the future be found necessary in many localities, and will enable the state to comply with the increasing demand for the land. The result would be the releasing of a large acreage for farming purposes with no disadvantage to the state or purchaser.

Should the foregoing recommendation not meet with the approval of the legislature, it is suggested that an amendment be adopted defining what shall be considered coal land, that is, designating what shall be the minimum thickness of beds of coal and the maximum depth beneath the surface, in order to warrant their classification as "coal land." Under the present provisions of law, wherever coal occurs, of whatever thickness or depth underground, the land must be called coal land, whether it would ever be valuable for mining purposes or not. It is apparent, however, that such a measure will force the state at some time to engage in extensive prospecting of a costly nature, while the result would not be as satisfactory as if the state could sell the surface right only.

It takes four years or more to make an amendment to the constitution operative and for the reason that during this time it may become necessary to hold sales of school lands in counties where no examinations have been made, it is recommended that an appropriation of $4,000 be made to enable the state engineer to conduct such further investigations as the Board of University and School Lands may find essential. Examinations have not been made in Adams, Billings, Bowman, a small part of Burleigh, a small part of Dunn, Golden Valley, Hettinger, McKenzie, McLean, Mountrail, Oliver, Slope and Sioux Counties, all of which lie within the limits of the lignite coal area.

(The Board of University and School Lands and the Land Commis-

sioner concur in the foregoing recommendations. See report of Land Commissioner for biennial period, July 1, 1914, to June 30, 1916.)

U. S. SURVEYOR GENERAL'S RECORDS

The State Engineer's office has had charge of the records of the U. S. Surveyor General's office for the State of North Dakota since the year 1908. While being custodian of these records has occasioned a large amount of additional work, they have been of specal value in the regular duties of the office and are used continually as a reference.

Much information of value for other purposes than the making of maps or surveys are contained in the plats and field notes. In the field notes soil descriptions are given along all of the section lines, while the plats give a good indication of the character of the topography of the various townships.

The State Engineer's office compiles a township plat, for which a charge of $1.50 is made, showing topographical features and in abbreviated form on each section line the soil descriptions taken from the field notes. These plats are of much use to land and loan companies, banks and prospective purchasers. A large number of copies of township plats and of field notes are furnished each year to county surveyors and private engineers.

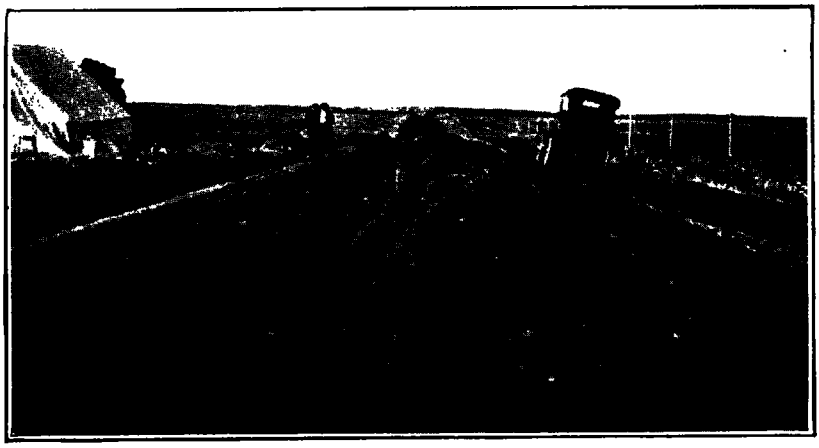
IRRIGATION

But ten applications for permits to appropriate water have been received during the biennial period ending June 30, 1916. The fact that the state has during this time generally enjoyed a plentiful rainfall accounts for the small number of applications received. For the same reason the holders of permits issued prior to the present biennial period have done practically no irrigating during the past two years.

The state engineer does not anticipate that irrigation in North Dakota will be attempted on any extensive scale in the near future, but believes that where it is practiced on a small scale by individual owners it is of great value. Small grains generally cannot be irrigated to any considerable advantage, as unusually favorable conditions must exist in order to make it feasible. The principal value of irrigation will be to increase the yield of and to insure forage crops and feed. The present tendency is toward diversified farming and the resulting increase in stock raising makes it essential that there shall be no failure in the crops depended upon for winter feed.

In previous reports it has been shown that throughout the western portion of the state there are countless locations where irrigating can be done in a small way by individual operators, and the bottom lands along the various rivers afford locations where practical irrigation is possible.

It is to be expected that interest in irrigation will be keen only in those years when rainfall is light. However, it is to be regretted, in view of the fact that we can have no previous knowledge as to what the rainfall will be, that more land holders do not have small irrigation



Partially Completed Road Near Wilton, Burleigh County, 1915.

plants in readiness to apply water to their land should dry weather make it necessary.

The state engineer's office has issued permits to appropriate water totaling 260.73 cubic feet per second, to be used on 20,589 acres. United States Reclamation Service projects in North Dakota total approximately 47,500 acres.

INDIVIDUAL PROJECTS
July 1, 1914, to June 30, 1916

87. Shields Project

John H. Shields made an application for a permit to appropriate two second feet of water from Little Muddy Creek, in Section 15, Township 154, Range 104, Williams County, for the irrigation of lands lying in Montana, just across the state line. The state engineer decided that he had not authority to grant permits for the appropriation of water originating within the state and to be diverted within the state for use across the boundary line. As is customary in other states, the application was placed on the file so that Mr. Shields may be entitled to an appropriation according to the priority of his application, should an interstate adjudication of the waters of the stream be had at some future time.

88. Morken Project

Ole J. Morken of Buford, Williams County, made an application for two-tenths second feet of water to irrigate 16 acres in Section 9, Township 152, Range 104. The water will be stored by means of a dam, from which a gravity ditch will conduct it to the land.

89. Hans Oium Et Al Project

Hans O. Oium, George D. Elliott and E. B. Talmadge, all of Towner, made an application for a permit to appropriate 9.8 second feet of water from the Mouse River for the purpose of irrigating 786 acres. A pumping plant will be installed for delivering water from the ditch to the distributing ditches.

90. Eton Project

J. B. Eaton of Denbigh was granted a permit to divert 4.1 second feet of water from the Mouse river for the purpose of irrigating 332 acres. A portable pumping plant which can be moved from place to place and used on either side of the river is the means of raising the water to the distributing ditches. The time requested for the completion of the work was one year and two years was asked for in which to make a complete application of water to the proposed beneficial use.

91. Foot Project

L. S. Foot of Minot made an application for 1.48 second feet of water to be used in irrigating 118 acres. The source of supply is melting snow and rains, retained in a coulee by the construction of an earth dam. The water will be distributed through gravity ditches.

92. Northern Pacific Railroad Reservoir

The Northern Pacific Railway Company made an application for five-tenths second feet of water from the Pipestem river, for railroad purposes. A dam 10 feet in height, 240 feet in length at the bottom and

396 feet in length at the top, with a thickness of 64 feet at the bottom and nine feet at the top, made of earth and concrete, has been constructed. The capacity of the reservoir is 340 acre feet and it covers 58 acres.

The Village of Sykeston filed an affidavit protesting against the granting of the permit, and on the date set for the hearing, September 20, 1915, an attorney representing the Village of Sykeston protested against the granting of the permit. The hearing was postponed until the 20th of October, at which time attorneys for the Village and for the Northern Pacific Railway Company appeared. After a careful investigation the permit was granted.

93. Northern Pacific Railroad Reservoir

A permit was issued to the Northern Pacific Railway Company for the use of two second feet of water from the Pipestem river at Jamestown, for railroad purposes.

94. Albright Project

Lucius S. Albright of Bonetraill, Williams County, was granted a permit to divert five-tenths second feet of water from Cow Creek, for the irrigation of 40 acres of land. A six-inch centrifugal pump and gasoline engine have been installed to raise the water to the distributing ditches. The ditches are to be completed in one year, and two years will be required to show the proposed beneficial use.

95. Morken Project

On December 9, 1915, Ole J. Morken made an application for an additional appropriation of one-eighth second feet of water from Garden Coulee, for the purpose of irrigating 10 acres in the SW¼ NW¼ Sec. 9, T. 152, R. 104. For the purpose of irrigating this additional 10 acres a pumping plant is to be installed, lifting the water to the distributing ditches, this land lying too high to be reached by the gravity ditches

An affidavit protesting the granting of this water right was filed by Elizabeth Forbes on January 20, 1916, while Mr. Morken submitted affidavits supporting the granting of the right. A representative of the state engineer's office inspected the proposed irrigation project on February 3d and on his recommendation the permit was granted.

96. Richards and Wilcox Project

On September 23, 1915, Richards, Wilcox & Company, of Dickinson, made an application for a permit to appropriate 10⅝ second feet of water from Sring Creek for the purpose of irrigating 850 acres lying in Township 145, Range 95. A dam 18 feet in height, 35 feet long at the bottom and 75 feet long at the top, 125 feet thick at the bottom and 35 feet thick at the top, constructed of earth and rock, having a capacity of 50 acre feet and covering five acres is to be constructed. Three years' time will be required for the construction of the work and complete application of water on the land.

97. Northern Pacific Railroad Reservoir

On February 2, 1916, the Northern Pacific Railway Company made an application for one second foot of water from the Knife river near Beulah, for railroad purposes. A steam pumping plant is installed and the water is diverted through a three-inch pipe.

FILINGS MADE IN ACCORDANCE WITH THE IRRIGATION CODE FROM JULY 1, 1915, TO JUNE 30, 1916.

No.	Name of Applicant.	Lands to Be Irrigated.	Source of Supply	Amount of Water Claimed	Date of Claim
87.	John Shields—refused.....				
88.	Ole J. Morken.....	16 acres in Sec. 9, Twp. 152, R. 104...	Garden Coulee	.2	3–23–15
89.	Hans O. Oium, Geo. D. Elliott, E. B. Talmadge.....	786 acres in Secs. 19 and 30. T. 157, R. 75; Secs. 24, 25, 26, 35 and 36, T. 157, R. 76	Mouse River	9.8	5– 1–15
90.	J. B. Eaton.....	332 acres in Secs. 30 and 31, T. 156, R. 76; Sec. 6, T. 155, R. 76; Sec. 1, T. 155, R. 77	Mouse River	4.1	5–26–15
91.	L. S. Foot.....	118 acres in Secs. 22 and 23, T. 156, R. 84	Melting snow and rains in coulee	1.48	6– 9–15
92.	Northern Pacific Ry. Co.....	For railway purposes.....	Pipestem River	.5	7–21–15
93.	Northern Pacific Ry. Co.....	For railway purposes.....	Pipestem River	2.0	8–16–15
94.	Lucius S. Albright.....	40 acres in Sec. 13, T. 156, R. 102....	Hole in bed of Cow Creek	.5	11–16–15
95.	Ole J. Morken.....	10 acres in Sec. 9, T. 152, R. 104....	Garden Coulee	⅛	12– 9–15
96.	Richards, Wilcox & Co.....	850 acres in Secs. 19, 20, 21 and 29, T. 145, R. 95.....	Spring Creek	10⅝	12–24–15
97.	Northern Pacific Ry. Co.....	For railway purposes.....	Knife River	1	2– 2–16

Total acreage, 2,152. Total amount of water claimed, 30.33.

DRAINAGE

The heavy snows of the past winter, together with the excessive rains of the spring and summer following, have forcibly emphasized the necessity of providing an adequate drainage system throughout the Red River Valley. It is not possible at this time to estimate closely the damage that crops will suffer this year on account of the lack of ditches, but it is not unreasonable to assume that the loss sustained will be nearly equal to the cost of construction of a drainage system that would have given relief.

The great importance of drainage to the Red River Valley has long been recognized, and in 1905 and 1906 the Office of Experiment Stations of the U. S. Department of Agriculture, in co-operation with the state engineer's office and the various counties, made complete surveys and plans for a comprehensive system of drainage for the eastern portions of Cass, Traill, Grand Forks, Walsh and Pembina Counties. These surveys have since proved of the greatest value to the counties named, and are constantly used as a reference in planning drainage work.

It is doubtful if any work of a public nature is more difficult to carry to a successful conclusion than that of securing a drainage ditch, owing usually to more or less incompetent drainage laws and to conflicting interests. It is well known that the drainage laws of North Dakota are in some respects faulty. The chief defect, in the opinion of the state engineer, is the fact that under our present drainage laws it is difficult and generally impossible to sell drainage bonds, thus forcing the assessment of all benefits upon the tax lists at one time. Where such assessments amount to more than $2.50 per acre it works a hardship to the land owners to be required to pay them at one time instead of having them distributed over a number of years. This defect has been one of the principal causes tending to retard drainage work.

Prior to the convening of the 1915 legislative assembly the state engineer requested a prominent attorney of the state to submit such amendments to our present drainage laws as would in his opinion make drainage bonds saleable. This request was courteously complied with and the proposed amendment was submitted to the legislature, but failed to pass.

This proposed amendment is as follows:

A BILL

For an Act to Amend Sections 2464, 2468 and 2471 of the Compiled Laws of North Dakota for the Year 1913, formerly known as Sections 1821, 1825 and 1828, Revised Codes of 1905, which were amended by Chapter 125, Laws of 1911.

Be It Enacted by the Legislative Assembly of the State of North Dakota.

That Sections 2464, 2468 and 2471 of the Compiled Laws of the State of North Dakota for the year 1913, formerly known as Sections 1821, 1825 and 1828, Revised Codes of 1905, which were amended by Chapter 125, Laws of 1911, are hereby amended to read as follows:

Sec. 2464. **How Established.** A petition for the construction of a drain may be made in writing to the board of drain commissioners, which petition shall designate the starting point and terminus and general course of the proposed drain. If among the leading purposes of the proposed drain are benefits to the health, convenience or welfare of the people of any city or other municipality, the petition shall be signed by a sufficient number of the citizens of such municipality or municipalities to satisfy the board of drain commissioners that there is a public demand for such drain. If the chief purpose of such drain is the drainage of agricultural, meadow, grazing or other lands, the petition shall be signed by at least six or more freeholders whose property shall be affected by the proposed drain. Upon the presentation of a petition as hereinbefore provided and filing of the same, the board of drain commissioners shall, personally, as soon as practicable, proceed to examine the line of the proposed drain, and if in its opinion it is necessary for the public good, it shall enter a resolution to that effect, and shall also enter a resolution designating a competent surveyor who shall survey the line thereof and establish the commencement and terminus and determine the route, width, length and depth thereof.

Provided, that the board of drain commissioners shall require a bond from the petitioners in sum sufficient to pay all expenses of the surveys and of the drainage commissioners if it should appear that the proposed drain would cost more than the amount of the benefit to be derived therefrom. For the purpose of making examinations or surveys the board of drain commissioners, surveyors and their employes may enter upon any land traversed by any such proposed drain or upon other lands when necessary. Such surveyor shall prepare profiles, plans and specifications of the proposed drain, an estimate of the cost thereof and a map or plat of the lands to be drained, in triplicate, showing the regular subdivisions thereof, one copy of which shall be filed in the office of the county auditor in the county in which the drain is proposed to be constructed, one copy with the board of drain commissioners, and the third copy in the state engineer's office, all subject to inspection. In locating a drain a board of drain commissioners may, under the advice of the surveyor, vary from the lines described in the petition as it seems best. When the line proposed is along highways already established the drain shall be located at a sufficient distance from the center of such highway to permit a good road along the central line thereof. When the length of the line described in the petition does not give sufficient fall to drain the land sought to be drained, the board of drain commissioners may extend the drain below the outlet named in the petition far enough to obtain a sufficient fall and outlet. Drains shall as far as practicable be located on dividing lines between sections

or regular subdivisions thereof, but the general utility of the drain must not be sacrificed to avoid crossing any tract of land in such direction as the board of drain commissioners find advisable. Upon the filing of the surveyor's report with the board of drain commissioners, the board shall fix a date for hearing objections to the petition; at least ten days' notice of such hearing shall be given by causing five notices to be posted along the line of the proposed drain at such points as will be likely, in the opinion of the board, to secure the greatest publicity; such notices shall contain a copy of the petition and a statement of the date of filing of the surveyor's report with the board and the date when the board will act upon the petition, and shall be signed by the members of the board, or a majority thereof. All persons whose lands may be affected by any such drain may appear before the board of drain commissioners and fully express their opinion and offer evidence upon the matters pertaining thereto. Should the owners of two-thirds of the lands subject to assessment for the construction of the proposed drain so desire, they may, by a petition in writing, request and secure the attendance at the above hearing of the state engineer, or one of his assistants, and at their request he shall be heard by the board upon all matters connected with said drain.

Sec. 2468. **Assessment of benefits subject to review.** The assessment of benefits provided for in this chapter shall be subject to review, and ten days' notice of the time when such assessment will be reviewed by the board of drain commissioners, shall be given by publishing in some newspaper of general circulation in the county, and printed notices, not less than five in all and at least one in each township or municipality interested in such drain shall be posted in such township and municipality at such points as may be likely, in the opinion of the board, to secure the greatest publicity for such notices. At the time appointed such board shall proceed to hear all complaints relative to such assessment and correct or confirm the same. Should the owners of two-thirds of the land subject to assessment so desire, they may secure and require the attendance of the state engineer, or one of his assistants, at the hearing upon the assessment by presenting to him a written petition requesting his attendance, and upon the hearing by the board they shall, upon the request of persons so petitioning, give a hearing to such state engineer in connection with the examination of the proposed assessments. For his services the state engineer shall be allowed ten dollars per day and actual, necessary expenses during the time he is engaged on the work, and the same shall be charged against the drain as a part of the cost of construction. All moneys received by the state engineer for his work shall be paid into the state treasury and credited to the general fund.

Sec. 2471. **Notice of letting contracts and review of assessments.** After completing the percentage assessment as hereinbefore provided, the board of drain commissioners shall without delay divide the line thereof into convenient divisions for construction, make diagrams of the same with specifications of the width of excavation at the bottom, the slope of the sides, and such other matters as may be necessary for the

proper construction of the drain, and set suitable stakes in such places as may be necessary. Such board shall give at least ten days' notice of the time when they will meet parties for the purpose of letting contracts for such construction. Such notice shall be published in some newspaper of general circulation in the county and printed notices not less than five in all and at least one in each township or municipality interested in such drain shall be posted in such township or municipalities at such points as will be likely, in the opinion of the board, to secure the greatest publicity for such notice. The hearing upon the review of the percentage assesments, and the letting of the contract for the construction may be held on the same date, and notice of the hearing and of the letting of the contract may be combined in one notice if the board shall so determine. All hearings by the board shall be held in the court house at the county seat of the county in which the drain is situated.

Emergency: Whereas an emergency exists in this, that it is necessary that the amendments included in this act shall take effect as soon as possible, therefore, this act shall take effect immediately upon its passage and approval.

The attention of the legislature is especially directed to the fact that the foregoing proposed amendment, or one similar, should by all means be adopted, in order that drainage work in the localities that require such relief may be facilitated. In this connection it is well to recall that many of our present drainage laws have been passed on and sustained by the Supreme Court and on this account no radical change is advisable. The foregoing proposed amendment proposes to correct defects in the present law which make bonding companies reluctant to handle bonds issued by drainage districts.

NELSON COUNTY DRAINAGE

Nelson County Drain No. 1, referred to in the fifth and sixth biennial reports, has been abandoned. The original surveys were made in 1911 and contract was let for construction in the spring of 1914, at 16½ cents per cubic yard. The contractor began work the last of May and stopped on August 14, having excavated at that time 26,508 cubic yards.

At the time the contract was awarded the county board of drain commissioners believed that the Wells & Dickey Company had agreed to take the bonds. However, on further advice of their attorneys they refused to accept them. The following letter from the attorneys for the Wells & Dickey Company to S. G. Skulason, attorney for the county drainage board, is self-explanatory:

August 25, 1914.

Subject: **Nelson County Drain No. 1.**

S. G. Skulason, Esq.,
Lakota, N. Dakota.

Dear Sir:—Referring again to the Nelson County drainage proceedings, will say that our clients, Wells & Dickey Co., have asked us for an opinion either approving or disapproving the proceedings.

We gave a conditional opinion of approval on August 15th, but declined to pass upon the question of compliance with the 1913 statute requiring service of notice by registered letter upon all land-owners interested. We called attention to the difficulty of getting this information and the further fact that after it was obtained there would then still be a question of fact lying outside of the record and subject to contradiction and dispute, thus placing upon our client the burden of obtaining and relying upon this outside information. As above stated, the matter was passed back to us for a positive approval or disapproval. Under these circumstances we are compelled to withhold our approval.

For a number of years, our firm has been the attorneys for the drainage board of Cass County. The passage of Chapter 125, Laws of 1911, resulted in the suspension of doing business by the Cass County drainage board. The amendments contained in this chapter were so numerous and dangerous that the board felt that it could not safely proceed and would have difficulty in marketing its bonds. For instance: Section 1825, as amended, authorizes the state engineer to re-assess and to re-locate the drain, etc., all without hearing and, as we advised our Board, without due process. The particular point in your drain arises under Section 1821, which relates to the notices of hearing upon the petition for location of the drain: "At least 10 days' notice of such hearing shall be given by causing five notices to be posted along the line of the proposed drain at such points as will be likely, in the opinion of the board, to secure the greatest publicity and, in addition, a notice shall be sent by registered letter to the last known address of each and every owner of land which may be affected by the proposed drain. Notices of this hearing shall contain a copy of the petition and a statement of the date of filing of the surveyor's report and the date when the board will act upon the petition and must be signed by the members of the board, or a majority thereof * * *."

Manifestly, the sending of these registered letters is jurisdictional. Further, they must be sent "to every owner of land which may be affected by the proposed drain," which means the owners of all land which may be assessed, or which may be damaged by the drain. This involves a determination of the fact as to the lands affected and, second, as to who are the owners of these lands, and third, as to whether each person who should have been notified was in fact notified; and after the investigation is made there is no way of perpetuating the evidence of the facts found. The facts reported in are always disputable and during the entire life of the bonds any one of the landowners might dispute the fact and contradict the finding which any investigator might report in. The proceedings, then, would be constantly open to question and nothing but a judicial determination, in which all the parties in interest were before the court, could determine the validity of the proceedings.

In our own country here, we have not felt justified in approving and certifying the validity of such bond issues, and now the matter is put up to us by Wells & Dickey Co. as to the proceedings in your county, we will be compelled to take the same position. We cannot approve the proposed bond issue. There is no way we know of that the facts can be made of record so that the right to contradict and impeach them can be foreclosed.

Respectfully,

WATSON & YOUNG.

It now being apparent that no bonds could be sold, the county authorities had no choice in the matter other than to extend the assessments upon the tax list for the following year. As this work was of an exceptionally difficult nature and the area of the lands benefited small, the cost per acre would have amounted to about twenty dollars an acre. This large assessment could not be met by the land owners at one time. No further work was undertaken and action was begun

in the district court to annul the proceedings of the county board of drain commissioners. The action brought by the land owners was dismissed without prejudice July 12, 1915, by Judge C. M. Cooley. An appeal was then taken to the Supreme Court, where the judgment of the lower court in dismissing the action was sustained. (See Bergen Township et al vs. Nelson County et al. 156 N. W. Reporter 559.)

Thus the attempt of a few land owners to reclaim some very valuable land was completely frustrated, owing to a defective drainage law, and a heavy expense was assessed against them for the work done.

PEMBINA COUNTY DRAINAGE

Ditch No. 39

The state engineer's office made surveys for this ditch during July, 1914. The ditch benefits 14,079 acres of land and is nearly seven miles in length. It was constructed in 1915 and the work consisted of the moving of 60,303 cubic yards of earth. The contract was let at 14½ cents per cubic yard. Final estimates were furnished to the board of drain commissioners September 25, 1915.

Ditch No. 40

The state engineer's office made surveys for Ditch No. 40 during July, 1914, and furnished the board of drain commissioners with plans and specifications. This proposed ditch would have benefited 8,447 acres of land, and its construction would have required the excavation of 51,170 cubic yards of earth. This proposed ditch was abandoned.

Alternate Ditch

A survey of a ditch, the construction of which would have eliminated the necessity of Ditch No. 40, was also made by the state engineer's office during July, 1914. This proposed ditch would have been 5½ miles in length and would have required the excavation of 51,722 cubic yards of earth. It would have benefited 10,829 acres. This ditch was also abandoned for the time.

Icelandic Coulee Ditch

The Icelandic Coulee Ditch had been constructed prior to 1914 and there was some doubt as to whether it had been completed in accordance with the specifications. The state engineer's office made a survey and filed a report with the drain commissioners showing the condition of the drain throughout its length. It was found that at a number of places the bottom of the ditch was not down to grade.

TRAILL COUNTY DRAINAGE

Hillsboro Township Proposed Drain

During June, 1916, the state engineer was called to Hillsboro to look over a drain the township proposed to build to benefit its roads. After carefully reviewing the proposed location of the ditch and making careful estimates, it was found that the proposed ditch was not feasible, owing partly to its size, making it too big an undertaking for a township, and partly to the location of a portion of the drain, which would have necessitated some very deep cutting.

ROADS AND BRIDGES

July 1, 1914, to June 30, 1916

ROADS

Federal Aid

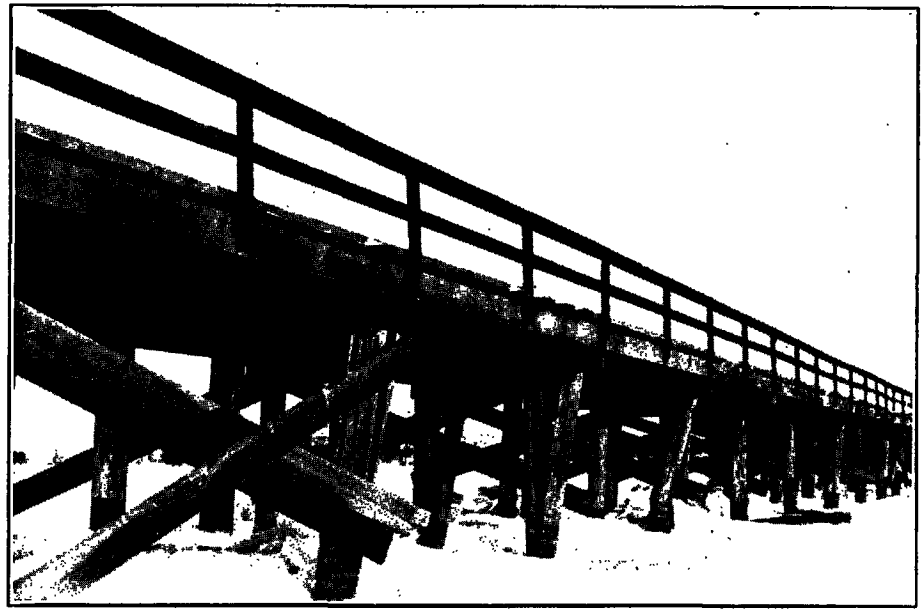
The act recently passed by Congress and approved by the President July 11, 1916, authorizing Federal co-operation in the building of roads, is of particular importance to North Dakota at this time. Under the present road laws it is not possible for the state to conform to the requirements of the Federal Law, and therefore North Dakota is not in a position to take advantage of Federal co-operation.

The Office of Public Roads has made a tentative apportionment of the seventy-five million dollars available for co-operative work in the various states, and for the year ending June 30, 1917, North Dakota should receive $76,143.06. For the years ending June 30, 1918, 1919, 1920 and 1921, there will be due the state approximately the sums of $142,280, $228,420, $304,560 and $380,700, respectively. Approximately a total of $1,132,100 will be paid for the construction of roads in North Dakota if the state will raise an equal amount. The apportionment made for the first year would be available for road building purposes in this state at the present time, could the state furnish a like amount for co-operation. In the states now granting state aid, work is being done, the Federal Government paying half the cost of construction and the state the other half.

The importance of taking such steps as may be necessary to place the state in a position to receive its apportioned share of Federal aid is very apparent. This problem will be one of the vital issues before the 1917 session of the legislature. Under the head of recommendations, the state engineer submits a short outline of what will have to be done in order to comply with the Federal requirements. Following is a reprint of the Federal aid bill:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Agriculture is authorized to co-operate with the states, through their respective state highway departments, in the construction of rural post roads; but no money apportioned under this Act to any State shall be expended therein until its legislature shall have assented to the provisions of this Act, except that, until the final adjournment of the first regular session of the legislature held after the passage of this Act, the assent of the governor of the State shall be sufficient. The Secretary of Agriculture and the State highway department of each State shall agree upon the roads to be constructed therein and the character and method of construction: Provided, That all roads constructed under the provisions of this Act shall be free from tolls of all kinds.

Sec. 2. That for the purpose of this Act the term "rural post road" shall be construed to mean any public road over which the United States mails now are or may hereafter be transported, excluding every street and road in a place having a population, as shown by the latest available



A Wooden Pile Trestle Over the Des Lacs Lake. *Note* How the Weaker Ice Under the Bridge Buckled on Account of the Pressure Exerted by the Expanding Bodies of Ice on Either Side. Piles are Broken Toward the Center of the Bridge.

Photo courtesy of H. C. Frahm.

Federal census, of two thousand five hundred or more, except that portion of any such street or road along which the houses average more than two hundred feet apart; the term "State highway department" shall be construed to include any department of another name, or commission, or official or officials, of a State empowered under its laws, to exercise the functions ordinarily exercised by a State highway department; the term "construction" shall be construed to include reconstruction and improvement of roads; "properly maintained" as used herein shall be construed to mean the making of needed repairs and the preservation of a reasonably smooth surface considering the type of the road; but shall not be held to include extraordinary repairs, nor reconstruction; necessary bridges and culverts shall be deemed parts of the respective roads covered by the provisions of this Act.

Sec. 3. That for the purpose of carrying out the provisions of this Act there is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the fiscal year ending June thirtieth, nineteen hundred and seventeen, the sum of $5,000,000; for the fiscal year ending June thirtieth, nineteen hundred and eighteen, the sum of $10,000,000; for the fiscal year ending June thirtieth, nineteen hundrd and nineteen, the sum of $15,000,000; for the fiscal year ending June thirtieth, nineteen hundred and twenty, the sum of $20,000,000; and for the fiscal year ending June thirtieth, nineteen hundred and twenty-one, the sum of $25,000,000. So much of the appropriation apportioned to any State for any fiscal year as remains unexpended at the close thereof shall be available for expenditure in that State until the close of the succeeding fiscal year, except that amounts apportioned for any fiscal year to any State which has not a State highway department shall be available for expenditure in that State until the close of the third fiscal year succeeding the close of the fiscal year for which such apportionment was made. Any amount apportioned under the provisions of this Act unexpended at the end of the period during which it is available for expenditure under the terms of this section shall be reapportioned, within sixty days thereafter, to all the States in the same manner and on the same basis, and certified to the Secretary of the Treasury and to the State highway departments and to the governors of States having no State highway departments in the same way as if it were being apportioned under this Act for the first time: Provided, That in States where the constitution prohibits the State from engaging in any work of internal improvements, then the amount of the appropriation under this Act apportioned to any such State shall be turned over to the highway department of the State or to the governor of said State to be expended under the provisions of this Act and under the rules and regulations of the Department of Agriculture, when any number of counties in any such State shall appropriate or provide the proportion or share needed to be raised in order to entitle such State to its part of the appropriation apportioned under this Act.

Sec. 4. That so much, not to exceed three per centum, of the appropriation for any fiscal year made by or under this Act as the Secretary of Agriculture may estimate to be necessary for administering the provisions of this Act shall be deducted for that purpose, available until expended. Within sixty days after the close of each fiscal year the Secretary of Agriculture shall determine what part, if any, of the sums theretofore deducted for administering the provisions of this Act will not be needed for that purpose and apportion such part, if any, for the fiscal year then current in the same manner and on the same basis, and certify it to the Secretary of the Treasury and to the State highway departments, and to the governors of the States having no State highway departments, in the same way as other amounts authorized by this Act to be apportioned among all the States for such current fiscal year. The Secretary of Agriculture, after making the deduction authorized by this section, shall apportion the remainder of the appropriation for each fiscal year among

the several States in the following manner: One-third in the ratio which the area of each State bears to the total area of all the States; one-third in the ratio which the population of each State bears to the total population of all the States, as shown by the latest available Federal census; one-third in the ratio which the mileage of rural delivery routes and star routes in each State bears to the total mileage of rural delivery routes and star routes in all the States, at the close of the next preceding fiscal year, as shown by the certificate of the Postmaster General, which he is directed to make and furnish annually to the Secretary of Agriculture.

Sec. 5. That within sixty days after the approval of this Act the Secretary of Agriculture shall certify to the Secretary of the Treasury and to each State highway department and to the governor of each State having no State highway department the sum which he has estimated to be deducted for administering the provisions of this Act and the sum which he has apportioned to each State for the fiscal year ending June thirtieth, nineteen hundred and seventeen, and on or before January twentieth next preceding the commencement of each succeeding fiscal year shall make like certificates for such fiscal year.

Sec. 6. That any State desiring to avail itself of the benefits of this Act shall, by its State highway department, submit to the Secretary of Agriculture project statements setting forth proposed construction of any rural post road or roads therein. If the Secretary of Agriculture approve a project, the State highway department shall furnish to him such surveys, plans, specifications, and estimates therefor as he may require: Provided, however, That the Secretary of Agriculture shall approve only such projects as may be substantial in character and the expenditure of funds hereby authorized shall be applied only to such improvements. Items included for engineering, inspection, and unforeseen contingencies shall not exceed ten per centum of the total estimated cost of the work. If the Secretary of Agriculture approve the plans, specifications, and estimates, he shall notify the State highway department and immediately certify the fact to the Secretary of the Treasury. The Secretary of the Treasury shall thereupon set aside the share of the United States payable under this Act on account of such project, which shall not exceed fifty per centum of the total estimated cost thereof. No payment of any money apportioned under this Act shall be made on any project until such statement of the project, and the plans, specifications, and estimates therefor shall have been submitted to and approved by the Secretary of Agriculture.

When the Secretary of Agriculture shall find that any project so approved by him has been constructed in compliance with said plans and specifications he shall cause to be paid to the proper authority of said State the amount set aside for said project: Provided, That the Secretary of Agriculture may, in his discretion, from time to time make payments on said construction as the same progresses, but these payments including previous payments, if any, shall not be more than the United States' pro rata part of the value of the labor and materials which have been actually put into said construction in conformity to said plans and specifications; nor shall any such payment be in excess of $10,000 per mile, exclusive of the cost of bridges of more than twenty feet clear span. The construction work and labor in each State shall be done in accordance with its laws, and under the direct supervision of the State highway department, subject to the inspection and approval of the Secretary of Agriculture, and in accordance with the rules and regulations made pursuant to this Act.

The Secretary of Agriculture and the State highway department of each State may jointly determine at what times, and in what amounts payments, as work progresses, shall be made under this Act. Such payments shall be made by the Secretary of the Treasury, on warrants drawn by the Secretary of Agriculture, to such official, or officials, or depository, as may be designated by the State highway department and

Masonry Arch on Square Butte Creek, Oliver County. Span of Arch is 10 Feet and is Too Small. Cost of Work at This Point $1,500.

Road South of Yucca, Oliver County. An Example of a Very Well Built Earth Road.

authorized under the laws of the State to receive public funds of the State or county.

Sec. 7. To maintain the roads constructed under the provisions of this Act shall be the duty of the States, or their civil shbdivisions, according to the laws of the several States. If at any time the Secretary of Agriculture shall find that any road in any State constructed under the provisions of this Act is not being properly maintained he shall give notice of such fact to the highway department of such State and if within four months from the receipt of said notice said road has not been put in a proper condition of maintenance then the Secretary of Agriculture shall thereafter refuse to approve any project for road construction in said State, or the civil subdivision thereof, as the fact may be, whose duty it is to maintain said road, until it has been put in a condition of proper maintenance.

Sec. 8. That there is hereby appropriated and made available until expended, out of any moneys in the National Treasury not otherwise appropriated, the sum of $1,000,000 for the fiscal year ending June thirtieth, nineteen hundred and seventeen, and each fiscal year thereafter, up to and including the fiscal year ending June thirtieth, nineteen hundred and twenty-six, in all $10,000,000, to be available until expended under the supervision of the Secretary of Agriculture, upon request of the proper officers of the State, Territory, or county for the survey, construction, and maintenance of roads and trails within or only partly within the national forests, when necessary for the use and development of resources upon which communities within and adjacent to the national forests are dependent: Provided, That the State, Territory, or county shall enter into a co-operative agreement with the Secretary of Agriculture for the survey, construction, and maintenance of such roads or trails upon a basis equitable to both the State, Territory, or county, and the United States: And provided also, That the aggregate expenditures in any State, Territory, or county shall not exceed ten per centum of the value, as determined by the Secretary of Agriculture, of the timber and forage resources which are or will be available for income upon the national forest lands within the respective county or counties wherein the roads or trails will be constructed; and the Secretary of Agriculture shall make annual report to Congress of the amounts expended hereunder.

That immediately upon the execution of any co-operative agreement hereunder the Secretary of Agriculture shall notify the Secretary of the Treasury of the amount to be expended by the United States within or adjacent to any national forest thereunder, and beginning with the next fiscal year and each fiscal year thereafter the Secretary of the Treasury shall apply from any and all revenues from such forest ten per centum thereof to reimburse the United States for expenditures made under such agreement until the whole amount advanced under such agreement shall have been returned from the receipts from such national forest.

Sec. 9. That out of the appropriations made by or under this Act, the Secretary of Agriculture is authorized to employ such assistants, clerks, and other persons in the city of Washington and elsewhere, to be taken from the eligible lists of the Civil Service Commission, to rent buildings outside of the city of Washington, to purchase such supplies, material, equipment, office fixtures, and apparatus, and to incur such travel and other expense as he may deem necessary for carrying out the purposes of this Act.

Sec. 10. That the Secretary of Agriculture is authorized to make rules and regulations for carrying out the provisions of this Act.

Sec. 11. That this Act shall be in force from the date of its passage.

Road Census

During the summer of 1915, the state engineer in co-operation with the U. S. Office of Public Roads conducted a very thorough road census,

collecting a large amount of valuable data concerning roads and road conditions in North Dakota. This information will be given in detail in a bulletin to be issued by the Office of Public Roads.

One of the principal features brought out in this work is the lack of uniformity between the various townships as well as between the various counties, in the method of keeping records concerning roads; also the inaccuracy of many such records as well as the fact that in many instances, particularly among the townships, no information whatever was available.

The data was secured by sending blanks to the clerks of all organized townships and to all county auditors and county surveyors.

Good Roads Week

Governor Hanna designated June 19 to 24, inclusive, as Good Roads Week, and issued a proclamation urging that everyone interested in better roads endeavor to make a success of this week. Soon after the proclamation was issued over 2,000 pamphlets were sent out from the state engineer's office to the various township clerks, county commissioners and secretaries of commercial clubs, and like organizations. These pamphlets give in detail a plan for Good Roads Week, as outlined by C. R. Pettes, a supervisor of Lakota Township, Nelson County. Blanks were sent out with the pamphlets, requesting that they be returned with a brief outline of what was done during Good Roads Week, in the way of improving the roads. A number of these blanks were returned and indicate that in many localities excellent results were obtained, while in others no attempt was made to do any work.

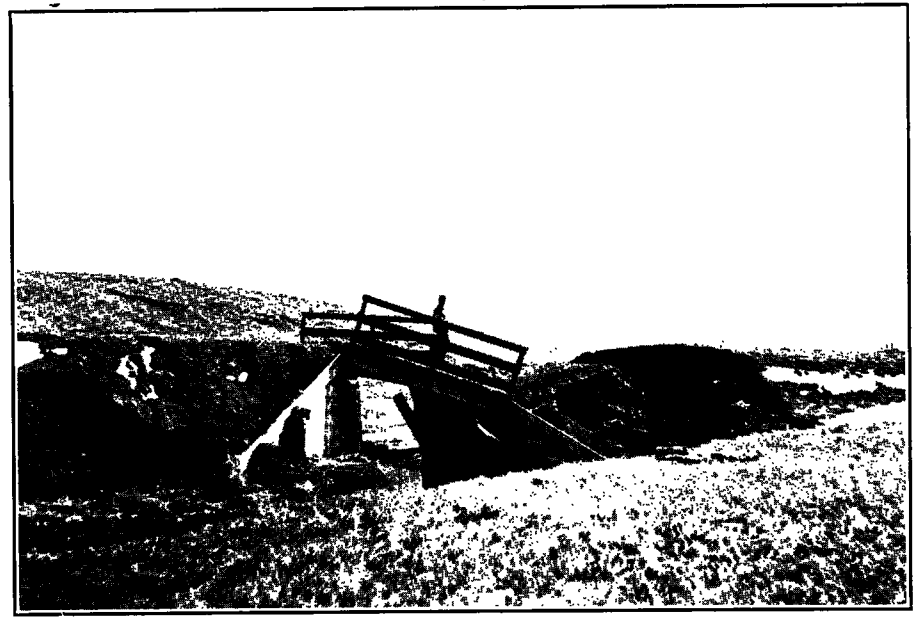
The following report received from Christian Potzner, Clerk of Castle Rock Township, Hettinger County, shows the best results:

Christian Potzner	donated 2 days' work with 1 team
W. A. Roozen	donated 3 days' work with 4 teams
John Willcom	donated 2 days' work with 2 teams
A. J. Bowers	donated 2 days' work with 2 teams
E. A. Thompson	donated 2 days' work with 2 teams
E. O. Starks	donated 4 days' work with 2 teams
David Powell	donated 1 day's work with 1 team
Wm. Forsch	donated 1 day's work with 1 tractor
Otto Barth	donated 2 days' work with 1 tractor

In addition to this cash donations were made amounting to $150.00. Mr. Potzner pronounced Good Roads Week in his township as being a decided success.

Educational Work

During the past two years an attempt has been made to direct the attention of the people of the state, and particularly the attention of county commissioners, to the fact that the state engineer's office is in a position to render valuable services to the various counties in their road and bridge building work. To that end the office has from time to time supplied the various county commissioners with copies of tentative specifications for the building of roads, bridges and culverts, and at various times has written county commissioners advising them that the office is at all times prepared to render them any assistance legally possible.



A Short Span Bridge in Ward County. A Result of a Saving of Engineering Expense Waterway was Insufficient and Piling was not Securely Driven

Photo Courtesy of H. C. Frahm, County Surveyor.

As provided by law, the state engineer or his assistants have attended as many good roads meetings as possible, particularly the sessions of the county boards of highway improvements.

The state engineer's office has issued three road bulletins during the past season. The first bulletins contained a complete set of road specifications, and prints showing standard roadways. Bulletin No. 2 contained an outline of the value to the counties of engineering services in connection with road and bridge work. Bulletin No. 3 consisted of a plan for Good Roads Week, and was issued immediately following the Governor's Good Roads Week proclamation.

The necessity of maintaining earth roads has been presented to all county and township road officials, as a sufficient mileage of graded and turnpiked roads has been constructed in North Dakota to make the problem of maintenance one of great importance.

Many counties in the state are building excellent roads from year to year, but are neglecting the proper maintenance of the roads previously constructed. Every type of road that has ever been built requires more or less maintenance in order to prevent its destruction, and this is particularly true of earth roads. An earth turnpiked or graded road is bound to become more or less rutted and the side ditches become filled with a dense growth of weeds, and the particular attention of the counties and townships is directed to the necessity of planning for this work by setting aside a certain definite sum for the purpose of dragging and keeping in a state of repair the roads that have been previously built. Some counties have adopted the plan of insisting that the townships shall maintain all county roads built within their borders. The state engineer does not believe that this will be ultimately successful, but it is his opinion that the counties will have to do this work directly. If direct legislation covering the maintenance of roads is required in order to assure the work being done, such legislation should be adopted. However, under our present laws it is entirely within the discretion of the county commissioners and township boards to make arrangements for a definite and regular system of road maintenance.

Engineering Services

It is pertinent at this time to again call attention to the fact that many counties do not as yet make a practice of employing a competent engineer to assist in road and bridge work. It cannot be too strongly urged upon the various boards of county commissioners that the best interests of the counties actually demand that they place the responsibility for the building of roads and bridges in the hands of someone competent and qualified to do the work and able to give his time and attention to it. Many believe that in level or gently rolling country an engineer can be of no service. However, hundreds of instances of roads located from a few feet to a few rods off from section lines, expensive grades built in cornerwise or off the line, and bridges improperly located, in a great many instances with insufficient waterways and on frail foundations, amply prove the contrary.

Competent engineers are available and there is no necessity of building roads and bridges by "guess." No county board in the state is justified in paying out a dollar of county funds for road or bridge work unless they have before them the certificate of their engineer that the work has been examined and found to be done according to plans and specifications. Particularly in the building of bridges, the counties should require careful inspection during erection, especially during the time when the foundation work is being done. It is the exception rather than the rule to find a county that places this work in the hands of an engineer. The system generally in vogue in the state, of permitting the various bridge companies, many of whom never have the bridge sites examined beforehand, to submit bids on their own plans and to furnish their own inspection, as well as to make out their own bills for extras, is indefensible.

In counties where the amount of road and bridge work may not justify employing an engineer by the year, the state engineer's office can be of particular service, as these counties can have their work done by experienced men at a price fixed by law, this price being approximately the actual cost of the work.

North Dakota is expending annually large sums in the construction of roads and bridges, and it is only good business judgment to make sure that every dollar expended is for work of a permanent value. Several illustrations are submitted in this report, demonstrating what has been said concerning the value of engineering services to counties.

Road Map

There has been a considerable demand for a map of the state showing the main traveled roads, and during the past year the state engineer's office has attempted to compile a map that would be sufficiently accurate to be of value. Requests were made of the various county auditors, sheriffs and surveyors for county maps showing the location of the main traveled county roads within the various counties, particularly those between the various county seats. In this manner sufficient information was secured to enable the state engineer to submit with this report a small map of the state showing most of the main county roads. The Meridian Road, Wonderland Trail, Red Trail and Yellowstone Park Trail are indicated by the heavier lines.

A careful study of the map shows that if North Dakota is, within a reasonable time, to develop a system of state roads, it is necessary that the work be done under the direction of a state highway commission.

The state engineer will be pleased to receive any information either in the way of corrections of the present location of roads or the locations of roads that may not be shown. The state engineer's office has no funds which it can devote to this work, and must depend largely on information voluntarily furnished by those who are interested.

Pier No. 1, Medora Bridge. The Bottom of the Pier is 14 Feet Below Point Where Man is Standing. Note Heavy Iron Ice Breaker on Nose of Pier

ROAD SURVEYS MADE UNDER THE DIRECTION OF THE STATE ENGINEER

Emmons County

A request was received during March, 1916, from the county commissioners of Emmons County, asking that the state engineer's office take charge of making surveys of the proposed county road construction for 1916. A considerable amount of work was done in laying out a number of difficult roads. Complete plans and specifications were furnished to the county.

Logan County—Red Lake Township

In June, 1916, the state engineer's office was requested by the officers of Red Lake Township to make a survey of five miles of road. The survey was made in order to obtain legal descriptions of the right of way, most of which followed along the edge of a lake.

Nelson County—Lakota Township

A request was received from the officers of Lakota Township, asking for a complete survey of the proposed road work for 1916. The required surveys were made and plans and specifications were furnished, covering the proposed improvements.

McLean County

During November, 1915, the state engineer's office was requested to make some detailed surveys in Township 144, Range 81, in connection with condemnation proceedings for a right of way. Detail maps were made and filed with the state's attorney and the attorney general.

Steele County

The state engineer's office made several road surveys for Steele County during the summer and the fall of 1915, and plans and specifications were furnished for most of the county road work done during the road season of 1916. Steele County has constructed a considerable mileage of first rate roads. The chief difficulty encountered has been the lack of experienced road builders among those bidding on the work.

BRIDGES

Several cuts accompany this report, which show in detail examples of a well designed steel bridge, reinforced concrete bridge, and culvert. These may be of service to county commissioners and township boards of supervisors, as they are complete working plans.

Steel is unusually high at the present time, and there is no indication that prices will return to the normal value within the near future. The high price of steel favors the construction of reinforced concrete bridges. There is no better material for the construction of bridges than reinforced concrete, and it is urged that it be used in the construction of bridges wherever practicable. However, it must be borne in mind that the strength, safety and permanence of reinforced concrete structures depends on the proper placing of a sufficient amount of reinforcing bars, in accordance with the specifications. Good, clean, aggre-

gates, well mixed, and placed in tight and substantial forms must be used. It is absolutely necessary that competent inspectors be employed when reinforced concrete bridges are built.

During the past biennial period the state engineer's office has furnished a number of counties with plans and specifications for bridges, as well as examining and reporting on existing structures, and examining plans for county boards. The more important work done is briefly described as follows:

Billings County

The National Parks Highway Association, in co-operation with Billings County and the Northern Pacific Railway Company, undertook the building of a much-needed wagon bridge across the Little Missouri River at Medora. The state engineer's office was requested to prepare the plans and specifications. A bridge consisting of three 135-foot steel trusses and gravity concrete piers and abutments was designed, and plans and specifications were furnished the county. The contract was awarded to the Illinois Steel Bridge Company of Minneapolis. The cement, sand and gravel used in the construction of the piers and abutments were examined and tested by E. J. Babcock, Dean of the College of Mining Engineering, and Prof. A. J. Becker, who made a number of breaking tests of the concrete. Samples of the aggregate were also sent to the laboratories of the Universal Portland Cement Company at Chicago, as well as to the Office of Public Roads at Washington.

A committee, known as the construction committee, was appointed by the National Parks Highway Association and the board of county commissioners. This committee consisted of W. R. Veigel of Dickinson, R. T. Hurtle of Glendive, Montana, Grant Call of Bismarck, E. D. Peck, chairman of the Board of County Commissioners, and the state engineer. While the piers and abutments were being constructed W. R. Veigel was in direct charge of the work of inspection.

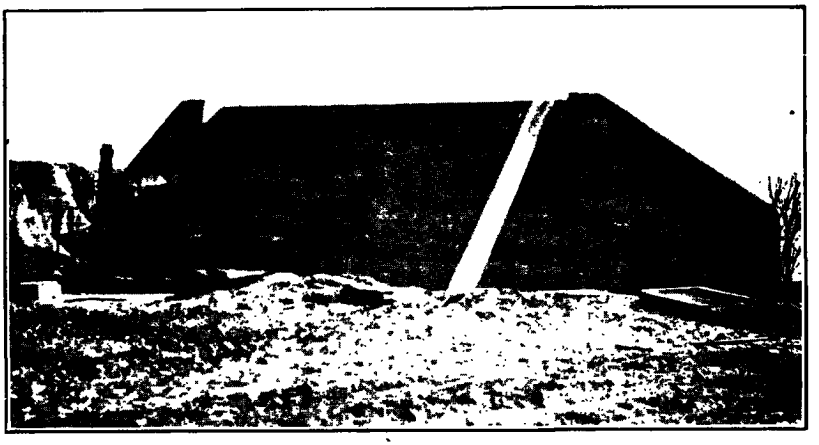
The bridge was completed in January, 1916, and was formally dedicated the 24th of July, 1916. The cost of the bridge complete, including all approaches and riprapping, was approximately $20,000.

Burke County

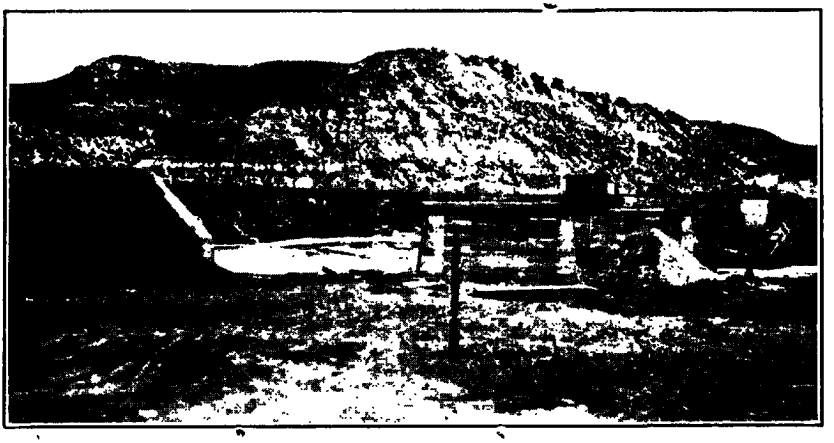
In May, 1916, a request was received from Burke County for detail plans for a seven by eight foot culvert. Detail plans and specifications for an unusually substantial concrete culvert were prepared and forwarded to Mr. J. H. Clark, County Surveyor, under whose direction the culvert was to be built. Mr. Clark has been instrumental in getting Burke County to build several concrete culverts and short span bridges.

Dunn County

In December, 1914, the state engineer received a request to inspect an 80-foot steel truss bridge built by the Great Northern Bridge Company over the Knife River at Halliday. This bridge had just been completed. The bridge was found to be a first-rate type of a low truss bridge but it was to be regretted that the foundations consisted of steel piling driven into the ground and that sheet steel should have been used for backing.



Medora Bridge. Gravity Type Concrete Abutment. 15 Foot 12 Inch Piling Driven to Refusal at Three Foot Centers Were Driven in Bottom of Excavation. The Man is Standing on Top of a Two Foot Concrete Footing



Medora Bridge, Showing One Abutment and Two Piers Complete, Work Being Done on West Abutment. Work Being Done in December. Water, Sand and Gravel Being Heated and Forms Protected For Ten Days

A 40-foot span bridge was examined at the same time, and was found to be too light in design to safely carry 16-ton engines.

Griggs County

In June, 1916, the state engineer's office received a request from Griggs County for plans for a reinforced concrete bridge of 20-foot span. The office furnished plans and specifications for a very substantial reinforced concrete bridge. On June 30th the contract for this bridge had not been let.

Logan County

In August of 1914, plans and specifications were furnished Logan County for one 50-foot low truss bridge and one 30-foot I beam skew bridge. These bridges were constructed during the spring of 1915. Before paying for them the county had them examined by the state engineer's office. The bridges were very well built and entirely in accordance with the plans and specifications.

Mercer County

The state engineer's office furnished plans and specifications for Mercer County for the following bridges: One 110-foot span with one 20-foot and one 40-foot approach; one 75-foot low truss span with one 15-foot approach; two 30-foot I beam bridges; two 40-foot low span bridges and two 50-foot span bridges. These plans and specifications provided for first-class bridges in every respect.

However, the county board, contrary to the advice of the state engineer, in a number of the bridges substituted I-beam steel piles with plank backing for the concrete abutments that were called for in the original plans. The result is that the county has a number of bridges with first-class superstructures on inexcusably poor types of abutments.

Morton County

In the spring of 1915 the state engineer's office received a request for the plans and specifications for a bridge over the Cannon Ball River at Solen. A 125-foot steel span bridge with 20-foot approaches was designed. The state engineer's office did not have charge of the work of inspecting this bridge during construction, nor was the office in receipt of any shop plans as stipulated in the specifications. Furthermore, the office was not advised when the work was started or finished.

The state engineer's office cannot, of course, be responsible for work done in this manner, even though it may have furnished the plans and specifications.

Oliver County

In July, 1914, the state engineer's office prepared plans and specifications for an 80-foot steel low truss bridge over Square Butte Creek at Center. This length of span was necessary, owing to the fact that the bridge set at a sharp angle with the center line of the stream, in order to be straight with the street in the village of Center.

No satisfactory bids were received on this bridge and the building of it was delayed.

In the spring of 1915 the state engineer's office was requested to

examine a masonry arch that had been built over Square Butte Creek. The arch, which is shown in an illustration, was just being completed at the time of inspection. As the span of the arch was only 10 feet, adjacent land owners had objected, on the ground that it would act as a dam in times of high water, and flood their bottom lands. Inasmuch as $1,500 had been put into the construction of this bridge, the state engineer did not recommend that it be torn down and replaced with a steel bridge, but after a careful study of the run-off tables, affecting Square Butte Creek, and an examination of the conditions at the bridge site, he recommended that two six-foot culverts be placed, one on either side of the arch, as this could have been done very readily at that time, no fill having been made. This would have made the arch capable of carrying all of the water that would have been retained in the banks of the stream in times of high water. The commissioners finally decided to let the arch stay as it was until the next season's run-off, in order that there might be no further expense incurred until it was definitely known whether or not the arch would be successful.

Pembina County

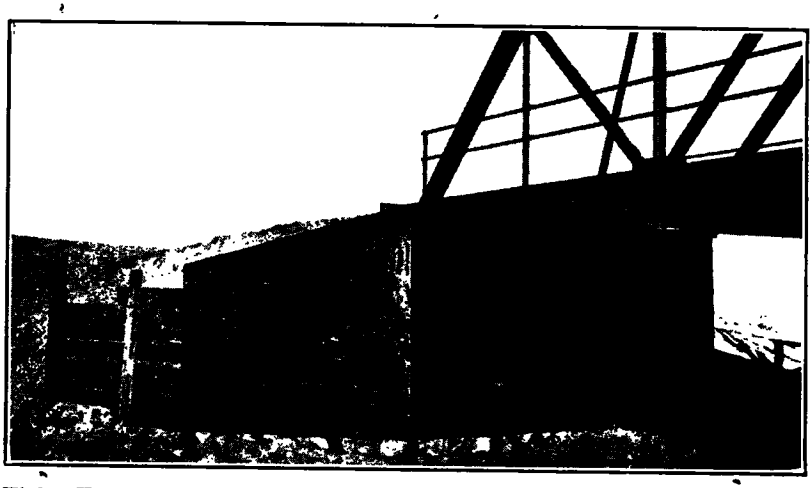
The state engineer's office furnished plans and specifications for a number of small bridges for Pembina County, during the spring of 1915. Pembina County has a complete set of standard bridge plans.

Williams County

During 1915 Mr. J. C. Field, county surveyor of Williams County, sent in a number of standard plans which he had designed, of bridges for Williams County. These plans were checked by the office, found satisfactory and returned to Mr. Field.

ROAD AND BRIDGE EXPENDITURES.

The state engineer's office has received a great many inquiries as to the amount of money that is spent annually in North Dakota for road and bridge building and an effort was made to collect the necessary figures to give a reasonably close estimate. The figures given below show the 1915 road and bridge tax, the data being obtained through the courtesy of the county auditors. The figures represent approximately the money that was available for road and bridge construction during the road building season of 1916. It is to be noted that more than half of the money spent for road work during the past season was handled by township boards, and that the amount spent by the townships was more than the total expenditure made by the counties. The motor vehicle license refund, amounting to $71,434.45 in 1915, is not included.



Eighty-Foot Low Truss Steel Bridge Over Knife River Near Halliday, Dunn County. Superstructure is First Rate. Note Poor Foundation, I Beam Piles and Sheet Steel Backing.

1915 Road Tax

County.	County road fund	County bridge fund	Twp. road & bridge fund	Total
Adams	$6,000.00	$6,000.00	$9,752.00	$21,752.00
Barnes	6,758.05	5,136.07	55,944.85	67,838.97
Benson	15,872.27	8,015.49	41,039.98	64,927.74
Billings	8,984.35	7,627.01	4,192.63	20,803.99
Bottineau	2,303.83	18,849.54	50,579.67	71,733.04
Bowman	.....	.....	.....	.....
Burke	17,500.00	7,500.00	20,856.45	45,856.45
Burleigh	29,944.00	29,944.00	25,577.42	85,465.42
Cass	11,008.56	40,364.74	100,650.82	152,024.12
Cavalier	12,001.58	18,616.92	43,906.71	74,525.21
Dickey	5,871.99	.....	32,579.34	38,451.33
Divide	16,107.00	8,030.00	28,178.00	52,315.00
Dunn	14,406.00	8,000.00	3,000.00	25,406.00
Eddy	.....	.....	.....	.....
Emmons	19,365.92	7,953.88	17,070.30	44,390.10
Foster	8,000.00	4,500.00	25,079.00	37,579.00
Golden Valley	3,000.00	6,000.00	27,287.82	36,287.82
Grand Forks	20,000.00	30,000.00	52,904.12	102,904.12
Griggs	5,612.41	4,365.19	28,517.56	38,495.16
Hettinger	7,000.00	14,000.00	20,700.00	41,700.00
Kidder	14,800.00	.....	9,000.00	23,800.00
Lamoure	3,250.00	12,300.00	37,121.00	52,671.00
Logan	8,110.58	1,918.55	16,382.54	26,411.67
McHenry	10,222.16	25,555.41	58,656.89	94,434.46
McIntosh	6,000.00	2,000.00	8,000.00	16,000.00
McKenzie	6,000.00	6,000.00	8,000.00	20,000.00
McLean	12,041.58	3,010.39	31,164.11	46,216.08
Mercer	30,843.00	13,708.00	13,708.00	58,259.00
Morton	49,000.00	25,000.00	34,200.00	108,200.00
Mountrail	13,755.10	2,229.13	27,369.41	43,353.64
Nelson	.....	4,993.73	44,195.26	49,182.99
Oliver	9,122.56	2,892.51	10,000.00	22,015.07
Pembina	1,677.33	16,353.90	33,481.32	51,512.55
Pierce	.....	.....	23,958.33	23,958.33
Ramsey	8,000.00	10,000.00	36,995.00	54,995.00
Ransom	10,441.70	5,527.48	9,392.77	25,361.95
Renville	13,000.00	7,000.00	16,500.00	36,500.00
Richland	23,925.14	50,025.29	55,102.29	129,0[illegible]2.72
Rolette	24,644.19	7,619.21	17,919.29	50,182.69
Sargent	3,500.00	.....	32,222.09	35,722.09
Sheridan	12,000.00	.....	8,441.01	20,441.01
Slope	4,702.00	5,000.00	19,376.00	29,078.00
Sioux	4,000.58	1,816.39	.....	5,816.97
Stark	28,824.58	11,502.62	13,850.76	54,177.96
Steele	8,000.00	8,000.00	25,577.57	41,577.57
Stutsman	20,000.00	10,000.00	66,631.12	96,631.12
Towner	6,948.86	6,948.86	41,831.46	55,729.18
Traill	2,965.38	30,077.22	29,000.87	62,043.47
Walsh	12,993.70	17,090.83	36,018.42	66,102.95
Ward	25,000.00	8,000.00	59,114.94	92,114.94
Wells	6,000.00	10,000.00	27,919.00	43,919.00
Williams	25,303.12	20,109.00	36,525.48	81,937.60
Total	$614,807.52	$549,581.36	$1,475,471.60	$2,639,860.48

1916 Road and Bridge Tax

At the time it was necessary to submit this report to the printing commission it was not possible to get complete information as to what the 1917 road tax in the various civil townships would amount to. The county road and bridge tax is shown below. These figures represent approximately the amount of money that the county boards of commissioners will handle during the road building season of 1917. The motor vehicle license refund, amounting to $86,072.50 for the first six months of 1916, is not included.

County.	County road fund	County bridge fund	Road fund in unorganized townships	Total
Adams	$3,000.00	$15,000.00	.....	$18,000.00
Barnes	13,516.10	6,300.00	$2,415.00	22,231.10
Benson	16,000.00	10,000.00	2,000.00	28,000.00
Billings	8,000.00	8,000.00	10,592.00	26,592.00
Bottineau	10,000.00	25,000.00	.....	35,000.00
Bowman	6,500.00	6,500.00	1,500.00	14,500.00
Burke	.....	.....	.....	.....
Burleigh	55,000.00	38,000.00	.....	93,000.00
Cass	15,000.00	40,000.00	.....	55,000.00
Cavalier	12,000.00	25,000.00	.....	37,000.00
Dickey	.....	.....	.....	.....
Divide	20,000.00	5,000.00	.....	25,000.00
Dunn	18,000.00	15,000.00	16,000.00	49,000.00
Eddy	.....	.....	.....	.....
Emmons	20,000.00	8,000.00	12,000.00	40,000.00
Foster	.....	.....	.....	.....
Golden Valley	.....	8,000.00	1,500.00	9,500.00
Grand Forks	20,000.00	35,000.00	.....	55,000.00
Griggs	7,000.00	6,000.00	.....	13,000.00
Hettinger	13,000.00	13,000.00	3,500.00	29,500.00
Kidder	15,000.00	.....	10,000.00	25,000.00
LaMoure	8,000.00	13,950.00	1,700.00	23,650.00
Logan	8,000.00	3,000.00	1,100.00	12,100.00
McHenry	9,000.00	25,000.00	5,000.00	39,000.00
McIntosh	12,000.00	4,000.00	.....	16,000.00
McKenzie	.....	.....	.....	.....
McLean	28,000.00	7,000.00	15,000.00	50,000.00
Mercer	31,812.00	14,139.00	.....	45,951.00
Morton	50,000.00	40,000.00	30,000.00	120,000.00
Mountrail	21,000.00	9,000.00	.....	30,000.00
Nelson	.....	.....	.....	.....
Oliver	.....	6,000.00	12,600.00	18,600.00
Pembina	2,000.00	18,000.00	.....	20,000.00
Pierce	2,000.00	4,000.00	12,000.00	18,000.00
Ramsey	8,000.00	10,000.00	1,100.00	19,100.00
Ransom	.....	.....	.....	.....
Renville	.....	.....	.....	.....
Richland	.....	.....	.....	.....
Rolette	28,000.00	8,000.00	.....	36,000.00
Sargent	.....	3,500.00	.....	3,500.00
Sheridan	16,000.00	.....	8,000.00	24,000.00
Slope	.....	.....	.....	.....
Sioux	.....	4,000.00	5,000.00	9,000.00
Stark	12,000.00	7,200.00	6,000.00	25,200.00
Steele	8,000.00	10,000.00	.....	18,000.00
Stutsman	40,000.00	25,000.00	12,500.00	77,500.00
Towner	7,000.00	12,000.00	2,950.00	21,950.00
Trail	5,000.00	32,000.00	.....	37,000.00
Walsh	13,000.00	17,000.00	.....	30,000.00
Ward	25,000.00	10,000.00	1,500.00	36,500.00
Wells	6,000.00	15,000.00	10,000.00	31,000.00
Williams	30,000.00	30,000.00	.....	60,000.00
Total	$621,828.10	$591,589.00	$183,957.00	$1,397,374.10

REPORTS OF COUNTY SURVEYORS.

The various county surveyors were requested to furnish short reports concerning road work within the county. While these requests were made of all the counties who employed a county surveyor, returns have been secured from but four counties.

Burleigh County

By T. R. Atkinson, County Surveyor.

The total number of miles of road in this county when the section line roads are all opened will be practically 3,300. At the present time

Steel Bridge Over Mouse River at Westhope, Bottineau County.
Photo courtesy of T. R. Atkinson, Engineer.

Burleigh County. Example of Sand Clay Road.
Photo courtesy of T. R. Atkinson, Engineer.

there are about 550 miles graded. The number of miles graded by the county during the road building season of 1914 was 25, during the road building season of 1915, 185 and we estimate that there will be graded about 150 miles during the season of 1916.

The total appropriation for road work in this county for 1914 was $14,000, for 1915, $30,000 and for 1916 and 1917, $45,000. The average cost per mile for turnpiking in this county, using the outfit owned by the county, is around $85.00. The contract price for cut and fill work averages about twenty cents.

In 1914 this county constructed 15 bridges, having a span of from 10 to 50 feet; in 1915 seven bridges were constructed, and the contract for 1916 and 1917 is let for the construction of 26 bridges. None of the bridge work in this county was inspected during construction until the year 1915, since which time all bridge work is under the direct charge of the county surveyor.

The county owns five 12-foot blade graders with a traction engine for each grader. We find this a very economical way of constructing our turnpiked roads.

Concerning the construction of roads in the county, my judgment is that all of the roads should be placed under the direct charge of the county commissioners, who should appoint a county superintendent of highways, which superintendent should be a civil engineer, skilled in road construction and sufficiently capable to draw a salary of at least $2,500 per year and expenses. The counties could then purchase their road machinery and operate it much more economically than by contract work, that is, for ordinary turnpiking. For cut and fill work the work should be let by contract at stipulated price per cubic yard, and done under the direction of the county superintendent of highways.

I also believe that since the demand for roads has become so universal in this state, that some manner of bonding the counties for highway construction should be placed on the statute, and it would aid very materially in building better roads.

Cass County

By S. F. Crabbe, County Surveyor.

There are 3,500 miles of graded or partially graded roads in the county, approximately 1,500 miles being well graded. During the year 1914, 250 miles of road were graded, during 1915, 300 miles, and during 1916 approximately 400 miles will be graded. The average cost of road construction under the township plan is from $150 to $200 per mile.

The county is building two main roads that traverse the county east and west and north and south. The work has been executed under the contract system, the work being done according to plans and specifications, special attention being given to proper drainage of the road grade. In my judgment proper drainage is fundamental in the construction of good roads. These roads cost from $150 to $500 per mile.

The county is replacing the old wooden bridges as fast as possible with steel and concrete bridges. This work is done by contract under the supervision of the board of commissioners.

The county owns no grading machinery except one outfit, for maintenance of the county roads.

It is my judgment that the best results will obtain in the construction of roads under the contract system.

We have constructed over 40 miles of road in connection with our drainage ditch work, utilizing part of the excavation in building a first-class road.

Renville County

By Ed White, County Surveyor.

Renville County has a total of 1,700 miles of established roads, of which 150 miles are estimated as being graded. In 1914 the county graded 22 miles and in 1915 36 miles, while it is estimated that 60 miles will be graded during the season of 1916.

$27,000 was expended during 1914 for road work, $31,000 during 1915 and it is estimated that $40,000 will be spent during 1916. The average cost per mile for turnpiking is $250 and the average price per cubic yard for cut and fill work is twenty-eight cents.

A 117-foot steel bridge was built in 1914, and a span of similar length was erected this year. The county does not make a practice of having any bridge work inspected during the time of erection.

A co-operative arrangement between the counties and the townships is followed out, the county doing all the turnpiking of roads, while the townships are expected to grade those places requiring fills. It is not a very satisfactory arrangement, as the township work is generally of an inferior nature.

The county owns and operates its own road machinery, but it is thought that better and more economical work would be secured if the work was let to private parties by contract.

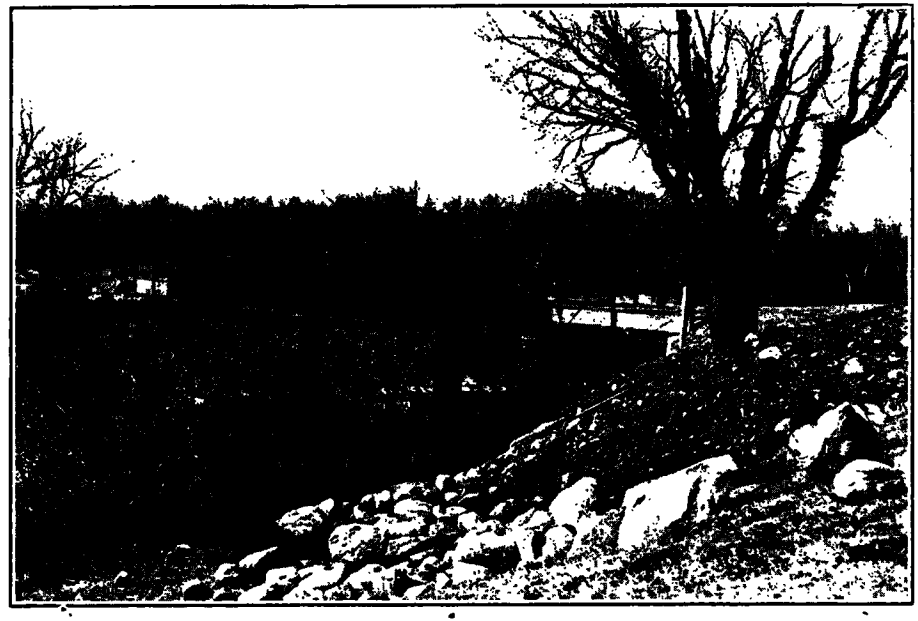
Stark County.

By W. R. Veigel, County Superintendent of Highways.

The total number of miles of section lines in the county is 2,664, of which 1,600 miles have been opened as highways. Most of the remainder are traveled, many with much work done on them, but never formally opened. One hundred miles of the roads of the county are graded with all culverts and bridges put in. In 1914, 25 miles were graded, in 1915 no grading was done, and it is estimated that at least 70 miles will be graded in 1916, 50 miles being completed at the present time.

During 1914 $21,272.75 was expended for road work in the county, during 1915, $18,163.52, and during 1916 about $18,000 will be expended The average cost for turnpiking is about $75.00 per mile, for a roadway from 30 to 32 feet wide. The cost is about $15.00 more per mile in heavy clay or gumbo and $15.00 less on light soil. In gumbo soils we use an engine and on sandy soils we use horses on the grader. The cost of the engine with engineer and all engine supplies is $2.00 per mile; the grader man is paid four dollars per day.

We make three rounds with a three-gang plow, setting the plows three, five and seven inches deep. After each round the loose earth is



Steel and Concrete Bridge Over the Mouse River Five Miles Below Minot, Ward County. A Type of Bridge Particularly Adapted to the Location, And of a Permanent Nature.

Photo courtesy of H. C. Frahm, County Surveyor

shoved in with a push grader, making on each mile with the engine, gumbo soil:

Three rounds with plows, 6 mi.	$12.00
12 to 15 rounds with grader, average, 27 mi.	54.00
Grader man two days	8.00
Blacksmithing, wear, breakage, moving, etc.	16.00
Total cost per mile in heavy soils	$90.00

We do all other road work under the superintendent of highways system. Twelve men are appointed each spring. Each has a camp outfit. They hire their own men and teams and move from place to place according to a plat furnished them by the superintendent and county commissioners each spring, after they have gone over the county to locate the work.

The deputies make a report to the superintendent at the end of each month, showing the amount of time spent on each piece of work, the names of their men and time of each, and all other work done during the month; also the location of government corners that have been covered or excavated.

Deputies are paid from three to four dollars per day, labor and team 25 cents per hour each. We have some good deputies by this time and have some more in the making, and with good deputies I do not believe this system can be improved much.

No large bridges were built in the county since 1913. Bridges from 10 to 32 feet long and 18 feet wide, we advertise for each spring, after going over the county to see what we need. These are all I beam bridges, some with I beam legs and some with concrete or stone masonry abutments, depending on the proximity of sand and stone. All have plank floors. All these bridges are put up by the deputies that have had the most experience. All bridge work is inspected once or twice during construction, except the smaller all steel bridges.

The county owns all its machinery and road tools except the engine.

I think the auto license should be raised to five dollars per year and the money used exclusively for dragging the main roads.

It would be a great help to us county surveyors if the state engineer were given a sufficient appropriation to enable him to prepare a set of standard plans and specifications for all kinds of culverts and small bridges, say up to 100 feet long. It takes time and money for each county surveyor to draw plans, etc., for each separate bridge or culvert, and many are not able to do so, without some such help, and the counties depend on the bridge companies for their plans and specifications.

Ward County

By H. C. Frahm, County Surveyor.

It is estimated that there is a total of 2,000 miles of roads in the county, 300 miles of which are graded. About 25 miles were graded during the road season of 1914, 25 miles during the season of 1915 and 50 miles during the season of 1916. Nine bridges were built in 1914, 11 in 1915 and 20 in 1916. Most of these bridges are heavy pile, timber and

combination construction, spans and lengths from 12 to 150 feet, costing about $275 to $1,500, some few being of steel and concrete, of higher cost.

The county owns four large blade graders and as many smaller ones, which have been operated by the county in connection with the townships. These machines are usually operated by the day or by the mile, the cost being about $75.00 per mile. The cut and fill work is generally contracted and the average cost would be about 22 cents per cubic yard.

The cost of road work might be made more economical in this part of the country by being planned further in advance. Petitions are sent in to the board of county commissioners for various pieces of roads in various parts of the county at various times of the year, and an attempt is made to rush the work through without any particular plan for definite lines of highways. The result is that considerable money is spent on some roads which are little used, depending on where the petition pushers show the greatest activity. The bidding at the various lettings is rather spasmodic, at times there being an over-supply of bidders, keen competition, and the work let at figures for which it cannot be profitably done. This is particularly true of inexperienced contractors, and results in some dissatisfaction on all sides. At other times no bidders are on hand, or are few in number, so that higher prices result. If the contractor obtains a good price the work is generally done more rapidly than if he finds himself on a losing proposition and drags it along sometimes for years.

On the whole a great improvement has been shown in recent years over old methods. Those who have been engaged in the work for some time have seen the value of inspection and of estimating the earthwork, and of knowing the per cent of grade to be obtained before beginning construction. A considerable part of the work consists of relocating old roads which have been found unsatisfactory. The roads around the sloughs and the hills are the ones which cause the least trouble, unless someone tries to shove them over onto the section line. Better construction also is demanded now than formerly and at no great distant date this part of the country will doubtless show as great improvement in road building as it has along other lines.

OIL IN ROAD BUILDING IN NORTH DAKOTA.

The state engineer's office has received a large number of inquiries concerning the use of oil on city streets and for country roads. Following is a short report by Mr. W. R. Veigel, City Engineer, Dickinson, giving information concerning experience there in the oiling of streets.

The cost of oiling the streets of Dickinson is as follows:

First cost of oil, f.o.b. Wood River, Ill., 6,356 gal.,4¼c	$270.13
Freight on same, Wood River to Dickinson	321.25
Freight on oil wagon, Mandan to Dickinson	14.85
Demurrage on car while unloading	31.00
Expense of putting oil on streets	109.10
Special assessment commission	30.00
Printing notices of assessment	15.00
	$791.33

Stutsman County. A View of the Red Trail.
Photo courtesy of T. R. Atkinson, Engineer.

I Beam Reinforced Concrete Bridge on Road Between Wilton and Washburn, McLean County. 30 Foot Span. Plans Furnished By State Engineer's Office.

A Burleigh County Road Outfit Working Near Wing, Season 1915.

The cost of oiling was assessed against the abutting property. A total of 13 blocks or 24,745 square yards of street were treated. Prior to the application of the oil the streets were shaped with a template, which was rolled along the curbs, with men following to fill or cut as required. After the streets were well shaped they were sprinkled with water and then were opened to traffic for from two to five days, after which they were swept and oiled. The oil was applied hot and was absorbed by the ground much sooner than if it had been applied cold. This year, on re-oiling the streets it was not necessary to crown them, as they were not cut up at all.

The oiling of streets has proved satisfactory and no complaints are heard excepting that on very windy days the merchants complain of oily dust blowing into their stores.

EXAMINATION OF STATE LANDS FOR COAL

The constitution provides that no coal-bearing, state-owned land shall be sold. Article 6 of chapter 5, Compiled Laws of 1913 provides for an examination of these lands for the purpose of determining whether they are coal bearing within the meaning of the constitution.

This work is delegated by law to the state engineer, who is also ex-officio state coal mine inspector, and under authority of the Board of University and School Lands an investigation was begun in December, 1914, which required a year's time to complete.

The lands examined were those specified by the Board, and lay in Burke, Burleigh, Divide, Dunn, Mercer, Morton, Sheridan, Stark and Williams Counties. The field work was done by W. H. Robinson, J. M. Hansen, and Harris Robinson, representing the state engineer's office.

The lands are classified either as "coal land," "held for further investigation," or "not coal land." Those classed as coal lands are lands which are without doubt coal bearing; those pieces "held for further investigation" are so classified to indicate that at some time they should be more closely examined by drilling to ascertain the thickness and depth of underlying beds of coal. Drilling is not feasible at the present time, as there is no statute designating what shall legally constitute "coal land." Land classified as not coal land is land which shows no likelihood of being at any time valuable for coal purposes, and near which no trace or record of coal could be found.

The data used as a basis in making the classifications was secured by careful field investigations, from logs of wells, promixity of known outcrops and mines, and from state and federal geological reports. The reports of the state geological survey were of especial value.

A short description of the character of every piece of state land is submitted with the reports filed with the land commissioner, copies of which may be seen either in the land commissioner's office or in the office of the state engineer.

The following table gives summaries of the work done:

County	Total Acreage Inspected	Coal land	Not coal land	Recommend further investigation	Per cent of Land Inspected		
					Coal land	Not coal land	Recommend further investigation
Burke	29,958.28	8,465.82	13,881.17	7,611.29	28.26	46.33	25.41
Burleigh	31,867.42	4,232.22	25,567.98	2,067.22	13.28	80.23	6.48
Divide	51,594.78	4,775.98	40,270.96	6,547.84	9.26	78.05	12.69
Dunn	59,811.12	25,371.12	12,160.00	22,280.00	42.42	20.33	37.25
Mercer	50,847.67	15,230.16	12,155.35	23,462.16	29.95	23.91	46.14
Morton	129,137.82	61,470.28	63,845.00	3,822.54	47.60	49.44	2.96
Sheridan*	.....	.....	.....	.....	.....	.....	.....
Stark	47,836.82	21,826.34	18,010.48	8,000.00	45.63	37.65	16.72
Williams	72,888.21	40,945.38	22,342.83	9,600.00	56.18	30.65	13.17
Total	473,942.12	182,317.30	208,233.77	83,391.05	38.68	43.51	17.81

*No land in Sheridan County classified as coal land.

A detailed statement of the expenditures made is also filed with the land commissioner, and is a part of the records of the state engineer's office, the following statement giving summaries only.

County	Office expense and salaries	Field expense	Field salaries	Total
Burke	$32.71	$112.94	$43.60	$189.25
Burleigh	22.28	147.77	30.00	200.05
Divide	47.23	289.08	94.84	431.15
Dunn	55.89	299.98	100.80	456.67
Mercer	42.64	276.78	121.67	441.09
Morton	94.20	469.12	159.00	722.32
Sheridan	....	25.70	6.40	32.10
Stark	36.30	259.35	107.60	403.25
Williams	59.98	407.04	180.16	647.18
Total	$391.23	$2,287.76	$844.07	$3,523.06

Total appropriation	$3,500.00	
Total expenditures	3,523.06	
Overdraft		$23.06

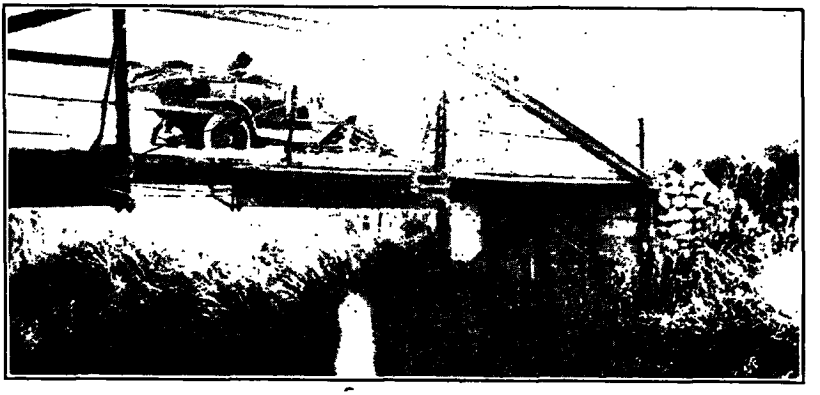
TABLE SHOWING COST PER ACRE FOR ALL WORK DONE IN EXAMING STATE LAND FOR LIGNITE COAL.

County	Total acreage	Cost per acre			Total cost per acre
		Office work	Field expense	Field salaries	
Burke	29,958.28	.00109	.00376	.00146	.00631
Burleigh	31,867.42	.00069	.00464	.00094	.00627
Divide	51,594.78	.00092	.00560	.00184	.00836
Dunn	59,811.12	.00093	.00501	.00168	.00762
Mercer	50,847.67	.00084	.00544	.00239	.00867
Morton	129,137.82	.00073	.00363	.00123	.00559
Sheridan*	.....	.....	.....	.....	.....
Stark	47,836.82	.00076	.00542	.00225	.00843
Williams	72,888.21	.00082	.00558	.00247	.00887

*Total cost of inspection in Sheridan County, $32.10.

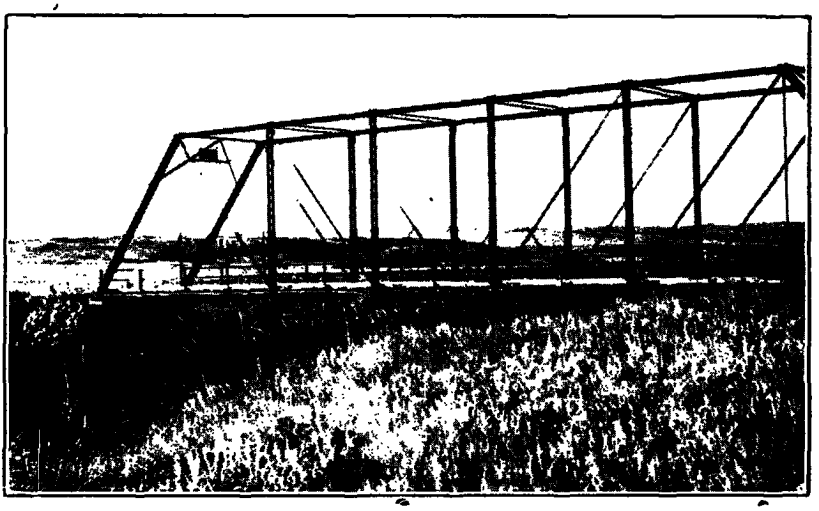
Total acreage	473,942.12
Total average cost per acre	$0.00743

State lands in Adams, Billings, Bowman, a small part of Burleigh, Golden Valley, Hettinger, McKenzie, McLean, Mountrail, Oliver, Slope, and Sioux Counties have yet to be classified. Under the head of "recommendations" the advisability of making a slight change in the existing law is presented.



Bridge in Mercer County. Note Damage Done by Ice, and the Poor Type of Abutment.

Mercer County Bridge. An Example of a Very Good Steel Truss Placed On a Poor Type of Abutment.



Old Bridge Over the Knife River in Mercer County. An Example of a Bridge Designed for a Very Light Load. Note the Poor Foundations. I Beam Piles With Plank Backing.

RIVER RECORDS

By E. F. Chandler
Assistant Engineer, United States Hydrographic Survey

By permission of the United States Geological Survey, with which the office of the state engineer has been co-operating in this work, the following tables of flow of the more important or typical streams in North Dakota and the Red River Valley have been selected and compiled from the records of the Survey for publication herein. The larger portion of the expense entailed in the continuous maintenance of these records has been provided for from Federal appropriations, but a part of the expense (in particular, the payment of gage-observers in each locality) has from time to time been properly carried from state funds by the states concerned. Less such work is maintained in North Dakota than in some other states where there is a greater opportunity for irrigation, for water-power development, or for navigation, where land drainage has been more thoroughly extended, or where water supplies for municipal and domestic use have been more completely investigated. But development in all these lines is often proposed or discussed in North Dakota, and also flood protection and various other matters intimately related to the flow of the streams. It is impossible to make defensible plans for progress in any such matter without a reasonably definite knowledge of the amount of water usually available in the streams. This varies from year to year more than the rainfall varies, and figures deduced for one region cannot be transferred to a far-distant region; thus it is absolutely necessary if there is to be economical development along any of these directions in North Dakota that there should be a reasonably comprehensive knowledge of the facts concerning the streams in our own state through a fairly long term of years available for use. This is therefore an activity that especially concerns the office of the state engineer.

In North Dakota there are few advantageous opportunities for the use of water power, and there are also difficulties in some other forms of stream use. Therefore, it often happens that the evidence given by the river records is merely negative evidence, which, instead of assisting in the development of some plan, absolutely forbids any effort to carry it through. At first thought, in such case the records seem to have been of little use to the people of the state; but it is as truly a benefit to a locality to prevent the waste of money in efforts to carry through some ill advised and unprofitable scheme which can only terminate in bankruptcy, as it is to assist in the extension of the profitable plans in which the money of the people might more advantageously be expended.

The methods followed in this work were described in detail in the First Report of the North Dakota State Engineer (1905), pages 49 to 62, and also in the Second Report (1907), pages 47 to 49. A discussion of

the conclusions which can be drawn from these records in regard to the available surface water supply in different portions of the state appears in the Third Report (1909), pages 53 to 66, although some of the conclusions there stated might be a little modified on the basis of the eight years of additional records now available. The methods used may be briefly stated thus:

At each "river station" or "gaging station" a gage is established and an observer appointed. Daily or several times each day the observer reads and records the height of the water level of the river at the gage, these gage-heights being recorded in feet and tenths of a foot. The zero of the gage is usually below the lowest known low water, and at some stations is many feet below the bottom of the channel, but the height of the floods is easily found by comparing the maximum gage-height readings recorded during floods with the minimum gage-heights recorded at times of low water.

At suitable intervals, an engineer or assistant (called in this work a "hydrographer"), equipped with appropriate meters and other instruments, makes measurements of the discharge (i. e., of the actual number of gallons of water per day flowing by the gage) and records the discharge and gage-height found at that time. It is thus known how much water will flow whenever the river happens to be at the same gage-height again, provided the river channel does not suffer change in the meantime.

When enough such measurements of discharge have been secured, at different heights of the river (low water, medium height, and flood height) it becomes possible by interpolation to determine closely how much water would flow by the gage daily at every possible foot and tenth of height from the lowest stage to highest water; but the use of this basis of fact, there is then computed from the record of daily gage-heights that has been made by the observer a record of actual daily quantity of water that has flowed by the station, and these quantities are tabulated in any form needed for reference. In the following pages, these results have been arranged as tables of "Monthly Discharge," showing for each month the flow for that day of the month when the flow was the greatest or maximum, the flow for the minimum day, and the mean flow or average for the whole month.

All figures of discharge given here are in "second-feet." One second-foot is a flow that carries one cubic foot of water past the observer each second; a rapid current in a small channel, or a slow current in a large channel, can carry the same amount of water past the observer in a second. For example, a stream two feet deep and five feet wide flowing with a velocity of six feet per second, and a stream twenty feet wide and six feet deep flowing with a velocity of one foot per second, would each carry sixty second-feet of water.

One second-foot amounts to 646,317 gallons per day, and will cover almost two acres one foot deep in twenty-four hours.

As successive years vary considerably, an absolutely exact record of the quantity of flow of a river through one year would not tell how much might flow the next year; it sometimes happens that the flow of one year is five, ten or twenty times as great as the total entire flow of a

previous year; nor could this record be applied without judgment to adjoining rivers, for no two records are precisely alike in their conditions and behavior, so that records of as many streams as possible are needed if well-considered use is to be made of them. Therefore, rather than spend a large appropriation in making a precise record of a single stream for a single year, it is much more advantageous to extend the work to as many streams through as long a period of years as the available funds will possibly permit; provided, however, that care must be taken that the work and attention are not reduced so much as to result in a disproportionate loss of accuracy.

The column headed "accuracy" in the tables of monthly discharge applies to the mean flow for the month, but not always to the maximum or the minimum (which might have been affected by accidental error entering for only a single day, such as absence of the observer for example). It depends on the reliability of the daily observer, upon the permanency of the stream channel and of the gage and other such conditions, and upon the number and consistency of the measurements of discharge; more discharge measurements ordinarily bring much greater accuracy to the computed results of the season, but in a region of rock-bound, absolutely permanent channels (no such streams being found in North Dakota) after a sufficient number of discharge measurements have once been secured, few or none are needed in following years.

The mean for any month marked A in these tables may safely be assumed as accurate within five per cent; of any month marked B, within 10 per cent; C, within 15 per cent; D, within 25 per cent; E indicates a rough estimate which is presumably within 50 per cent of the truth, although in some of the cases of winter month estimates marked E, it is possible that the flow is but a small fraction of the estimates, but it can be stated with reasonable assurance that in none of these cases could the flow possibly have been more than 50 per cent greater than the estimate.

The summaries from September 1, 1914, to August 31, 1916, of the records of these streams are included here:

Red River at Grand Forks, N. D.
Red River at Fargo, N. D.
Pembina River at Neche, N. D.
Red Lake River at Crookston, Minn.
Thief River near Thief River Falls, Minn.
Mouse River at Minot, N. D.
Grand River (North Branch) at Haley, N. D.
Cannon Ball River near Stevenson, N. D.
Heart River near Richardton, N. D.
Knife River near Broncho, N. D.

The portions of these summaries for the year 1916 have been extracted from the official records in advance of the completion of the computations of the season's work as made for publication by the U. S. Geological Survey and are therefore still subject to minor revision, and some other portions of the tables here included are also from the preliminary computations. But in no case is it expected that the final revision will introduce any large changes in the figures here given, and in most cases there will be no appreciable change.

Similar summaries of many of the river records in this region for previous years may be found in the following reports:

1903-1904, in Third Report of North Dakota Geological Survey
1905-1906, in Second Report of North Dakota State Engineer
1907-1908, in Third Report of North Dakota State Engineer
1909-1910, in Fourth Report of North Dakota State Engineer
1911-1912, in Fifth Report of North Dakota State Engineer
1913-1914, in Sixth Report of North Dakota State Engineer

Complete records are published from year to year in the Water Supply and Irrigation papers series published by the United States Geological Survey, in which also all the methods are fully described.

These summaries and many other less important ones are on file in the office of the state engineer at Bismarck. All the original data of every kind on which these results and summaries have been based are kept in the Washington office of the U. S. Geological Survey, and copies of all the data are also on file in the office of the resident hydrographer of the Survey, E. F. Chandler, whose post office address is University, N. D. On request to any one of these offices full information can be obtained if desired by any one who has reason for interest in any of these records or investigations.

RED RIVER AT GRAND FORKS, N. D.

Gagings of the flow of the Red River of the North at Grand Forks, N. D., were begun by the United States Geological Survey in 1901, but a gage height record was kept under the direction of the Corps of Engineers (War Department) by whom the dredging fleet was operated for the improvement of the river, for about twenty years previously and a few discharge measurements were made by them; thus fairly good run-off summaries begin with the year 1882. The gaging station is located below the confluence of the Red and Red Lake Rivers. The total drainage area is 25,000 square miles, of which 13,400 is in Minnesota.

The tables of discharge, based on the measurements in the list below and on ninety-two measurements made during the fourteen preceding years, are fairly accurate through the entire year.

MEASUREMENTS OF DISCHARGE.

Date	Name of Hydrographer	Gage-height	Discharge
1- 9-1915	O. Christianson	6.65*	842
2-20-1915	O. Christianson	6.70*	754
4-16-1915	E. F. Chandler	11.54	4,140
6-14-1915	Chandler and Sprague	9.17	2,950
7-15-1915	E. F. Chandler	18.06	8,380
10- 9-1915	Sprague and McKay	6.78	1,750
12-23-1915	Chandler and McKay	6.97*	1,090
2- 8-1916	Sprague and H. Miller	6.15*	628
3-18-1915	Sprague and H. Miller	7.40*	862
4- 8-1916	Sprague and McKay	35.46	17,800
4-16-1916	Sprague and McKay	40.77	25,200

*Frozen; mean thickness of ice from 0.8 to 1.8 feet.

MONTHLY DISCHARGE OF RED RIVER AT GRAND FORKS, N. D.

	Month	Maximum	Minimum	Mean	Accuracy
1914	September	1,630	890	1,180	B
	October	1,460	1,030	1,270	B
	November	1,500	.....	1,350	C
	December	.....	.....	1,170	D
1915	January	.....	.....	780	D
	February	.....	.....	740	D
	March	.....	.....	1,170	D
	April	9,950	2,000	4,150	B
	May	4,740	2,050	3,220	A
	June	18,600	2,100	5,750	A
	July	21,500	3,880	11,000	A
	August	3,750	1,760	2,410	A
	September	1,720	1,460	1,550	A
	October	1,760	1,500	1,610	A
	November	1,540	1,340	1,480	B
	December	.....	.....	1,240	C
1916	January	.....	.....	847	D
	February	.....	.....	671	D
	March	.....	.....	1,070	D
	April	28,300	6,340	22,000	C
	May	23,400	5,980	11,000	B
	June	8,990	4,870	6,820	B
	July	14,700	6,770	11,300	B
	August	6,410	4,070	4,920	B

Maximum gage-heights, 30.8 feet July 3, 1915; 41.0 feet April 16, 1916; 24.1 feet July 14, 1916; maximum ever recorded, 50.2 feet April 10, 1897.

Minimum gage-heights, 5.4 feet October 4, 1914; 6.3 feet November 17, 1915; minimum ever recorded, 2.6 feet February 10, 1912.

RED RIVER AT FARGO, N. D.

The gaging station on the Red River of the North at Fargo was established May 27, 1901. The drainage area above this point is 6,020 square miles, of which 1,750 square miles is in North Dakota, 500 square miles in South Dakota, and 3,770 square miles in Minnesota.

In September, 1914, the gage location for the Geological Survey was changed from the Front Street bridge to a point immediately above the Island Park dam. The zero of the gage at Island Park is about one foot below the crest of the dam, and is so related to the zero of the Front Street gage that at flood stages, when the dam is drowned out and causes no irregularity in the surface slope of the river, readings on the Front Street gage are about 10.2 feet more than on the Island Park gage now used.

The tables of discharges, based on the measurements in the list below and sixty-one measurements made during the fourteen preceding years, are unusually accurate except during extreme flood periods (especially in early spring, when the retarding effect of ice in the current cannot be conveniently determined) and except during winter, when they are mere estimates.

MEASUREMENTS OF DISCHARGE.

Date	Name of Hydrographer	Gage-height	Discharge
9-12-1914	E. F. Chandler	2.84	451
12-26-1914	L. W. Burdick	2.51	394
2-25-1915	O. Christianson	8.90*	307
4-14-1915	O. Christianson	3.58	833
7-12-1915	E. F. Chandler	4.49	1,700
8- 2-1915	E. F. Chandler	4.01	1,190
8-18-1915	E. F. Chandler	3.74	1,040
9-24-1915	V. H. Sprague	3.31	732
11- 6-1915	E. F. Chandler	3.28	697
4- 8-1916	E. F. Chandler	28.79*	about 7,200
4-19-1916	V. H. Sprague	19.95*	4,400
6-10-1916	V. H. Sprague	5.02	2,140
8-24-1916	E. F. Chandler	5.18	2,350

*Gage-height at Front Street.

MONTHLY DISCHARGE OF RED RIVER AT FARGO, N. D.

	Month	Maximum	Minimum	Mean	Accuracy
1914	September	710	435	542	A
	October	650	543	583	A
	November	622	448	532	B
	December	.....	.....	410	D
1915	January	.....	.....	340	E
	February	.....	.....	310	D
	March	.....	.....	390	D
	April	2,430	494	1,000	A
	May	906	708	788	A
	June	2,620	679	1,530	A
	July	3,110	1,225	1,900	A
	August	1,220	900	1,060	A
	September	943	708	791	A
	October	836	739	794	A
	November	.....	.....	661	C
	December	.....	.....	565	E
1916	January	.....	.....	328	E
	February	.....	.....	154	E
	March	.....	.....	618	E
	April	7,440	4,480	5,420	C
	May	4,560	1,860	2,530	A
	June	3,760	1,140	2,040	A
	July	7,720	2,710	5,460	C
	August	3,080	1,100	1,860	A

Maximum gage-heights, 6.0 feet (15.8 on Front Street gage) July 3, 1915; 19.9 feet (30.1 on Front Street gage) April 6, 1916; 17.3 feet (27.5 on Front Street gage) July 11, 1916.

Minimum gage-heights during open season, 2.55 feet November 16, 1914; 2.85 feet November 18, 1915; minimum ever recorded, 5 7 feet (on Front Street gage) November 1, 1910.

PEMBINA RIVER AT NECHE, N. D.

The gaging station on the Pembina River was established April 29, 1903, and is located at Neche, sixteen miles from the mouth of the river. The drainage area above this point is 2,940 square miles, of which 920 square miles is in North Dakota and 2,020 square miles in Manitoba. On account of lack of funds, observations at this station were discontinued September 30, 1915.

The tables of discharges, based on the measurements in the list below and fifty measurements in the previous twelve years, would be fairly accurate through the whole open season except that at low stage the flow is so small that an error of a few second-feet is a large percentage of the entire flow; the winter figures are merely estimates.

MEASUREMENTS OF DISCHARGE.

Date	Name of Hydrographer	Gage-height	Discharge
9- 1-1914	E. F. Chandler	2.48	12
7-20-1915	E. F. Chandler	3.87	24
9- 6-1915	E. F. Chandler	2.79	2
4-24-1916	E. F. Chandler	16.82	2,040

MONTHLY DISCHARGE OF PEMBINA RIVER AT NECHE, N. D.

Month		Maximum	Minimum	Mean	Accuracy
1914	September	22	6	13	C
	October	38	17	28	C
	November	29	.....	21	D
	December	.....	.....	9	E
1915	January	.....	.....	6	E
	February	.....	.....	5	E
	March	.....	.....	9	E
	April	.....	.....	46	C
	May	29	25	25	C
	June	29	22	25	B
	July	22	16	20	B
	August	16	5	9	B
	September	22	9	12	C

Maximum gage-height, 6.0 feet April 8, 1915; maximum ever recorded, 20.9 feet May 2, 1904; April 19, 1916, height said to be 21.5 feet.
Minimum-gage height, 3.1 feet August 13, 1915.

RED LAKE AT CROOKSTON, MINNESOTA

The Red Lake River is the principal tributary of the Red River, and its average flow is slightly greater than that of the Red River itself above Grand Forks; hence it is an important factor in the behavior of the lower Red River. The gaging station on the Red Lake River at Crookston, Minnesota, was established May 19, 1901. The drainage area above Crookston is 5,320 square miles, and there are no considerable tributaries between this point and the mouth of the river at Grand Forks, so that almost the entire discharge is shown here.

Since September, 1911, an automatic gage has been maintained at this station by which a continuous record of the hourly variations of flow is secured, so that the records are unusually accurate.

The tables of discharge are based on the measurements in the list below and on ninety-two measurements in the fourteen preceding years and have excellent accuracy through the open season and fair through the winter; on account of the operation of power plant above the gage,

under some conditions for a single hour the gage-height does not indicate the true amount of flow, which is the cause of the discrepancies appearing in some of the measurements.

MEASUREMENTS OF DISCHARGE.

Date	Name of Hydrographer	Gage-height	Discharge
10-17-1914	O. Christianson	4.21	707
11-13-1914	O. Christianson	3.98	610
1- 2-1915	O. Christianson	4.68*	314
2- 9-1915	O. Christianson	5.17*	339
6-22-1915	O. Christianson	7.62	2,660
7- 2-1915	O. Christianson	12.28	6,280
7-24-1915	E. F. Chandler	6.19	1,750
10-30-1915	E. F. Chandler	3.83	550
1- 3-1916	D. C. McKay	4.95*	536
2- 7-1916	V. H. Sprague	4.79*	384
3-17-1916	D. C. McKay	5.22*	391
3-18-1916	D. C. McKay	5.31*	383
4-20-1916	D. C. McKay	17.27	10,400
4-25-1916	D. C. McKay	15.85	9,270
8- 2-1916	E. F. Chandler	4.77	958
8- 3-1916	E. F. Chandler	4.93	918

*Frozen; mean thickness of ice 0.6 to 1.3 feet.

MONTHLY DISCHARGE OF RED LAKE RIVER AT CROOKSTON, MINNESOTA.

Month		Maximum	Minimum	Mean	Accuracy
1914	September	580	402	516	A
	October	700	344	545	A
	November	.....	.....	604	C
	December	.....	.....	468	D
1915	January	.....	.....	386	D
	February	.....	.....	450	D
	March	.....	.....	543	D
	April	2,980	.....	1,340	B
	May	2,550	835	1,340	A
	June	7,860	745	2,380	A
	July	7,020	1,040	2,980	A
	August	1,200	480	712	A
	September	790	460	600	A
	October	660	500	597	A
	November	660	289	483	C
	December	745	382	558	C
1916	January	620	344	450	C
	February	540	382	463	C
	March	985	500	690	C
	April	14,400	790	6,910	C
	May	7,180	3,430	4,490	A

Maximum gage-heights, 14.25 feet June 29, 1915; 21.8 feet April 17, 1916; maximum ever recorded, 25.25 feet April 11, 1897.

Minimum gage-heights, 3.4 feet October 4, 1914; 3.45 feet November 15, 1915; minimum ever recorded, 2.16 feet October 9, 1911.

THIEF RIVER NEAR THIEF RIVER FALLS, MINNESOTA

The gaging station on the Thief River was established July 1, 1909. It is located about six miles above the confluence with the Red Lake River at Thief River Falls of the Thief River, which is one of the two most important tributaries of the Red Lake River, and is one of the

typical sources of occasional spring floods. The drainage area above the station is 1,010 square miles.

The tables of discharges are based on the measurements in the list below and twenty-three measurements made in the previous six years, and are excellent in accuracy except during the winter (when, however, the total discharge is very small) and the early spring break-up, when the effect of ice in raising the gage-height during the first flood is not readily determined.

MEASUREMENTS OF DISCHARGE.

Date.	Name of Hydrographer.	Gage-height	Discharge
12–28–1914	O. Christianson	*5.56	66
3– 6–1915	O. Christianson	*4.46	43
6–18–1915	O. Christianson	6.83	586
7–22–1915	E. F. Chandler	6.08	348
9–18–1915	E. F. Chandler	4.56	40
12–21–1915	D. C. McKay	*5.50	3
2– 5–1916	D. C. McKay	*4.00	1
3–12–1916	D. C. McKay	*4.06	2
4–23–1916	D. C. McKay	14.50	4,320
4–29–1916	D. C. McKay	13.42	3,290
8– 5–1916	E. F. Chandler	4.64	41
9– 8–1916	E. F. Chandler	6.13	405

*Frozen.

MONTHLY DISCHARGE OF THIEF RIVER NEAR THIEF RIVER FALLS, MINN.

	Month.	Maximum	Minimum	Mean	Accuracy
1914.	September	67	24	51	A
	October	144	31	92	A
	November	...	...	84	D
	December	...	...	63	E
1915.	January	...	...	42	E
	February	...	...	33	E
	March	...	...	59	E
	April	1,060	60	293	A
	May	640	112	247	A
	June	1,900	124	550	A
	July	1,860	184	545	A
	August	171	27	88	A
	September	39	26	32	C
	October	54	29	46	B
	November	66	22	43	D
	December	...	...	9	E
1916.	January	...	...	2	E
	February	...	...	1	E
	March	...	...	2	E
	April	4,080	4	2,060	D
	May	2,500	424	1,010	A
	June	472	149	245	A
	July	244	49	104	A
	August	885	22	247	A

Maximum gage-height, 10.6 feet June 30, 1915; 14.5 feet April 23, 1916. (April 23, 1916, maximum ever recorded.)

Minimum gage-heights (in open season), 4.4 feet September 17, 1915; minimum ever recorded, 3.5 feet August 2, 1911.

MOUSE RIVER AT MINOT, N. D.

The gaging station on the Mouse River at Minot, N. D., was established May 5, 1903. The drainage area above this point is 8,400 square miles, of which three-fourths is in Canada and one-fourth in North Dakota. The gage is located directly north of the Great Northern roundhouse, so that thus the gage-heights relate to the water level of the river at that point, which is the same as at the Great Northern Railway bridge.

The tables of discharge, based on the measurements in the list below and on fifty-two measurements made during the previous twelve years, are fairly accurate for all seasons.

MEASUREMENTS OF DISCHARGE.

Date.	Name of Hydrographer.	Gage-height	Discharge
9–16–1914	E. F. Chandler	4.14	4
2– 4–1915	E. F. Chandler	4.20	2
3– 6–1915	E. F. Chandler	4.26	3
7– 9–1915	V. H. Sprague	4.60	17
9–11–1915	E. F. Chandler	4.21	3
4–27–1916	E. F. Chandler	16.76	2,390
9– 5–1916	E. F. Chandler	4.59	23

MONTHLY DISCHARGE OF MOUSE RIVER AT MINOT, N. D.

	Month.	Maximum	Minimum	Mean	Accuracy
1914.	September	6	2	4	C
	October	1.8	1.4	1.6	C
	November	3.8	1.8	2.9	D
	December	...	...	1.3	E
1915.	January	...	...	1.0	E
	February	...	...	1.3	D
	March	...	...	2.7	D
	April	27	8	21	B
	May	27	14	20	B
	June	41	12	21	B
	July	17	12	15	B
	August	17	8	12	B
	September	8	6	7	C
	October	5	1	2	C
	November	...	...	0.9	D
	December	...	...	0.6	D
1916.	January	...	...	0.6	D
	February	...	...	1.5	D
	March	...	...	6	D
	April	3,000	150	1,440	B
	May	4,200	482	1,990	B
	June	455	239	337	B
	July	320	90	206	B
	August	137	33	58	B

Maximum gage-heights, 4.9 feet June 26, 1915; 19.1 feet May 6, 1916; maximum ever recorded 21.9 feet April 20, 1904.

Minimum gage-heights, 3.65 feet October 18, 1914; 3.5 feet December 19, 1915.

GRAND RIVER (NORTH BRANCH) AT HALEY, N. D.

The gaging station on the North Branch of the Grand River at Haley, N. D., was established May 11, 1908. The drainage area above this point is 500 square miles. The tables of discharge based on the measurements listed below and sixty-five measurements made in the previous seven years, are only approximate during most of the season, because of uncertainty in estimating the effect of ice during early spring floods and lack of enough measurements to determine possible channel changes affecting low stages.

MEASUREMENTS OF DISCHARGE.

Date.	Name of Hydrographer.	Gage-height	Discharge
8-11-1915	E. F. Chandler	1.64	17

MONTHLY DISCHARGE OF GRAND RIVER AT HALEY, N. D.

	Month.	Maximum	Minimum	Mean	Accuracy
1914.	September	4	2	3	D
	October	2.2	2.2	2.2	D
	November	...	...	1.1	D
	December	...	...	0.8	E
1915.	January	...	...	0.4	E
	February	...	...	0.3	E
	March	30	...	7	D
	April	19	2	4	C
	May	1,140	2	57	C
	June	3,230	16	199	C
	July	1,090	8	210	C
	August	370	5	47	C
	September	3.4	3.4	3.4	D
	October	...	...	3	D
	November	...	...	2	E
	December	...	...	1	E
1916.	January	...	...	1	E
	February	...	...	36	E
	March	...	...	15	E
	April	232	3	53	D
	May	39	1	12	D
	June	96	3	18	D
	July	...	...	34	D

Maximum gage-heights, 9.85 feet January 13, 1915; 8.6 feet February 21, 1916; maximum ever recorded, June 13, 1915.

Minimum gage-heights, 1.05 feet November 7, 1914; 1.25 feet June 10, 1916; minimum ever recorded, 0.55 feet September 5, 1912.

CANNON BALL RIVER NEAR STEVENSON, N. D.

The gaging station on the Cannon Ball River was first established June 10, 1903, at the postoffice of Stevenson, which was at that time about thirty miles above the mouth of the Cannon Ball River and four miles above the confluence of Dogtooth Creek, at a point four miles south of the present postoffice and railroad station, Timmer. After two years' discontinuance, the station was reestablished August 9, 1911, about a mile upstream from its original location, at M. H. Burdick's ranch. Because of more favorable channel conditions at the original location, in August, 1915, the station was transferred to its original location at

the old Stevenson ranch, now occupied by F. H. Bingenheimer. The datum-planes of the gages at the two locations are so related that readings on the gage at Burdick's ranch (used 1911 to 1915) are approximately 10 feet greater than on the gage at Bingenheimer's (used originally and 1915 to 1916); thus a reading of 15 feet on one gage indicates amost precisely the same depth of water and quantity of flow as a reading of five feet on the other gage.

The drainage area above this point is 3,650 square miles.

The tables of discharge, based on the measurements in the list below and fifty measurements in previous years, are fairly accurate except during the winter and during the early spring floods when the effect of ice cannot be readily determined.

MEASUREMENTS OF DISCHARGE.

Date.	Name of Hydrographer.	Gage-height	Discharge
9– 7–1914	E. F. Chandler	12.78	13
10–29–1914	L. W. Burdick	12.72	7
4–12–1915	O. Christianson	13.15	60
6–29–1915	V. H. Sprague	13.85	165
6–30–1915	V. H. Sprague	13.85	165
7– 1–1915	V. H. Sprague	13.84	155
8–12–1915	E. F. Chandler	3.89	198
8–13–1915	E. F. Chandler	3.80	174
8–14–1915	E. F. Chandler	3.73	166
9– 2–1915	V. H. Sprague	3.55	129
9–22–1915	V. H. Sprague	3.19	38
4–20–1916	V. H. Sprague	6.98	2,200
4–21–1916	V. H. Sprague	5.96	1,420
6– 8–1916	V. H. Sprague	3.52	101
8–30–1916	E. F. Chandler	2.94	17

MONTHLY DISCHARGE OF CANNON BALL RIVER NEAR STEVENSON, N. D.

	Month.	Maximum	Minimum	Mean	Accuracy
1914.	September	37	2	12	B
	October	37	2	13	C
	November	14	2	8	C
	December	...	...	6	D
1915.	January	...	...	5	E
	February	...	...	7	E
	March	...	...	24	E
	April	462	46	96	C
	May	1,650	27	251	C
	June	5,040	275	1,660	C
	July	1,560	134	599	C
	August	1,310	124	449	C
	September	120	42	73	A
	October	1,410	50	146	B
	November	...	...	30	D
	December	...	...	15	E
1916.	January	...	...	7	E
	February	...	...	106	E
	March	...	...	152	E
	April	4,090	573	1,870	B
	May	1,430	144	292	A
	June	172	80	111	B
	July	188	24	66	B
	August	120	15	37	A

Maximum gage-heights, 19.7 feet June 4, 1915; 11.2 feet March 18, 1916; maximum ever recorded, 21.0 feet April 2, 1912.

Minimum gage-heights, 12.5 feet October 1, 1914; 3.1 feet November 9, 1915; minimum ever recorded, 1.4 feet October 23, 1907.

HEART RIVER NEAR RICHARDTON, N. D.

The gaging station on the Heart River was established May 18, 1903, and was located at the steel highway bridge ten miles south of Richardton, N. D. On September 4, 1911, it was transferred one mile downstream, and the gage-datum was changed so as to add approximately 20 feet to all gage-readings; thus a reading of 25 feet on the present gage indicates approximately 5 feet on the original gage. The drainage area above this point is 1,250 square miles.

The tables of discharge, based on the measurements in the following list and on forty-one measurements in the twelve preceding years, are only approximate through most of the season, for the reasons that during winter and the early spring flood the total effect of ice on the discharge cannot conveniently be determined accurately and that during the medium and low stages of summer and fall the relation between gage-height and discharge has been continuously changed by changes in the many beaver dams repeatedly built in the river adjoining. As the beaver have been absolutely protected by the state game laws the past two years, it has not been practicable to overcome this difficulty.

MEASUREMENTS OF DISCHARGE.

Date.	Name of Hydrographer.	Gage-height	Discharge
9- 6-1914	E. F. Chandler	24.74	7
7- 2-1915	V. H. Sprague	24.61	45
8-16-1915	E. F. Chandler	24.58	10
9-22-1915	W. B. Stevenson	25.26	7
4-25-1916	W. B. Stevenson	28.99	832

MONTHLY DISCHARGE OF HEART RIVER NEAR RICHARDTON, N. D.

Month.		Maximum	Minimum	Mean	Accuracy
1914.	September	...	...	8	D
	October	...	...	13	D
	November	...	...	15	E
	December	...	...	9	E
1915.	January	...	...	6	E
	February	...	...	6	E
	March	...	...	8	E
	April	132	...	51	C
	May	248	45	97	D
	June	1,210	17	130	C
	July	134	2	51	D
	August	188	6	42	C
	September	20	5	9	C
	October	...	...	36	D
	November	...	...	18	D
	December	...	...	12	E
1916.	January	...	...	5	E
	February	...	...	220	E
	March	...	...	253	E
	April	2,470	241	949	C

Maximum gage-heights, 32.6 feet June 15, 1915; 35.7 feet February 23, 1916; 34.7 feet April 4, 1916; maximum ever recorded, 25.9 feet June 10, 1906.

Minimum gage-heights, 24.1 feet May 15, 1915; 24.95 feet September 13, 1915; minimum ever recorded, 23.3 feet August 2, 1911.

KNIFE RIVER NEAR BRONCHO, N. D.

The gaging station on the Knife River is about twenty miles north of Hebron, in Section 4, Township 142, Range 90, at the ranch of C. D. Smith, the former location of Broncho postoffice. A station was first established on the river in this vicinity on May 29, 1903. The drainage area above the station is 1,260 square miles.

The tables of discharge, based on the measurements in the list below and thirty-six measurements made in previous years, are fairly accurate except during the winter and the early spring flood while ice is still obstructing the channel.

MEASUREMENTS OF DISCHARGE.

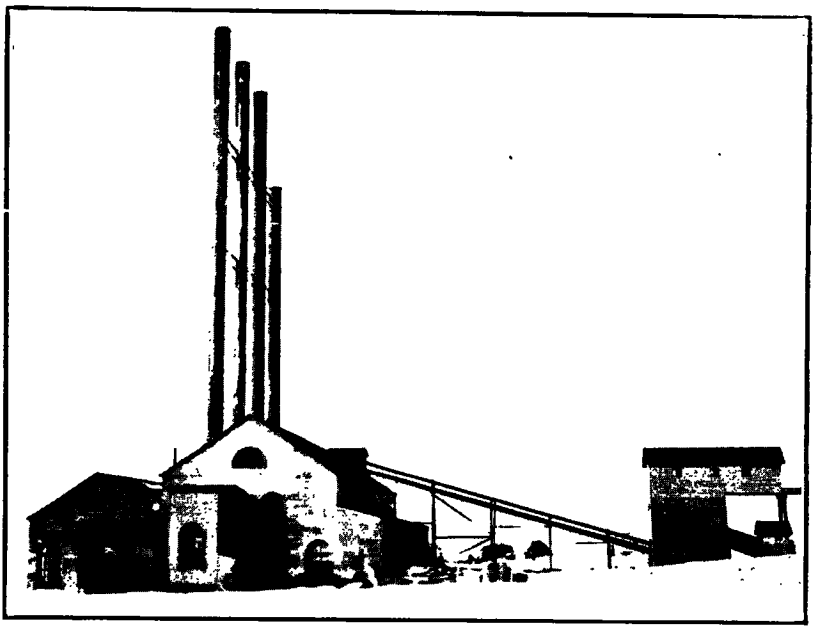
Date.	Name of Hydrographer.	Gage-height	Discharge
9- 5-1914	E. F. Chandler	3.69	12
7- 6-1915	V. H. Sprague	3.50	23
7- 7-1915	V. H. Sprague	3.50	20
8-17-1915	E. F. Chandler	3.31	13
4-26-1916	W. B. Stevenson	5.75	248

MONTHLY DISCHARGE OF KNIFE RIVER NEAR BRONCHO, N. D.

	Month.	Maximum	Minimum	Mean	Accuracy
1914.	September	19	11	14	C
	October	13	9	11	C
	November	...	...	12	D
	December	...	...	11	E
1915.	January	...	...	10	E
	February	...	...	8	E
	March	...	...	16	E
	April	95	32	55	B
	May	78	27	36	C
	June	2,320	44	349	A
	July	315	22	77	B
	August	179	11	40	B
	September	27	9	14	C
	October	395	12	62	B
	November	...	...	12	D
	December	...	...	10	E
1916.	January	...	...	8	E
	February	...	...	248	E
	March	...	...	412	E
	April	4,600	44	1,230	C
	May	70	22	33	C
	June	860	11	145	B
	July	627	7	58	B

Maximum gage-heights, 12.0 feet June 14, 1915; 17.0 feet February 21, 1916; 21.2 feet March 28, 1916; 17.0 feet April 3, 1916; maximum ever recorded, 24.0 feet June 26, 1914.

Minimum gage-heights, 3.2 feet September 3, 1915.



Power Plant and Tipple of United States Reclamation Project at Williston. Coal is Delivered From the Mine to the Tipple, Shown at the Right, Where it is Broken Up in a Crusher and Carried to the Power House by a Chain Conveyor, Also Shown.

North Dakota Lignite Coal Mines

Biennial Period 1914-1915

NORTH DAKOTA LIGNITE COAL MINE REPORT

1914-1915

The fifth biennial inspection of coal mines was made during the winter of 1915-1916, by Harris Robinson, assistant state engineer. Mr. Robinson compiled most of the information contained in the tables and in the individual descriptions of the mines.

The following comparative tables show the increase in production for the past eight years:

Calendar Years	No. of Mines	Production	Annual Increase	Annual Percentage of Increase
1908*	65	320,742	.....	.....
1909	103	372,570	51,828	16.15
1910*	84	416,580	44,010	11.81
1911	100	486,842	70,262	16.86
1912*	82	501,827	14,985	3.09
1913**	109	514,632	12,805	2.41
1914*	128	569,869	55,237	10.72
1915	137	586,116	16,247	2.86

*Data collected by blanks sent to mine owners and operators.
**Including slack production (Sixth Biennial Report, page 51).

An attempt was made in 1913 to collect accurate data on the production of coal and slack separately, but owing to various causes this plan had to be abandoned. First, many mines sell run of mine coal, others use screens of various sizes, and there appears to be no common basis on which such a separation can be made and reliable data compiled.

1914

Reports from 128 mines were received for the year 1914, of which 109 were underground mines and 19 were surface mines. The annual average number of men employed was 762, an average of 949 men being employed during the six winter months, 644 of whom were miners and the remaining 305 employed about the mines in other capacities. The average number of men employed during the six summer months was 530, of whom 305 were miners and the remaining 225 employed about the mines in other capacities. The average daily output per man employed was 3.47 tons. Two fatal and 26 non-fatal accidents were reported for the year 1914. The percentage of accidents to the total average number employed for the year was, fatal, 0.26; non-fatal, 3.41. The number of accidents per 100,000 tons of coal mined was, fatal, 0.35; non-fatal, 4.57. The average annual selling price for the year was $1.61 per ton; 384,537 tons of coal were shipped and 185,332 tons were sold to local trade.

1915

For the year 1915 reports were received from 137 mines, of which 130 were inspected during the winter of 1915-1916. One hundred and fifteen of these mines are underground, the remaining 22 being surface mines. The average number of men employed during the year was 730. During the six winter months 960 men were employed, of whom 637 were miners and the remaining 323 employed as helpers. During the six summer months 500 men were employed, 289 of whom were miners and the remaining 211 helpers. The average daily output per man employed was 3.89 tons.

One fatal and 14 non-fatal accidents were reported for the year 1915. The percentage in terms of the annual average number of men employed was, fatal, 0.14; non-fatal, 1.92. The rate of accidents per 100,000 tons of coal mined was, fatal, 0.17; non-fatal, 2.39. The average annual selling price for the year was $1.57 per ton; 366,331 tons of coal were shipped and 219,785 tons were sold to local trade.

Table showing coal sold to local trade and coal shipped:

Year	Number of Tons Sold Locally	Number of Tons Shipped
1913	162,531	352,101
1914	185,332	384,537
1915	219,785	366,331

FATALITIES

Two fatal accidents were reported as having occurred during 1914 and one during 1915. One of the men listed as having been killed in 1914 was not an employe of the mine. The fatality occurring in 1915 was the result of an accident in a small mine in McKenzie County, of which this office had no previous record and which was not in operation when the mine was visited for the purpose of making inspection.

1914

John Olson of Bowbells was found dead at his working place in the Farmers' Mine. He was killed by a fall of roof clay. His death is directly due to the fact that the roof immediately back of the working face was insufficiently timbered.

Emil Carlson, eleven years of age, was killed at the Foxholm Mine. He was leaning over the railroad surrounding the top of the shaft and was not observed by the engineer, who dropped the cage on his head. His skull was badly crushed and he died shortly afterwards. This accident was directly due to the fact that the top of the shaft was not properly protected for a place where people not acquainted with the dangers that may exist are permitted. This mine shaft should either be protected in such a way that it would be impossible for anyone to lean over the shaft, or stringent rules should be enforced, requiring outsiders to keep away from this part of the mine.

1915

Charles Smith of East Fairview was killed in the Snyder Coal Mine, where he was working alone. There are no details as to the manner in which he met his death, but it was reported that he was killed by a cave-in caused by a heavy blast.

NON-FATAL ACCIDENTS

The non-fatal accidents, of which there were 26 in 1914 and 14 in 1915, include all of the accidents reported, whether of a minor nature or serious. There are a good many accidents of a minor nature that are never reported to this department.

Table showing percentage of fatal and non-fatal accidents:

Year	Average No. men employed	Percentage of fatal accidents in terms of men employed	Percentage of non-fatal accidents in terms of men employed	Number of fatal accidents per 100,000 tons coal mined	Number of non-fatal accidents per 100,000 tons coal mined
1912	598	0.0	2.51	0.0	2.99
1913	605	1.15	5.78	1.62	8.12
1914	762	0.26	3.41	0.35	4.57
1915	730	0.14	1.92	0.17	2.39

EXPLANATORY

Coal mine information for the past biennial period is presented in a tabulated form with a short description of each mine. The mines are listed according to counties, both the counties and names of mines being arranged alphabetically. Each mine is given a number, which is used throughout the tables and the individual descriptions.

The directory gives the name of the owner, the lessee, the post-office address and the location of the mine.

Table No. 1 gives the name of the superintendent, the kind of opening, method of ventilation, method of lighting, the years operated and the date of inspection.

Table No. 2 shows the depth of the coal, the thickness of the coal bed and the thickness of the coal mined, system of mining, method of mining and means of delivering the coal at the surface.

Table No. 3 shows the number of days operated during the past two years, the average number of days worked each month and the average number of miners employed, the average daily production, average number of men other than miners and the average price paid the miners, together with average day wages.

Table No. 4 shows the dimensions of the mine entries and rooms.

Table No. 5 shows the kind of roof and floor found in the mines,

how they are drained, the kind of timber used in them and its approximate cost.

Table No. 6 gives information concerning the track and the mine cars, the explosives used and method of ignition; also the distance of the mine from the shipping station and the name of the railroad.

Table No. 7 gives information concerning the production, the selling price at the mine and the total value for both 1914 and 1915.

Following the tables will be found, in tabulated form, the information listed below:

A list of mines that shipped coal,

A list of mines operating in 1912 and 1913 and closed in 1914 and 1915,

A list of the changes in names of mines between 1912 and 1913, and 1914 and 1915,

Fatal accidents in 1914 and 1915,

Non-fatal accidents in 1914 and 1915.

Following the tabulated information will be found individual descriptions of the mines.

DIRECTORY OF NORTH DAKOTA COAL MINES

ADAMS COUNTY

Name of Mine	Owner	Lessee	Post Office	Subdivision	Location Sec.	Twp.	Rge.
1. Clermont Coal Mine	Clermont Coal Co.		Haynes	W½ NW¼	8	129	94
2. Farmers Coal Mine	Haynes Coal Assn.		Haynes	NW¼ SW¼	9	129	94
3. Haynes Coal Mine	Haynes Co-operative Coal & Mining Co.		Haynes	NE¼ SE¼	8	129	94
4. Leff Coal Mine	Albert Leff		Reader	SE¼ NE¼ & NE¼ SE¼	10	130	98
5. Livingston Coal Mine	C. W. Livingston		Hettinger	SW¼	23	129	96
6. Pinkham Coal Mine	Wm. Pinkham		Haynes	SE¼ SE¼	24	130	94
7. Stvenson & Gunderson Coal Mine	Stevenson & Gunderson		Haynes	N½ NW¼	15	129	94

BILLINGS COUNTY

Name of Mine	Owner	Lessee	Post Office	Subdivision	Sec.	Twp.	Rge.
8. De Mores Coal Mine	N. P. Refrigerator Car Co.	H. G. Kinmark	Medora	NW¼	26	140	102
9. High Grade Coal Mine	High Grade Lignite Coal Co.		Medora	SW¼	26	140	102

BOWMAN COUNTY

Name of Mine	Owner	Lessee	Post Office	Subdivision	Sec.	Twp.	Rge.
10. Bowman Coal Mine	Jas. Touhey	John Gilfaln	Bowman	SW¼	14	132	102
11. Scranton Coal Mine	Scranton Coal Co.		Scranton	SW¼	24	131	100

BURKE COUNTY

Name of Mine	Owner	Lessee	Post Office	Subdivision	Sec.	Twp.	Rge.
12. Domrese Coal Mine	H. J. Domrese		Larson		24	162	94
13. Fenster Coal Mine	Fred Fenster		Larson	NE¼ NE¼	7	162	94
14. Gille Coal Mine	M. Sewald	Chas. S. Post	Columbus	SE¼	20	162	93
15. Hagen Coal Mine	Hagen Bros.		Noonan		7	162	94
16. Kielhack Coal Mine	Zimdas & Kielhack.		Columbus		20	162	93
17. Makee Coal Mine	Shannon G. Ruffcorn Estate	Chas. Tauber	Columbus		32	164	93
18. Souther Coal Mine	P. J. Souther		Larson	N½ S½	17	162	94
19. Vick Coal Mine	H. F. Vick		Larson		19	163	92

	Name of Mine	Owner	Lessee	Post Office	Subdivision	Location Sec.	Twp.	Rge.
	BURLEIGH COUNTY							
20.	Anderson Coal Mine	V. L. Anderson		Wilton	SE¼	23	142	79
21.	Asplund Coal Mine	Wm. Asplund	T. J. Asplund	Wilton	SW¼	4	142	79
22.	Backman Coal Mine	Emil Backman		Wilton	SW¼	8	142	79
23.	Lind Coal Mine	Mrs. Anna Lind	J. Albert Johnson	Wilton		6	142	79
24.	Peterson Coal Mine	C. J. Peterson		Wilton	NE¼	9	142	79
25.	Wilton Coal Mine	Washburn Lignite Coal Co.		Wilton		1	142	80
	DIVIDE COUNTY							
26.	Daugherty Coal Mine	Chas. Daugherty		Noonan	NE¼ NW¼	10	162	95
27.	Haught Coal Mine	J. E. Haught		Noonan	S½ SE¼	3	162	95
28.	Noonan Coal Mine	John Lobeski		Noonan	N½ SE¼	3	162	95
29.	Truax Coal Mine	E. M. Truax		Noonan	E¼ NE¼	10	162	95
	DUNN COUNTY							
30.	Bang Coal Mine	John Bang	Otto Miller	Dunn Center	SW¼ SW¼	26	145	94
31.	Heiser Coal Mine	Northwest Abst. Co.	J. O. Grady and L. P. Allen	Manning	NW¼	17	143	95
32.	High Grade Coal Mine	A. H. Pelton and O. R. Chamberlain		Dunn Center	NW¼	29	145	93
33.	Paulson Coal Mine	Paul Paulson	W. H. Hill	Werner	SE¼	28	145	93
	GOLDEN VALLEY COUNTY							
34.	Corliss Coal Mine	I. J. Corliss		Sentinel Butte	NW¼ SE¼	25	139	105
35.	Kussick Coal Mine	Mr. Kussick		Sentinel Butte		8	139	104
36.	Madland Coal Mine	A. L. Madland		Sentinel Butte	SW¼ NE¼	8	139	104
37.	Porter Coal Mine	U. S. Government	W. H. Porter	Beach	SW¼	22	139	105
38.	Sentinel Butte Coal Mine	Hunter Land Co.	F. C. Dempsy	Sentinel Butte		...	...	...
	HETTINGER COUNTY							
39.	Arnold Coal Mine	Chas. T. Arnold	John Weinandy	Regent	N½	5	134	95
40.	Havelock Coal Mine	Mrs. E. W. Adams	Jack Strosser	Havelock	NE¼	27	135	96
41.	Merry Coal Mine	C. H. Merry		Mott	SE¼ NE¼	34	132	93
42.	Nelson Coal Mine	W. H. Brown & Co. Floid A. and	Mons Nelson	Regent	SW¼	35	134	95
43.	Square Deal Coal Mine	W. A. Crary		Bently	SE¼	35	133	91

McLEAN COUNTY

44.	Bitumina Coal Mine	John Satterlund	Edward Kugler	Washburn SE¼	1	144	82
45.	Borchardt Coal Mine	E. G. Borchardt		Underwood SE¼ NE¼	5	145	82
46.	Fredrich Coal Mine	Wm. Fredrich	Henry Fredrich	Underwood SW¼	1	146	82
47.	Hanson Coal Mine	Peter Hanson	Fred Wagner	Underwood E½ W½	18	146	81
48.	Johnson Coal Mine	Swan A. Johnson		Coleharbor SE¼	18	148	83
49.	Kunkel Coal Mine	J. A. Kunkel	Al Glover	Garrison E½	18	148	84
50.	Rupp Coal Mine	Frank Seibel	E. R. Rupp	Garrison NW¼	35	148	84
51.	Ulrich Coal Mine	U. S. Government	Kingsley, Ulrich & Louser	Garrison W½ NW¼	18	148	83
52.	Youngquist Coal Mine	Ed Youngquist	Fred Phister	Washburn SE¼	10	144	83

MERCER COUNTY

53.	Black Diamond Coal Mine	Chas. Semler		Stanton SW¼ NE¼	25	144	88
54.	Keeley Coal Mine	Ed Oster	John Keeley	Hazen E½ NE¼	7	144	86
55.	Krem Coal Mine	Fred Malke	Philip Sayler	Krem NW¼	22	145	86
56.	Reichenberg Coal Mine	Jack Reichenberg	Tony Gawlona	Hazen NW¼	8	144	86
57.	Schmidt Coal Mine	Geo. G. Schmidt		Beulah S½	19	145	87
58.	Standard Coal Mine	Geo. G. Schmidt		Beulah N½ NW¼	25	144	88

MORTON COUNTY

59.	Black Diamond Coal Mine	Mamie M. Dunn	G. W. Zimmerman	Leith NE¼ SE¼	12	133	88
60.	Coffin Butte Coal Mine	Not known	R. C. Babcock	Pretty Rock SE¼	35	132	90
61.	Coopenhaver Coal Mine	Coopenhaver Min. Co.		Flasher N½ NE¼	15	134	84
62.	Garfield Coal Mine	Carl Lueder		New Salem SE¼	19	139	85
63.	Hebron Coal Mine	Hebron Fire & Pressed Brick Co.		Hebron	2&11	140	90
64.	Knutson Coal Mine	John Knutson		Almont SE¼	31	138	86
65.	Lindstrom Coal Mine	Mrs. Anna Lindstrom	F. E. Brown	Glen Ullin NE¼	22	138	88
66.	New Salem Coal Mine	R. W. Webb & Co.	M. Tausend	New Salem SE¼ SW¼	15	139	85
67.	North Star Coal Mine	Murray & Haven	Ignat Ostendorf	Hebron SE¼	3	130	90
68.	Ormiston Coal Mine	G. J. Ormiston		Judson SE¼	17	137	84
69.	Pleasant Ridge Coal Mine	A. L. Tavis	Louie Kwako	Glen Ullin SW¼	20	139	88
70.	Ramsland Coal Mine	Geo. Reichel		Almont Lot 3	6	137	86

	Name of Mine	Owner	Lessee	Post Office	Subdivision	Location Sec.	Twp.	Rge.
	MOUNTRAIL COUNTY							
71.	Algers Coal Mine	F. L. Alger	F. E. Blake	Stanley		13	155	92
72.	Barto Coal Mine	Joseph Barto		White Earth		10	156	94
73.	Blake Coal Mine	Frank E. Blake		Stanley	E½ SW¼	13	155	92
74.	Bowman Coal Mine	Chas. H. Bowman	Joe Landaker	Epworth	SW¼	18	153	89
75.	Fraser Coal Mine	C. H. Anglum	Wm. M. Fraser	Palermo, % A. Whitaker	NW¼	27	154	89
76.	Hefte Coal Mine	Ole Hefte		White Earth	NE¼ NE¼	8	157	93
77.	Hoppe Coal Mine	Henry Hoppe	Herman Moerke	Epworth	E½ SE¼	21	153	90
78.	Kale Coal Mine	F. L. Alger	H. Kale	Stanley	SW¼ NE¼	13	155	92
79.	North Star Coal Mine	Albert Roseno		Palermo	NE¼	28	153	90
80.	Porger Coal Mine	Geo. Porger		White Earth		15	156	94
81.	Rodgers Coal Mine	G. S. Rodgers		Palermo	SE¼ SW¼	5	154	89
82.	Roseno Coal Mine	Albert Roseno	Herman Moerke	Epworth	NE¼	28	153	90
83.	Sellar Coal Mine	W. L. Sellar		Epworth	NE¼ NE¼	17	153	89
84.	Stacy Coal Mine	State Bank of Crary	Geo. W. Stacy	Stanley		4	154	91
85.	Sunday Coal Mine	Albert Roseno	Herman Moerke	Epworth	NE½	28	153	90
86.	Williams Coal Mine	B. D. Williams		White Earth	NE¼	22	154	94
	OLIVER COUNTY							
87.	Flint Coal Mine	Mrs. Henregetta Flint	Flint Brothers	Hannover	SE¼	9	142	85
88.	Meyhoff Coal Mine	Dick Meyhoff		Hannover	SW¼ SW¼	2	141	84
89.	Pleasant Valley Coal Mine							
90.	Spring Valley Coal Mine	N. O. Nelson		Center		12	141	84
91.	Tripp Coal Mine	M. N. Tripp		Center		23	142	83
	RENVILLE COUNTY							
92.	Tehelka Coal Mine	P. P. Tehelka		Carpio	NE¼	33	158	86
93.	Wooster Coal Mine	Bert Wooster		Carpio		34	158	86
	STARK COUNTY							
94.	Bunker Hill Coal Mine	Benjamin Webb	John Gavin	Richardton	NW¼	4	139	92
95.	Gross Coal Mine	Carl Podolanchuk		Belfield	E½	34	140	99
96.	Lehigh Coal Mine	Consolidated Coal Co.		Dickinson	S½	8	139	95
97.	North Creek Coal Mine	C. H. Wiley		South Heart	SW¼	26	140	98
98.	North Star Coal Mine	Albert Koesel		Richardton	Lot 1	5	140	92
99.	Pittsburgh Coal Mine	Dakota Lignite Coal Mines		Dickinson	NW¼	8	139	95
				Dickinson	NW¼	8	139	98
100.	Zenith Coal Mine	Dakota Lignite Mines Co.		Dickinson	SE¼	1	139	99

WARD COUNTY

101.	Bartoshivich Coal Mine..	Mary Bartoshivich...	Geo. Buchler	Sawyer .....SE¼	24	151	82
102.	Brick Yard Coal Mine...	Kenmare Coal and Brick Co.		Kenmare	32	160	88
103.	Burlington City Coal Minc	Foot and Brunner...	J. W. Perlechek....	Burlington, E½ SW¼, NW¼ SE¼, NE¼ SW¼.....	2	155	84
104.	Caflisch Coal Mine.....	H. E. Christienson...		Burlington .....NE¼ SW¼	11	155	84
105.	Christophson Coal Mine.	C. Christophson.....		Sawyer .....SE¼ SE¼	29	152	81
106.	Colton Coal Mine.....	L. D. Colton.....		Carpio .....NW¼ NE¼	3	157	86
107.	Conan Coal Mine.....	D. A. Conan, Sr.....	J. F. Casteel.....	Burlington .....SE¼ SE¼	1	155	84
108.	Crosby Coal Mine.....	H. E. Peck.....	John A. Pohe.....	Burlington .....NE¼	1	155	84
109.	Davis Coal Mine.....	Northern Briquetting Co.		Bowbells, Route 1...NW¼ SE¼	30	161	88
110.	Diamond Coal Mine.....	H. E. Peck.....		Minot .....NE¼ SW¼	12	155	84
				Kenmare .....Lot 1	29	160	88
				.....SE¼	20	160	88
111.	Farmers' Coal Mine.....	Stockholders	Jack Hanson	Bowbells .....SE¼	20	161	88
112.	Forsythe Coal Mine....	A. P. Forsythe.....	Peterson Bros.	Burlington .....Lots 3 and 4	5	155	84
113.	Foxholm Coal Mine.....	Foxholm Coal Co.....		Foxholm, W½ SW¼, SW¼ NW¼	2	156	85
114.	Hot Blast Coal Mine....	Rogers & Maynard..	Mr. Miller	Donnybrook..3 mi. Donnybrook.	..	...	..
115.	Hunnewell Coal Mine...	R. J. Hunnewell.....		Burlington .....NE¼	1	155	84
116.	Johnson Coal Mine.....	Jonas Johnson		Kenmare .....S½ SW¼	29	161	88
117.	Klondike Coal Mine....	W. Spencer	Wm. Lloyd Spencer.	Donnybrook .....NE¼ NE¼	31	159	81
118.	Leeson Coal Mine No. 1..	J. J. Leeson.....		Velva .....SW¼	27	152	81
119.	Leeson Coal Mine No. 2..	J. J. Leeson.....	Henry Greenwald..	Sawyer .....NE¼	19	152	81
120.	Lloyd Coal Mine.....	Lloyd Coal Co.....		Minot .....SE¼ SE¼	32	156	84
121.	McClure Coal Mine.....	McClure Coal Co.....	W. J. Verzatt.....	Tasker	19 30 24	156	84 85
122.	Mellon Coal Mine.....	J. A. Wright.....	John Mellon	Kenmare.....Lot 2, E½ NW¼	28	...	..
				.....NW¼	33	160	88
123.	Ogborn Coal Mine.....	Ottis Ogborn	Peter Anderson....	Baden .....1 mi. Baden	..	...	..
124.	Pierce Coal Mine.....	J. W. Fox.....		Kenmare	33	160	88
125.	Red Flag Coal Mine....	Jed Knowles Estate..	John Nordstrom....	Velva	31	152	81
126.	Rich Coal Mine.....	R. W. Rich.....		Bowbells, SW¼ NE¼, SE¼ NW¼ and Lot 3.....	30	161	88
127.	Smith Coal Mine.....	National Briquetting Company		Kenmare	6, 7, 18	160	88
128.	Square Deal Coal Mine..	Minnesota Loan & Trust Co.	Stephen Hodgson..	Baden .....SE¼ SW¼	25	159	88
129.	Strong Coal Mine.....	F. F. Finnegan.....	M. G. Wood.....	Velva .....SE¼ SE¼	21	152	81
130.	Tree-Bausch Coal Mine..	Rufus Tree and Jacob Bausch	Lawrence Marlinee.	Velva .....NE¼	30	152	81
131.	Vadnais Coal Mine.....	O. O. Adams.....	O. Tisdall	Kenmare .....NE¼ NE¼	29	160	88
132.	Wallace Coal Mine.....	J. S. Wallace.....		Burlington .....SE¼	2	155	84
133.	Wallin Coal Mine.....	John Wallin	T. Hoeck	Minot ..SW¼ NE¼, NW¼ SE¼	7	155	83

WILLIAMS COUNTY

	Name of Mine	Owner	Lessee	Post Office	Subdivision	Location Sec.	Twp.	Rge.
134.	Black Diamond Coal Mine	J. W. Jackson	Thompson and Frye	Williston	SW¼ NE¼	33	154	100
135.	Big Four Coal Mine	Ben Fedge		Bonetrail	NE¼ NW¼	14	156	101
136.	Bryne Coal Mine	Harry Hanson Estate	Ole Bryne	Williston	SW¼ SE¼	33	154	100
137.	Ellithorpe Coal Mine	Mabel B. Ellithorpe	C. Ellithorpe	Williston	W½ SE¼, SW¼ NE¼	7	154	100
138.	Falk Coal Mine	Ole Falk	J. B. Boardman	Stady	N½ SE¼, SE¼ SE¼	7	159	101
139.	Folvog Coal Mine	Lucy Dacoteau	H. E. Folvog	Gladys	NE¼	10	153	103
140.	Freeman Coal Mine	Tom J. Freeman	John Erickson	Marmon	NW¼ SW¼	10	158	101
141.	Head Coal Mine	P. G. Head		Williston	NW¼	7	154	101
142.	Husebye Coal Mine	J. A. Husebye		Williston		17	154	100
143.	Johnson Coal Mine	John Johnson		Marmon	NW¼	10	158	101
144.	Miller Coal Mine	A. C. Miller		Williston	NE¼ NW¼	24	156	101
145.	Moorman Coal Mine	J. M. Moorman		Wheelock	NW¼ SW¼	29	155	97
146.	Narveson Coal Mine	N. T. Narveson		Marmon	NE¼	10	158	101
147.	Powell Coal Mine	Mary L. Powell	John Penson	Williston	NW¼ SE¼	33	154	100
148.	Reclamation Service Coal Mine	U. S. Reclamation Service		Williston		7	154	100
149.	Zahl Coal Mine	Mrs. M. E. Zahl	James Seabrook	Howard		29	159	101

TABLE NO. 1

ADAMS COUNTY

	Name of Mine	Superintendent	Kind of Opening	Method of Ventilation	Method of Lighting	When Operated	Date of Inspection
1.	Clermont Coal Mine	A. W. Peterson	Slope	Air shaft	Carbide	1914-1915	Dec. 10, 1915
2.	Farmers Coal Mine	F. H. Due	Slope	Air shaft	Carbide	1914-1915	Closed
3.	Haynes Coal Mine	John B. Slosson	Slope	Air shaft	Carbide	1914-1915	Dec. 10, 1915
4.	Leff Coal Mine	Albert Leff	Strip pit			1914-1915	Dec. 13, 1915
5.	Livingston Coal Mine	C. W. Livingston	Slope	None	Kerosene Lantern	1914-1915	Dec. 13, 1915
6.	Pinkham Coal Mine	Wm. Pinkham	Slope	None	Carbide	Opened Slope 1915	Dec. 11, 1915
7.	Stevenson & Gunderson Coal Mine	Stevenson and Gunderson	Slope	Air shaft	Carbide	1914-1915	Dec. 10, 1915

			BILLINGS COUNTY				
8.	De Mores Coal Mine	H. G. Kinmark	Drift	Air shaft	Carbide	1914-1915	Jan. 19, 1916
9.	High Grade Coal Mine	N. D. Nichols	Drift	Air shaft	Carbide	1914-1915	Jan. 20, 1916
			BOWMAN COUNTY				
10.	Bowman Coal Mine	John Gilfaln	Slope	Air shaft	Carbide	....-1915	Dec. 14, 1915
11.	Scranton Coal Mine	Chas. A. Liddell	Slope	Air shaft	Carbide	1914-1915	Dec. 14, 1915
			BURKE COUNTY				
12.	Domrese Coal Mine	H. J. Domrese	Strip pit			1914-1915	Feb. 23, 1916
13.	Fenster Coal Mine	Clifford Mott	Strip pit			1914-1915	Feb. 23, 1916
14.	Gille Coal Mine	Mr. Gille	Strip pit			1914-1915	Feb. 23, 1916
15.	Hagen Coal Mine	Owner	Slope	None	Carbide	1914-1915	Feb. 24, 1916
16.	Kielhack Coal Mine	T. Kielhack	Drift and strip	Air shaft	Carbide	1914-1915	Feb. 23, 1916
17.	Makee Coal Mine	Chas. Teuber	Shaft	Drift and shaft	Carbide	1914-1915	Feb. 24, 1916
18.	Souther Coal Mine	P. J. Souther	Slope	Air shaft	Carbide	1914-1915	Feb. 24, 1916
19.	Vick Coal Mine	H. F. Vick	Strip pit			1914-1915	Feb. 23, 1916
			BURLEIGH COUNTY				
20.	Anderson Coal Mine	V. L. Anderson	Slope	Air shaft	Carbide	1914-1915	Reported 1-14-1916
21.	Asplund Coal Mine	T. J. Asplund	Slope	Air shaft	Carbide	1914-1915	Feb. 7, 1916
22.	Backman Coal Mine	Emil Backman	Slope	Air shaft	Carbide	1914-1915	Feb. 7, 1916
23.	Lind Coal Mine	O. E. Anstrom	Slope	Air shaft	Carbide	1914-1915	Feb. 7, 1916
24.	Peterson Coal Mine	C. J. Peterson	Slope	Air shaft	Carbide	1914-1915	Feb. 7, 1916
25.	Wilton Coal Mine	P. J. Cahill	Shaft	Electric fan	Carbide*	1914-1915	Jan. 29, 1916
			DIVIDE COUNTY				
26.	Dougherty Coal Mine	W. A. Anderson	Slope	Air shaft	Carbide	1913-1914	Feb. 25, 1916
27.	Haught Coal Mine	J. E. Haught	Slope	Air shaft	Carbide	1913-1914	Feb. 25, 1916
28.	Noonan Coal Mine	John Lobeski	Slope	Air shaft	Carbide	1913-1914	Feb. 25, 1916
29.	Truax Coal Mine	A. H. Truax	Slope	Electric fan	Carbide	1913-1914	Feb. 25, 1916
			DUNN COUNTY				
30.	Bang Coal Mine	Otto Miller	Drift	None		1914-1915	Feb. 1, 1916
31.	Heiser Coal Mine	J. O'Grady	Strip pit			1914-1915	Feb. 2, 1916
32.	High Grade Coal Mine	A. H. Pelton	Shaft	None	Carbide	Shaft opened in 1915	Feb. 1, 1916
33.	Paulson Coal Mine	Paul Paulson	Drift	None	Carbide	1914-1915	Feb. 1, 1916

	Name of Mine	Superintendent	Kind of Opening	Method of Ventilation	Method of Lighting	When Operated	Date of Inspection
	GOLDEN VALLEY COUNTY						
34.	Corliss Coal Mine	I. J. Corliss	Strip pit			1914-1915	Dec. 16, 1915
35.	Kussick Coal Mine	Owner	Drift	None	None	1914-1915	Dec. 17, 1915
36.	Madland Coal Mine	A. L. Madland	Drift	None	None	1914-1915	Dec. 16, 1915
37.	Porter Coal Mine	W. H. Porter	Drift	None	Carbide	1914-1915	Dec. 16, 1915
38.	Sentinel Butte Coal Mine	F. C. Dempsy	Drift	None	Carbide	1914-1915	Dec. 16, 1915
	HETTINGER COUNTY						
39.	Arnold Coal Mine	John Winandy	Drift	None	Carbide	1914-1915	Jan. 14, 1916
40.	Havelock Coal Mine	Jack Strosser	Drift	None	Carbide	1914-1915	Jan. 14, 1916
41.	Merry Coal Mine	C. H. Merry	Strip pit			1914-1915	Jan. 13, 1916
42.	Nelson Coal Mine	Mons Nelson	Strip pit			1914-1915	Jan. 14, 1916
43.	Square Deal Coal Mine	Floid A. Crary	Strip pit			1914-1915	Jan. 13, 1916
	McLEAN COUNTY						
44.	Bitumina Coal Mine	Edward Kugler	Drift	Air shaft & Compressed air	Carbide	1914-1915	Feb. 8, 1916
45.	Borchardt Coal Mine	E. G. Borchardt	Shaft	Air shaft	Carbide	1914-1915	Feb. 9, 1916
46.	Fredrich Coal Mine	Wm. Fredrich	Shaft	Air shaft	Carbide	1914-1915	Feb. 9, 1916
47.	Hanson Coal Mine	Fred Wagner	Drift	Air shaft	Carbide	1914-1915	Feb. 9, 1916
48.	Johnson Coal Mine	Swan A. Johnson	Slope	Air shaft	Carbide	1914-1915	Feb. 10, 1916
49.	Kunkel Coal Mine	Al Glover	Drift	Air shaft	Carbide	1914-1915	Feb. 11, 1916
50.	Rupp Coal Mine	E. R. Rupp	Strip pit			....-1915	Feb. 11, 1916
51.	Ulrich Coal Mine	Geo. Louser	Slope	Air shaft	Carbide	1914-1915	Feb. 10, 1916
52.	Youngquist Coal Mine	Fred Pfister	Drift	None	Carbide	1914-1915	Feb. 8, 1916
	MERCER COUNTY						
53.	Black Diamond Coal Mine	Chas. Westmark	Shaft	None	Carbide	Opened in 1915	Feb. 3, 1916
54.	Keeley Coal Mine	John Keeley	Drift	None	Carbide	1914-1915	Feb. 5, 1916
55.	Krem Coal Mine	Philip Sayler	Shaft	Air shaft and fan	Lard Oil	1914-1915	Feb. 4, 1916
56.	Reichenberg Coal Mine	Tony Gawlone	Slope	None	Carbide	....-1915	Feb. 5, 1916
57.	Schmidt Coal Mine	Geo. G. Schmidt	Slope	Air shaft	Carbide	1914-1915	Reported 2-3-1916
58.	Standard Coal Mine	Geo. G. Schmidt	Slope	None	Carbide	....-1915	Feb. 3, 1916

			MORTON COUNTY				
59.	Black Diamond Coal Mine	G. W. Zimmerman.	Shaft	Air shaft	Carbide	1914-1915	Jan. 16, 1916
60.	Coffin Butte Coal Mine	R. C. Babcock	Strip pit			1914-1915	Jan. 12, 1916
61.	Coopenhaver Coal Mine.	Not operated	Strip pit			1914	Jan. 17, 1916
62.	Garfield Coal Mine	Carl Lueder	Strip pit			1914-1915	Jan. 27, 1916
63.	Hebron Coal Mine	T. Bennek	Drift	Air shaft and fan	Carbide	1914-1915	Jan. 24, 1916
64.	Knutson Coal Mine	John Knutson	Strip pit			1914-1915	Jan. 26, 1916
65.	Lindstrom Coal Mine	F. E. Brown	Drift	Air Shaft	Carbide	1914-1915	Jan. 25, 1916
66.	New Salem Coal Mine	A. J. Gray	Slope	Air shaft & steam fan.	Carbide*	1914-1915	Jan. 27, 1916
67.	North Star Coal Mine	Ignat Ostendorf	Slope	Air shaft	Carbide	1914-1915	Jan. 24, 1916
68.	Ormiston Coal Mine	G. J. Ormiston	Drift	None	Carbide	1914-1915	Jan. 26, 1916
69.	Pleasant Ridge Coal Mine	Louie Kwako	Slope	Air shaft	Carbide	....-1915	Jan. 25, 1916
70.	Ramsland Coal Mine	Geo. Reichel	Strip pit			1914-1915	Jan. 26, 1916
			MOUNTRAIL COUNTY				
71.	Algers Coal Mine	F. E. Blake	Strip pit			1914-1915	Reported 3-13-1916
72.	Barto Coal Mine	Joseph Barto	Drift	None	Carbide	1914-1915	Mar. 12, 1916
73.	Blake Coal Mine	Frank E. Blake	Drift	None	Lard Oil	....-1915	Mar. 13, 1916
74.	Bowman Coal Mine	Isaac Allison	Shaft	Air shaft	Carbide	1914-1915	Mar. 14, 1916
75.	Fraser Coal Mine	Wm. M. Fraser	Drift	None	Carbide	....-1915	Mar. 14, 1916
76.	Hefte Coal Mine	Ole Hefte	Strip pit			1914-1915	Mar. 11, 1916
77.	Hoppe Coal Mine	Herman Moerke	Strip pit			....-1915	Mar. 15, 1916
78.	Kale Coal Mine	H. Kale	Drift and strip pit.	None	Carbide	....-1915	Mar. 13, 1916
79.	North Star Coal Mine	Chris Rude	Strip pit			1914	Reported 5-4-1915
80.	Porger Coal Mine	Geo. Porger	Drift	None	Carbide	1914-1915	Mar. 12, 1916
81.	Rodgers Coal Mine	G. S. Rodgers	Strip pit			1914-1915	Mar. 14, 1916
82.	Roseno Coal Mine	Herman Moerke	Strip pit			....-1915	Mar. 15, 1916
83.	Sellar Coal Mine	W. L. Sellar	Drift and strip pit.	None	Carbide	1914-1915	Mar. 14, 1916
84.	Stacy Coal Mine	Geo. W. Stacy	Strip pit			1914	Reported 1-5-1915
85.	Sunday Coal Mine	Herman Moerke	Drift	None	Carbide	1914	Reported 5-4-1915
86.	Williams Coal Mine	B. D. Williams	Strip pit			1914-1915	Reported 3-12-1916
			OLIVER COUNTY				
87.	Flint Coal Mine	Flint Brothers	Strip pit			1914-1915	Reported 1-17-1916
88.	Meyhoff Coal Mine	Dick Meyhoff	Strip pit			1914-1915	Reported 1-17-1916
89.	Pleasant Valley Coal Mine	Victor Boerner	Strip pit			1914-1915	Reported 1-17-1916
90.	Spring Valley Coal Mine	N. O. Nelson	Strip pit			1914-1915	Reported 2-1-1916
91.	Tripp Coal Mine	M. N. Tripp	Strip pit			1914-1915	Reported 5-26-1916

	Name of Mine	Superintendent	Kind of Opening	Method of Ventilation	Method of Lighting	When Operated	Date of Inspection
	RENVILLE COUNTY						
92.	Tehelka Coal Mine	P. P. Tehelka	Slope	None	Carbide	1914-1915	Feb. 19, 1916
93.	Wooster Coal Mine	Bert Wooster	Drift	Air shaft	Carbide	1914-1915	Feb. 19, 1916
	STARK COUNTY						
94.	Bunker Hill Coal Mine	John Gavin	Slope	None	Carbide	....-1915	Jan. 23, 1916
95.	Gross Coal Mine	Carl Podolanchuk	Slope	Air shaft	Carbide	1914-1915	Jan. 21, 1916
96.	Lehigh Coal Mine	Jas. H. Schestan	Slope	Air shaft	Carbide*	1914-1915	Jan. 23, 1916
97.	North Creek Coal Mine	C. H. Wiley	Strip pit			1914-1915	Reported 1-26-1916
98.	North Star Coal Mine	August Windhaus	Slope	Air shaft	Carbide	1914-1915	Jan. 23, 1916
99.	Pittsburg Coal Mine	Edward Summers	Slope	Shaft and steam fan	Carbide	1914-1915	Jan. 22, 1916
100.	Zenith Coal Mine	Henry Truelson	Slope	Air shaft	Carbide	1914-1915	Jan. 21, 1916
	WARD COUNTY						
101.	Bartoshivich Coal Mine	Joe Bartoshivich	Drift	None	Carbide	1914-1915	Feb. 12, 1916
102.	Brick Yard Coal Mine	R. F. Lewis	Drift	Shaft and furnace	Carbide	1914-1915	Feb. 21, 1916
103.	Burlington City Coal Mine	J. W. Perlechek	Slope	Air shaft	Carbide	1914-1915	Feb. 16, 1916
104.	Caflisch Coal Mine	H. E. Christienson	Drift	Air shaft	Carbide	1914-1915	Feb. 12, 1916
105.	Christophson Coal Mine	Christophson Bros.	Slope	None	Carbide	1914-....	Reported 1-12-1915
106.	Colton Coal Mine	L. D. Colton	Slope	Air shaft	Carbide	1914-1915	Feb. 15, 1916
107.	Conan Coal Mine	J. F. Casteel	Slope	None	Carbide	1914-1915	Feb. 17, 1916
108.	Crosby Coal Mine	John A. Pohe	Drift	Air shaft	Carbide	1914-....	Feb. 28, 1916
109.	Davis Coal Mine	B. E. Theurer	Slope	Air shaft	Carbide	1914-1915	Feb. 17, 1916
110.	Diamond Coal Mine	H. E. Peck	Slope	Air shaft	Carbide	1914-1915	Feb. 21, 1916
111.	Farmers' Coal Mine	Jack Hanson	Drift	Air shaft	Carbide	1914-1915	Feb. 28, 1916
112.	Forsythe Coal Mine	Peterson Bros.	Slope	Air shaft	Carbide	1914-1915	Feb. 18, 1916
113.	Foxholm Coal Mine	Mack Hendricks	Shaft	Air shaft	Carbide	....-1915	Feb. 18, 1916
114.	Hot Blast Coal Mine	Mr. Miller	Slope	Air shaft	Carbide	1914-1915	
115.	Hunnewell Coal Mine	R. J. Hunnewell	Slope	Air shaft	Carbide	1914-1915	Feb. 17, 1916
116.	Johnson Coal Mine	Jonas Johnson	Shaft and slope	Shaft	Carbide	1914-1915	Feb. 28, 1916
117.	Klondike Coal Mine	Wm. Lloyd Spencer	Slope	None	Carbide	1914-1915	Feb. 22, 1916
118.	Leeson Coal Mine No. 1	J. J. Leeson	Drift	Air shaft	Carbide	1914-1915	Feb. 12, 1916
119.	Leeson Coal Mine No. 2	Henry Greenwold	Drift	Air shaft	Carbide	1914-1915	Feb. 12, 1916
120.	Lloyd Coal Mine	H. T. Stewart	Slope	Air shaft	Carbide	1914-1915	Feb. 18, 1916

121.	McClure Coal Mine	W. J. Verzatt	Drift	Air shaft	Carbide	1914-1915	Feb. 18, 1916
122.	Mellon Coal Mine	John Mellon	Slope	None	Carbide	Slope Open in 1915	Feb. 21, 1916
123.	Ogborn Coal Mine	Peter Anderson	Slope	None	Carbide	....-1915	Feb. 22, 1916
124.	Pierce Coal Mine		Slope	Air shaft	Carbide	1914-....	
125.	Red Flag Coal Mine	John Nordstrom	Drift and strip pit	None	Carbide	1914-....	Reported 1-26-1916
126.	Rich Coal Mine	Ralph W. Rich	Drift	Air shaft	Carbide	1914-1915	Feb. 28, 1916
127.	Smith Coal Mine	J. W. Deemy	Drift	Air shaft & electric fans	Carbide	1914-1915	Feb. 29, 1916
128.	Square Deal Coal Mine	Stephen Hodgson	Slope	Air shaft	Carbide	1914-1915	Feb. 22, 1916
129.	Strong Coal Mine	Milo G. Woods	Slope	None	Carbide	1914-1915	Feb. 12, 1916
130.	Tree-Bausch Coal Mine	Lawrence Marlime	Strip pit			1914-1915	Feb. 14, 1916
131.	Vadnais Coal Mine	O. Tisdall	Slope	Air shaft	Carbide	1914-1915	Feb. 21, 1916
132.	Wallace Coal Mine	J. S. Wallace	Slope	Air shaft & electric fan	Carbide	1914-1915	Feb. 16, 1916
133.	Wallin Coal Mine	T. Hoeck	Drift	Air shaft	Carbide	1914-1915	Feb. 15, 1916
	WILLIAMS COUNTY						
134.	Black Diamond Coal Mine	F. W. Frye	Drift	Air shaft	Carbide	1914-1915	Mar. 3, 1916
135.	Big Four Coal Mine	Ben Fedge	Drift	Air shaft	Carbide	1914-1915	Mar. 9, 1916
136.	Bryne Coal Mine	Ole Bryne	Drift	Air shaft	Carbide	1914-1915	Mar. 3, 1916
137.	Ellithorpe Coal Mine	C. Ellithorpe	Slope	Air shaft	Carbide	1914-1915	Mar. 3, 1916
138.	Falk Coal Mine	H. Boardman	Drift	Air shaft	Carbide	1914-1915	Mar. 8, 1916
139.	Folvog Coal Mine	H. E. Folvog	Slope	Air shaft	Carbide	1914-1915	Mar. 8, 1916
140.	Freeman Coal Mine	John Erickson	Drift	None	Carbide	1914-1915	Mar. 7, 1916
141.	Head Coal Mine	P. G. Head	Slope	Air shaft	Carbide	1914-1915	Mar. 9, 1916
142.	Husebye Coal Mine	J. A. Husebye	Shaft and slope	Shaft	Carbide	1914-1915	Mar. 2, 1916
143.	Johnson Coal Mine	John Johnson	Drift	None	Carbide	1914-1915	Mar. 7, 1916
144.	Miller Coal Mine	A. C. Miller	Drift	None	Carbide	1914-1915	Mar. 6, 1916
145.	Moorman Coal Mine	J. M. Moorman	Drift	Air shaft	Carbide	1914-1915	Mar. 10, 1916
146.	Narveson Coal Mine	N. J. Narveson	Drift	None	Carbide	1914-1915	Mar. 8, 1916
147.	Powell Coal Mine	John Penson	Drift	Air shaft	Carbide	1914-1915	Mar. 3, 1916
148.	Reclamation Service Coal Mine	Wm. S. Arthur	Drift	Air shaft & electric fan	Carbide	1914-1915	Mar. 4, 1916
149.	Zahl Coal Mine	James Seabrook	Drift and strip pit			1914-1915	Mar. 7, 1916

*Main entries electrically lighted.

TABLE NO. 2

Name of Mine.	Depth of Coal Bed, Feet.	Thickness of Coal Bed, Feet.	Thickness of Coal Mined, Ft.	System of Mining.	Method of Mining.	How Delivered at Surface.
ADAMS COUNTY						
1. Clermont Coal Mine	25	16	10	Double entry	Blast off solid	Steam hoist
2. Farmers' Coal Mine	40	12½	9 —10	Single entry	Blast off solid	Horse
3. Haynes Coal Mine	40	14	9 —10	Single entry	Blast off solid	Horse
4. Leff Coal Mine	6— 15	2 — 8	All	Surface	Blast off solid	
5. Livingston Coal Mine	4— 20	8 —16	10	Single entry	Blast off solid and pick	Horse
6. Pinkham Coal Mine	15— 40	13	.....	Single entry		
7. Stevenson & Gunderson Coal Mine	35—100	12½	9 —10	Single entry	Blast off solid	Horse
BILLINGS COUNTY						
8. De Mores Coal Mine	300	7½	5½	Single entry	Blast off solid	Hand
9. High Grade Coal Mine	40—150	9	7	Single entry	Blast off solid	Mule
BOWMAN COUNTY						
10. Bowman Coal Mine	24	29	10	Single entry	Blast off solid	Horse
11. Scranton Coal Mine	50	19	12	Double entry	Blast off solid	Mule
BURKE COUNTY.						
12. Domrese Coal Mine	8— 10	9 —10	9 —10	Surface	Blast off solid	.....
13. Fenster Coal Mine	10	9	9	Strip and single entry	Blast off solid	Team and cable
14. Gille Coal Mine	3— 8	9	9	Strip pit	Blast off solid	.....
15. Hagen Coal Mine	10	6	5½	Single entry	Blast off solid	Gas engine hoist
16. Kielhack Coal Mine	18	9 —11	6 — 7	Single entry	Blast off solid	Gas engine hoist
17. Makee Coal Mine	30	6 — 6½	5½	Single entry	Blast off solid	Team and cable
18. Souther Coal Mine	23	9	6 — 7	Single entry	Blast off solid	Horse and cable
19. Vick Coal Mine	4— 10	7 — 8	7 — 8	Surface	Blast off solid	.....
BURLEIGH COUNTY						
20. Anderson Coal Mine	40	7	6	Single entry	Blast off solid	Team and cable
21. Asplund Coal Mine	70	12	8	Single entry	Blast off solid	Team and cable
22. Backman Coal Mine	50	10 —12	8	Single entry	Blast off solid	Gas engine hoist
23. Lind Coal Mine	30	10 —11	8	Single entry	Blast off solid	Team and cable
24. Peterson Coal Mine	80	9 —13	7	Single entry	Blast off solid	Team and cable
25. Wilton Coal Mine	60	10 —15	8	Double entry	Machine mining	Steam hoist

DIVIDE COUNTY						
26. Dougherty Coal Mine	39	7	6	Single entry	Blast off solid	Steam hoist
27. Haught Coal Mine	39	6 — 7	6	Double entry	Blast off solid	Horse
28. Noonan Coal Mine	30	6 — 7	6	Single entry	Blast off solid	Gas engine hoist
29. Truax Coal Mine	30	6 — 7	6	Double entry	Machine mining	Electric hoist
DUNN COUNTY						
30. Bang Coal Mine	9	14	14	Surface	Blast off solid	.....
31. Heiser Coal Mine	10	6	6	Surface	Blast off solid	.....
32. High Grade Coal Mine	35	20	7	Single entry	Blast off solid	Horse with whim
33. Paulson Coal Mine	35	16 —18	7 — 8	Single entry	Blast off solid	Horse and sledges
GOLDEN VALLEY COUNTY						
34. Corliss Coal Mine	15	20	20	Surface	Blast off solid	.....
35. Kussick Coal Mine	50—300	14	8	Single entry	Blast off solid	Horse
36. Madland Coal Mine	50—150	30	8	Rooms driven in side of hill	Blast off solid	Team and wagon
37. Porter Coal Mine	40	30	6	Single entry	Blast off solid	Horse and sledge
38. Sentinel Butte Coal Mine	200	32	11	Single entry	Blast off solid	Teams driven into mine
HETTINGER COUNTY						
39. Arnold Coal Mine	40	10	9	Single entry	Blast off solid	Horse
40. Havelock Coal Mine	50	11	8	Single entry	Blast off solid	Wheelbarrow
41. Merry Coal Mine	10— 30	10	10	Surface	Blast off solid	.....
42. Nelson Coal Mine	4— 5	4	4	Surface	Pick and wedge	.....
43. Square Deal Coal Mine	3— 8	4 — 5½	4 — 5½	Surface	Blast off solid	.....
McLEAN COUNTY						
44. Bitumina Coal Mine	100	9½—11	8	Double entry	Machine mining	Horse*
45. Borchardt Coal Mine	38	12	8	Double entry	Blast off solid	Horse with whim
46. Fredrich Coal Mine	59	6	6	Single entry	Blast off solid	Team with whim
47. Hansen Coal Mine	55	11	7	Single entry	Blast off solid	Horse
48. Johnson Coal Mine	40— 80	6 — 8	5 — 7	Single entry	Blast off solid	Team and cable
49. Kunkel Coal Mine	30	6 — 7	5½	Double entry	Blast off solid	Mule
50. Rupp Coal Mine	8	6½	6½	Surface	Pick and bar	.....
51. Ulrich Coal Mine	48	5 — 6	5 — 6	Double entry	Blast off solid	Team and cable
52. Youngquist Coal Mine	45	8	7	Single entry	Blast off solid	Horse

MERCER COUNTY

	Name of Mine.	Depth of Coal Bed, Feet.	Thickness of Coal Bed, Feet.	Thickness of Coal Mined, Ft.	System of Mining.	Method of Mining.	How Delivered at Surface.
53.	Black Diamond Coal Mine.....	46—100	11	7	Single entry	Blast off solid	Gas engine hoist
54.	Keeley Coal Mine.....	60	5	4	Single entry	Blast off solid	Hand
55.	Krem Coal Mine.....	36	10	7	Single entry	Blast off solid	Gas engine hoist
56.	Reichenberg Coal Mine.....	35— 60	4½	4	Single entry	Blast off solid	Hand
57.	Schmidt Coal Mine.....	22	23	15	Single entry	Blast off solid	Horse with whim
58.	Standard Coal Mine.....	60	12	5½	Single entry	Blast off solid	Horse with whim

MORTON COUNTY

	Name of Mine.	Depth of Coal Bed, Feet.	Thickness of Coal Bed, Feet.	Thickness of Coal Mined, Ft.	System of Mining.	Method of Mining.	How Delivered at Surface.
59.	Black Diamond Coal Mine.....	40	8	5½	Double entry	Pick and blast off solid	Gas engine hoist
60.	Coffin Butte Coal Mine.....	8— 16	5½— 9	5½— 9	Surface	Blast off solid	.....
61.	Coopenhaver Coal Mine.....	16½	4½	4½	Surface	Blast off solid and pick	.....
62.	Garfield Coal Mine.....	6— 12	6	6	Surface	Blast off solid	.....
63.	Hebron Coal Mine.....	50— 70	8	7	Double entry	Blast off solid	Horse
64.	Knutson Coal Mine.....	20	7½— 8	7½— 8	Surface	Blast off solid	.....
65.	Lindstrom Coal Mine.....	50	9 —11	9 —10	Single entry	Blast off solid	Horse
66.	New Salem Coal Mine.....	50	5½— 6	5	Double entry	Machine mining	Steam hoist
67.	North Star Coal Mine.....	80	8	6 — 7	Double entry	Blast off solid and pick	Horse
68.	Ormiston Coal Mine.....	15— 40	7	6	Single entry	Blast off solid	Hand
69.	Pleasant Ridge Coal Mine....	50— 60	6	5½	Single entry	Blast off solid	Horse with whim
70.	Ramsland Coal Mine.....	14	4 — 4½	4 — 4½	Surface	Blast off solid	.....

MOUNTRAIL COUNTY

	Name of Mine.	Depth of Coal Bed, Feet.	Thickness of Coal Bed, Feet.	Thickness of Coal Mined, Ft.	System of Mining.	Method of Mining.	How Delivered at Surface.
71.	Algers Coal Mine.....	8— 15	6	4	Surface	Blast off solid	.....
72.	Barto Coal Mine.....	30—100	3	3	Single entry	Blast off solid	Hand
73.	Blake Coal Mine.....	20	3⅔	3⅔	Single entry	Pick mining	Hand
74.	Bowman Coal Mine.....	40	7	5½— 6	Single entry	Blast off solid and pick	Horse and whim
75.	Fraser Coal Mine.....	40	4½	4½	Single entry	Pick mining	Hand
76.	Hefte Coal Mine.....	6— 15	5½	5½	Surface	Blast off solid	.....
77.	Hoppe Coal Mine.....	4— 5	3 — 5	3 — 5	Surface	Blast off solid	.....
78.	Kale Coal Mine.....	6— 7	3½	3½	Surface	Pick mining	.....
79.	North Star Coal Mine.....	6— 20	7	7	Surface	Blast off solid	.....
80.	Porger Coal Mine.....	120	6 — 7	6	Single entry	Blast off solid	Hand
81.	Rogers Coal Mine.....	10— 30	7	7	Surface	Blast off solid	.....
82.	Roseno Coal Mine.....	6— 20	7	7	Surface	Blast off solid	.....
83.	Sellar Coal Mine.....	35— 60	4	4	Single entry	Pick mining	Hand
84.	Stacy Coal Mine.....	10— 40	3	3	Surface	Pick mining	.....
85.	Sunday Coal Mine.....	35— 60	6	6	Single entry	Pick mining	Hand
86.	Williams Coal Mine.....	8	8	8	Surface	Blast off solid	.....

OLIVER COUNTY						
87. Flint Coal Mine	16	2½	2½	Surface	Pick mining	.....
88. Meyhoff Coal Mine	6— 15	10	7	Surface	Pick mining	.....
89. Pleasant Valley Coal Mine	6— 10	16	16	Surface	Blast off solid	.....
90. Spring Valley Coal Mine	12	6	6	Surface	Pick mining	.....
91. Tripp Coal Mine	.....	7	7	Surface	Pick mining	.....
RENVILLE COUNTY						
92. Tehelka Coal Mine	30— 80	2½	2½	Single entry	Blast off solid and pick	Horse
93. Wooster Coal Mine	30— 75	2½	2½	Single entry	.....	Hand
STARK COUNTY						
94. Bunker Hill Coal Mine	20—100	6½	5	Single entry	Blast off solid	Horse
95. Gross Coal Mine	25	6 — 8	5	Single entry	Blast off solid	Horse
96. Lehigh Coal Mine	65— 70	9	6 — 7	Single entry	Machine mining	Mules
97. North Creek Coal Mine	20	15 —20	12	Surface	Blast off solid	.....
98. North Star Coal Mine	40	5½	5½	Single entry	Blast off solid	Horse
99. Pittsburg Coal Mine	90	10 —11	7	Double entry	Blast off solid	Steam hoist
100. Zenith Coal Mine	10— 40	20 —22	9 —10	Double entry	Blast off solid	Steam hoist
WARD COUNTY						
101. Bartoshivich Coal Mine	40	18	7	Single entry	Blast off solid	Horse
102. Brick Yard Coal Mine	140	3 — 4	3 — 4	Double entry	Mining seam near top and blast off solid	Mules
103. Burlington City Coal Mine	20—120	10 —11	7	Double entry	Blast off solid	Horse
104. Caflisch Coal Mine	30— 40	12 —14	7	Single entry	Blast off solid	Horse
105. Christophson Coal Mine	80— 90	2 — 3	2 — 3	Single entry	Pick mining	Horse
106. Colton Coal Mine	30—115	10	7	Double entry	Blast off solid	Horse
107. Conan Coal Mine	30—100	10	6½— 7	Double entry	Blast off solid	Horse
108. Crosby Coal Mine	150	5½	5½	Single entry	Blast off solid	Horse
109. Davis Coal Mine	200	9	6	Double entry	Blast off solid	Steam hoist
110. Diamond Coal Mine	50	5	5	Double entry	Pick mining	Horse
111. Farmers Lignite Coal Mine	20— 70	5 — 6	4½— 6	Single entry	Pick mining	Hand
112. Forsythe Coal Mine	75—125	9	6 — 7	Double entry	Pick mining	Horse
113. Foxholm Coal Mine	60	10	7	Double entry	Blast off solid	Gas engine hoist
114. Hot Blast Coal Mine	70	2½	2½	Single entry	Blast off solid and pick	Team and cable
115. Hunnewell Coal Mine	50—100	10	6 — 7	Double entry	Blast off solid	Horse
116. Johnson Coal Mine	110	5 — 5½	5 — 5½	Double entry	Blast off solid	Steam hoist and horse

	Name of Mine.	Depth of Coal Bed, Feet.	Thickness of Coal Bed, Feet.	Thickness of Coal Mined, Ft.	System of Mining.	Method of Mining.	How Delivered at Surface.
117.	Klondike Coal Mine	20— 70	3	3	Single entry	Pick mining	Hand
118.	Leeson Coal Mine No. 1	40	12	8	Double entry	Blast off solid	Horse and sledge
119.	Leeson Coal Mine No. 2	35	14	7 — 8	Single entry	Blast off solid	Gravity
120.	Lloyd Coal Mine	65—150	9	6	Double entry	Blast off solid	Horse
121.	McClure Coal Mine	20—100	7	6 — 7	Double entry	Blast off solid	Mules
122.	Mellon Coal Mine	50	4	4	Single entry	Pick mining	Horse
123.	Ogborn Coal Mine	20—100	2½— 3	2½— 3	Single entry	Pick mining	Mules
124.	Pierce Coal Mine	220	4	4	Single entry	Pick mining	Steam hoist
125.	Red Flag Coal Mine	15	4	4	Single entry	Pick mining	Horse
126.	Rich Coal Mine	150	11	7	Single entry	Blast off solid	Horse
127.	Smith Coal Mine	80	5 — 6	5 — 5½	Double entry	Machine mining	Electric motor
128.	Square Deal Coal Mine	30—100	3½	3½	Single entry	Pick mining	Horse
129.	Strong Coal Mine	40	10	7	Single entry	Blast off solid	Gas engine hoist
130.	Tree-Bausch Coal Mine	14— 16	14	14	Surface	Pick mining	.....
131.	Vadnais Coal Mine	30— 40	3	3	Single entry	Blast off solid	Horse
132.	Wallace Coal Mine	100—175	11	7½	Double entry and stub	Blast off solid	Horse
133.	Wallin Coal Mine	45	9	9	Double entry	Pick mining	Mule
	WILLIAMS COUNTY						
134.	Black Diamond Coal Mine	90	10	7	Double entry	Blast off solid	Mule
135.	Big Four Coal Mine	50	7	6	Single entry	Blast off solid	Horse
136.	Bryne Coal Mine	20— 80	10	7	Double entry	Blast off solid	Mule
137.	Elithorpe Coal Mine	150	9	7	Double entry	Blast off solid	Mule
138.	Falk Coal Mine	53	8	6	Single entry	Blast off solid	Hand
139.	Folvog Coal Mine	40— 60	10	7	Single entry	Blast off solid	Horse
140.	Freeman Coal Mine	50	7 — 8	6 — 7	Single entry	Blast off solid	Horse
141.	Head Coal Mine	35	11 —15	8	Single entry	Blast off solid	Horse
142.	Husebye Coal Mine	60	10	7	Double entry	Blast off solid	Steam hoist
143.	Johnson Coal Mine	30— 50	8 — 8½	6 — 7	Single entry	Blast off solid	Hand
144.	Miller Coal Mine	40— 60	9	6	Single entry	Blast off solid	Horse
145.	Moorman Coal Mine	50	10	7 — 9	Double entry	Blast off solid	Hand
146.	Narveson Coal Mine	30	8 — 8½	6	Single entry	Blast off solid	Hand
147.	Powell Coal Mine	91	8½— 9½	7 — 8	Double entry	Blast off solid	Horse
148.	Reclamation Service Coal Mine	90	8 — 9	7	Double entry	Blast off solid	Mule
149.	Zahl Coal Mine	20— 40	6 — 7	5½	Single entry	Blast off solid	Hand

*Delivered at surface by horses; hoisted to tipple by steam.

TABLE NO. 3

ADAMS COUNTY

Name of Mine.	Year	No. days operated	Average days per month		Average No. of miners		Average daily production	Average No. of men other than miners		Average price paid miners per ton		Average daily wages
			Winter	Summer	Winter	Summer		Winter	Summer	Room	Entry	
1. Clermont Coal Mine.....	1914	306	26	25	4	2	11.09	2	...	3.00‡	...	2.75
	1915	306	26	25	4	2	13.3	2	...	2.50‡	...	2.50
2. Farmers' Coal Mine.....	1914	90	12	4	3	1	9.45	1	...	.25†	...	.25†
	1915	91	11	16	3	1	8.14	1	...	.25†	...	.25†
3. Haynes Coal Mine.....	1914	300	25	25	4	2	12.96	2	1	.25†	...	.25†
	1915	300	25	25	4	2	12.56	2	1	.25†	...	.25†
4. Leff Coal Mine.....	1914	240	25	15	...	...	8.91	3	3	...	...	2.50
	1915	240	25	15	...	...	8.92	3	3	...	...	2.50
5. Livingston Coal Mine..	1914	149	20	4	2	1	5.7	...	...	2.50‡	...	...
	1915	136	19	4	2	1	6.61	...	...	2.50‡	...	...
6. Pinkham Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	...	...	...	...	...	...	...	...	...	...	...
7. Stevenson & Gunderson Coal Mine	1914	312	26	26	4	2	10.1	1	...	.30†	...	.30†
	1915	307	25	26	3	1	9.67	1	...	.30†	...	.30†

BILLINGS COUNTY

8. De Mores Coal Mine....	1914	120	20	...	1	...	3.78	...	...	.60	.60	...
	1915	118	20	...	1	...	3.75	...	...	.60	.60	...
9. High Grade Coal Mine..	1914	300	26	24	7	3	22.92	3	2	.60	.75	2.50
	1915	302	26	21	10	3	35.06	3	2	.60	.75*	2.50

BOWMAN COUNTY

10. Bowman Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	205	20	14	3	1	7.31	1	...	2.50‡	...	2.50
11. Scranton Coal Mine.....	1914	300	26	24	6	4	26.36	3	1	.50	.60*	2.50
	1915	300	26	24	7	4	28.58	3	1	.50	.60*	2.50

*One dollar per lineal yard extra.

BURKE COUNTY

Name of Mine.	Year	No. days operated	Average days per month		Average No. of miners		Average daily production	Average No. of men other than miners		Average price paid miners per ton		Average daily wages
			Winter	Summer	Winter	Summer		Winter	Summer	Room	Entry	
12. Domrese Coal Mine....	1914	241	25	15	3*	...	8.3	...	2	2.50‡	...	2.50
	1915	241	25	15	3*	...	8.3	...	2	2.50‡	...	2.50
13. Fenster Coal Mine.....	1914	272	25	20	3	3	14.7	3	2	2.00‡	...	2.00
	1915	280	26	21	4	2	19.28	...	3	2.00‡	...	2.00
14. Gille Coal Mine.....	1914	159	16	11	2	1	6.28	...	1	2.00‡	...	2.00
	1915	204	23	11	2	1	9.68	...	1	2.00‡	...	2.00
15. Hagen Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	73	12	...	2	...	3.9	...	...	2.00‡	...	...
16. Kielhack Coal Mine....	1914	243	23	17	6	3	37.03	3	1	.60	.70	2.00
	1915	265	22	22	6	1	39.86	4	1	.60	.90	1.50
17. Makee Coal Mine	1914	64	10	...	1	...	1.56	...	...	.60	.70	...
	1915	126	15	6	2	1	3.96	1	...	.60	.70	1.50
18. Southern Coal Mine....	1914	75	13	...	1	...	4.00	...	...	2.00‡	...	...
	1915	310	26	26	4	3	8.08	1	1	.60	.70	2.00
19. Vick Coal Mine.....	1914	113	19	3	2	1	8.84	...	2	...	...	2.00
	1915	75	13	...	2	...	11.33	...	...	...	...	2.00

BURLEIGH COUNTY

Name of Mine.	Year	No. days operated	Average days per month		Average No. of miners		Average daily production	Average No. of men other than miners		Average price paid miners per ton		Average daily wages
			Winter	Summer	Winter	Summer		Winter	Summer	Room	Entry	
20. Anderson Coal Mine....	1914	126	18	3	2	...	3.8	...	...	.75	1.00	...
	1915	144	26	...	2	...	1.66	...	...	1.25	...	...
21. Asplund Coal Mine.....	1914	263	25	19	3	1	9.29	1	...	.75	1.00	2.25
	1915	248	24	17	3	1	8.89	1	...	.75	1.00	2.25
22. Backman Coal Mine.....	1914	110	18	...	2	...	5.38	...	...	.75	1.00	2.00
	1915	100	17	...	2	...	7.24	1	...	.75	1.00	1.80
23. Lind Coal Mine.....	1914	264	22	26	3	1	10.37	1	1	.75	1.00	35.00§
	1915	312	26	26	2	1	6.97	2	...	.75	.90	1.50
24. Peterson Coal Mine....	1914	272	25	20	3	2	8.82	2	1	.85	.90	2.00
	1915	260	24	23	2	1	2.33	1	1	.85	1.10	2.00
25. Wilton Coal Mine.....	1914	168	17	11	141	83	1160.22	107	81	.38	.48	2.50
	1915	160	18	9	124	72	1094.61	101	71	.38	.39**	2.50

*Men do hauling and digging.
**9c per ton additional for yardage.

DIVIDE COUNTY												
26. Dougherty Coal Mine...	1914	293	25	24	31	12	91.19	13	5	.70	1.00	2.00
	1915	293	25	24	17	7	51.19	7	3	.70	1.00	2.00
27. Haught Coal Mine.....	1914	307	25	26	9	3	24.10	5	1	.70	1.00	2.35
	1915	307	25	26	15	5	43.00	5	1	.70	1.00	2.25
28. Noonan Coal Mine.....	1914	295	25	24	8	4	12.76	3	2	.70	1.00	1.50*
	1915	283	25	22	7	3	30.03	2	2	.70	1.00	45.00§*
29. Truax Coal Mine.....	1914	312	26	26	44	15	87.17	34	9	.70	1.00	2.00
	1915	300	26	26	43	15	86.66	33	9	.70	1.00	2.00
DUNN COUNTY												
30. Bang Coal Mine.....	1914	113	19	...	1	...	3.53	...	...	1.10	...	...
	1915	79	13	...	2	...	3.54	...	...	1.10	...	...
31. Heiser Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	91	13	2	2	1	3.28	...	1	2.50‡	...	2.50
32. High Grade Coal Mine..	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	48	8	...	2	1	2.08	1	...	...	.80	2.00
33. Paulson Coal Mine.....	1914	240	24	16	1	1	4.16	...	...	.90	...	...
	1915	257	22	19	2	1	4.54	1	...	.90	...	35.00§
GOLDEN VALLEY COUNTY												
34. Corliss Coal Mine	1914	97	16	...	2	...	5.14	...	1	2.50‡	...	2.50
	1915	56	9	...	1	...	3.57	...	1	2.50‡	...	2.50
35. Kussick Coal Mine.....	1914	59	10	...	2	...	3.05	...	...	1.00	...	...
	1915	60	10	...	2	...	3.33	...	...	1.00	...	...
36. Madland Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	48	8	...	2	...	3.12	...	...	1.00	...	...
37. Porter Coal Mine.....	1914	76	13	...	1	...	3.42	...	...	1.00	...	...
	1915	76	13	...	1	...	3.28	...	...	1.00	...	...
38. Sentinel Butte Coal Mine	1914	140	24	...	2	...	7.07	...	...	45.00§	...	...
	1915	143	24	...	2	...	6.99	...	...	45.00§	...	...
HETTINGER COUNTY												
39. Arnold Coal Mine.....	1914	177	24	5	1	1	4.51	...	...	2.00‡	...	...
	1915	252	17	26	1	1	5.05	1	...	2.00‡	...	...
40. Havelock Coal Mine....	1914	46	8	...	2	...	8.69	...	...	.75	.75	...
	1915	120	10	10	2	2	8.33	...	...	.75	.75	...
41. Merry Coal Mine.....	1914	255	24	18	1	1	4.20	...	1	35.00‡	...	...
	1915	255	24	18	1	1	4.21	...	1	35.00‡	...	...
42. Nelson Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	101	17	...	2	...	2.97	...	...	2.50‡	...	...
43. Square Deal Coal Mine..	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	51	26	...	3	...	22.84	...	...	45.00§	...	...

*And board

McLEAN COUNTY

Name of Mine.	Year	No. days operated	Average days per month		Average No. of miners		Average daily production	Average No. of men other than miners		Average price paid miners per ton		Average daily wages
			Winter	Summer	Winter	Summer		Winter	Summer	Room	Entry	
44. Bitumina Coal Mine....	1914	312	26	26	4	1	19.97	3	2	.35	.36	2.50
	1915	208	26	9	6	3	31.04	3	2	.35	.39	2.50–2.75
45. Borchardt Coal Mine...	1914	162	22	5	2	1	5.73	1	...	.70	.80	2.50
	1915	112	16	3	1	1	3.5	1	...	.70	.80	2.50
46. Fredrich Coal Mine.....	1914	112	19	...	2	...	9.26	2	...	.30	.80	1.50
	1915	104	17	...	2	...	5.23	2	...	.60	.84	1.00–2.50
47. Hansen Coal Mine.....	1914	298	26	24	4	2	10.06	2	2	.53	.67	2.25
	1915	292	26	23	4.	2	9.87	2	2	.53	.67	1.50
48. Johnson Coal Mine.....	1914	93	16	...	2	...	9.67	2	...	.65	1.00	2.00–3.00
	1915	69	12	...	1	...	4.81	1	...	.65	1.20	2.00
49. Kunkel Coal Mine.....	1914	211	23	12	3	1	9.47	2	2	.60	.80	2.00
	1915	286	26	22	3	1	9.61	2	2	.80	1.20	26.00§
50. Rupp Coal Mine.....	1914	300	25	25	1	1	4.00	...	1	50.00§*	...	...
	1915	310	26	26	2	2	7.72	...	...	50.00§*	...	...
51. Ulrich Coal Mine.....	1914	153	21	4	4	3	15.68	2	...	.65	1.00	2.00
	1915	165	20	8	4	1	10.2	2	...	.65 to .85	1.00–1.20	1.50–3.50
52. Youngquist Coal Mine..	1914	60	10	...	2	...	2.33	1	...	.60	.75	1.30
	1915	62	10	...	1	...	5.16	...	...	.60	.90	...

*And board.

MERCER COUNTY

53. Black Diamond Coal Mine .	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	...	...	...	...	...	...	...	...	...	...	...
54. Keeley Coal Mine.....	1914	36	6	...	2	...	5.55	...	...	1.00	1.00	...
	1915	90	10	5	2	2	7.3	...	...	1.00	1.00	...
55. Krem Coal Mine.....	1914	227	25	13	3	1	8.81	1	1	1.00	...	2.50
	1915	227	25	13	3	1	8.81	1	1	1.00	...	2.50
56. Reichenberg Coal Mine.	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	18	3	...	1	...	1.11	...	...	1.00	1.00	...
57. Schmidt Coal Mine.....	1914	132	20	2	1	1	6.43	...	...	.75	.75	...
	1915	114	17	2	1	1	6.57	...	...	.75	.75	...
58. Standard Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	83	11	2	2	2	12.04	1	1	.60	.60	3.50

MORTON COUNTY

59. Black Diamond Coal Mine	1914	216	22	14	2	1	4.16	2	1	.80	1.25	2.25
	1915	307	25	26	2	1	6.39	2	1	.80	1.25	2.25
60. Coffin Butte Coal Mine.	1914	244	23	17	2	2	5.94	1	2	60.00§	...	2.50
	1915	244	23	17	2	2	6.14	1	2	60.00§	...	2.50
61. Coopenhaver Coal Mine.	1914	76	25	...	4	...	10.52	...	...	2.00‡	...	...
	1915	...	...	...	...	...	...	...	...	...	...	...
62. Garfield Coal Mine.....	1914	184	16	15	2	2	9.02	...	1	2.00‡	...	2.00
	1915	198	18	16	2	2	8.71	...	1	2.00‡	...	2.00
63. Hebron Coal Mine.....	1914	276	22	24	5	7	36.23	2	2	1.00	1.00	2.25
	1915	302	25	26	7	8	76.15	4	4	.75	...	2.50–3.50
64. Knutson Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	99	16	...	1	...	2.52	...	...	2.50‡	...	...
65. Lindstrom Coal Mine...	1914	154	16	10	2	1	7.98	1	...	.70	1.10	...
	1915	132	18	4	2	1	6.82	1	...	.70	1.10	30.00§
66. New Salem Coal Mine...	1914	267	23	22	15	5	62.56	16	7	.48	.55	2.50–3.00
	1915	212	21	14	11	5	57.75	16	12	.48	.55	2.75–3.00
67. North Star Coal Mine..	1914	161	23	4	4	1	15.27	1	...	.60	1.00	...
	1915	272	25	20	6	2	18.58	1	...	.70	1.10	2.50
68. Ormiston Coal Mine....	1914	100	25	...	2	...	5.00	...	...	.75	1.00	...
	1915	100	25	...	2	...	5.00	...	...	.75	1.00	...
69. Pleasant Ridge Coal Mine	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	160*	20	7	2	1	5.62	1	...	...	...	...
70. Ramsland Coal Mine....	1914	230	22	16	1	1	6.52	...	3	3.00‡	...	...
	1915	230	22	16	1	1	6.52	...	3	3.00‡	...	...

MOUNTRAIL COUNTY

71. Algers Coal Mine.....	1914	90	10	5	2	1	5.00	...	2	...	...	1.50–2.00
	1915	...	...	...	...	...	...	...	...	...	...	1.50–2.00
72. Barto Coal Mine.....	1914	95	13	3	2	...	3.15	...	...	.90	1.10	...
	1915	70	10	4	2	1	3.57	...	...	.90	1.10	...
73. Blake Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	128	18	3	1	1	3.90	...	2	...	...	2.50
74. Bowman Coal Mine.....	1914	80	13	...	1	...	1.87	1	...	1.00	...	1.50
	1915	55	9	...	1	...	1.81	1	...	1.00	...	1.50
75. Frazer Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	38	6	...	1	...	1.36	...	...	1.00	1.00	...
76. Hefte Coal Mine.....	1914	49	8	...	2	...	2.04	...	...	...	...	2.50
	1915	46	8	...	2	...	2.19	...	...	...	...	2.50
77. Hoppe Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	176	15	14	1	1	1.70	...	...	...	...	2.50
78. Kale Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	51	8	...	2	...	3.92	...	...	.20†	...	...
79. North Star Coal Mine...	1914	130	26	...	2	...	1.53	2	...	1.00	...	2.00
	1915	...	...	...	...	...	...	...	...	...	...	...

*Estimated.

Name of Mine.	Year	No. days operated	Average days per month		Average No. of miners		Average daily production	Average No. of men other than miners		Average price paid miners per ton		Average daily wages
			Winter	Summer	Winter	Summer		Winter	Summer	Room	Entry	
80. Porger Coal Mine.....	1914	76	10	3	2	1	6.57	...	...	.80	1.00	...
	1915	40	7	...	1	...	1.50	...	...	.80	1.00	...
81. Rogers Coal Mine.....	1914	138	15	7	3	1	8.42	2	1	...	...	.25†
	1915	120	20	...	1	...	2.91	...	1	...	...	.25†
82. Roseno Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	57	10	...	1	...	2.63	...	1	...	...	...
83. Sellar Coal Mine.....	1914	77	10	2	1	...	2.59	...	...	1.00	1.00	...
	1915	94	14	2	1	1	2.65	...	...	1.00	1.00	...
84. Stacy Coal Mine.....	1914	156	20	6	1	1	1.36	...	...	...	...	2.00
	1915	...	...	...	...	...	...	...	...	...	...	...
85. Sunday Coal Mine.....	1914	104	17	...	2	...	0.99	...	...	1.00	1.00	...
	1915	...	...	...	...	...	...	...	...	...	...	...
86. Williams Coal Mine....	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	121	16	5	2	1	4.95	...	1	...	...	2.50
OLIVER COUNTY												
87. Flint Coal Mine.....	1914	33	6	...	2	...	3.18	...	...	...	...	2.00
	1915	50	8	...	2	...	4.10	...	1	...	...	2.50
88. Meyhoff Coal Mine.....	1914	15	3	...	2	...	10.00	...	...	...	...	2.50
	1915	10	2	...	1	...	1.4	...	...	...	...	2.50
89. Pleasant Valley Coal M.	1914	...	...	...	...	...	...	...	...	...	...	...
	1915	...	...	...	...	...	...	...	...	...	...	...
90. Spring Valley Coal Mine	1914	231	22	17	2	2	10.13	...	2	...	...	2.00
	1915	237	19	21	2	2	10.32	...	2	...	...	2.00
91. Tripp Coal Mine.....	1914	183	17	13	2	1	5.46	...	1	...	...	2.00
	1915	180	17	13	2	1	5.55	...	1	...	...	2.00
RENVILLE COUNTY												
92. Tehelka Coal Mine.....	1914	104	11	6	3	1	5.01	1	1	1.00	1.00††	2.00
	1915	67	11	...	2	...	5.74	1	...	...	1.00	2.00
93. Wooster Coal Mine.....	1914	117	12	7	3	1	2.30	...	...	1.00	1.25	2.50
	1915	106	11	6	2	1	2.16	...	...	1.00	1.25	2.50

	STARK COUNTY												
94.	Bunker Hill Coal Mine..	1914	...	...	...	...	...	...	...	...	...	...	...
		1915	83	13	2	1	1	2.40	...	...	...	...	...
95.	Gross Coal Mine.....	1914	102	15	2	2	1	3.92	...	...	.55	.55	...
		1915	90	15	...	2	...	2.22	...	...	.55	.55	...
96.	Lehigh Coal Mine.....	1914	234	20	20	15	8	80.43	8	7	.37–.60	.45–.75	2.50–3.00
		1915	169	17	11	15	7	85.52	8	4	.40	.45	2.50–3.00
97.	North Creek Coal Mine..	1914	45	7	1	2	1	4.44	...	2	...	...	2.50
		1915	59	9	1	2	1	4.07	...	2	...	...	2.50
98.	North Star Coal Mine..	1914	238	24	16	2	1	6.30	1	...	.60	1.10	...
		1915	198	25	8	3	1	10.20	1	...	.60	1.10	...
99.	Pittsburg Coal Mine....	1914	240	20	20	15	15	100.19	10	10	.60	1.00	3.00
		1915	116	16	3	11	1	116.71	5	1	.60	.80	2.75
100.	Zenith Coal Mine.....	1914	205	14	12	10	7	58.53	4	3	.60	.75	2.75
		1915	215	18	18	12	8	200.35	4	3	.60	.75	2.75
	WARD COUNTY												
101.	Bartoshivich Coal Mine.	1914	100	17	...	2	...	5.00	1	...	.75	.75	...
		1915	120	20	...	2	...	5.00	1	...	.75	.75	...
102.	Brick Yard Coal Mine..	1914	217	21	15	5	2	14.43	3	2	.90	2.00	2.22–2.50
		1915	165	17	9	4	2	11.09	1	...	.90	...	2.25–2.50
103.	Burlington City Coal Mine	1914	85	12	2	2	1	3.52	1	...	.70	.90	2.50–3.00
		1915	298	26	24	6	4	19.16	3	3	.70	.90	2.50–3.00
104.	Caflisch Coal Mine.....	1914	180	23	7	4	2	11.11	1	...	.70	.90	1.50*
		1915	130	22	...	3	...	11.53	1	...	.70	1.00	1.50*
105.	Christophson Coal Mine	1914	64	11	...	1	...	2.81	1	...	1.00	1.25	2.00–3.00
		1915	...	...	...	...	...	...	...	...	...	...	...
106.	Colton Coal Mine.....	1914	177	23	7	5	2	9.03	3	1	.70	.90	2.50
		1915	175	22	7	5	2	9.00	3	1	.70–.80	.90–1.05	2.50
107.	Conan Coal Mine.....	1914	95	16	...	2	...	7.36	1	...	.70	.90	2.50
		1915	88	13	1	1	1	4.57	1	...	.70	.90	...
108.	Crosby Coal Mine.....	1914	68	11	...	1	...	2.94	1	...	.80	1.10	...
		1915	...	...	...	...	...	...	...	...	...	...	...
109.	Davis Coal Mine.....	1914	239	24	16	9	5	37.88	11	8	.70	.90	2.25–3.00
		1915	228**	24	14	8	5	35.08	10	8	.70	.90	2.25–3.00
110.	Diamond Coal Mine....	1914	168*	19	9	2	1	5.95	1	...	.80	1.00	2.50–3.00
		1915	225	17	16	3	2	7.66	1	1	.80	1.00	2.50–3.00
111.	Farmers' Coal Mine.....	1914	288	23	25	4	1	4.46	1	1	1.10	1.10	.30–.50†
		1915	94	16	...	3	...	8.10	...	...	1.10	1.10	.30–.40†
112.	Forsythe Coal Mine....	1914	217	22	14	5	1	13.91	1	1	.70	1.00	2.50
		1915	156	21	5	3	1	10.83	1	...	.70	...	.10¶

*And board.
**Estimated.

	Name of Mine.	Year	No. days operated	Average days per month		Average No. of miners		Average daily production	Average No. of men other than miners		Average price paid miners per ton		Average daily wages
				Winter	Summer	Winter	Summer		Winter	Summer	Room	Entry	
113.	Foxholm Coal Mine....	1914	149*	20	5	2	1	6.71	1	...	.70	...	2.50
		1915	312	26	26	6	6	12.99	2	2	.70	.70	2.50
114.	Hot Blast Coal Mine....	1914	76	13	...	2	...	5.72	1	...	1.00	1.25	2.50
		1915	75	12	...	1	...	2.00	1	...	1.00	1.25	2.50
115.	Hunnewell Coal Mine...	1914	235*	21	18	4	2	8.51	1	...	.80	1.00	1.00
		1915	300	26	24	4	2	5.52	...	...	.80	1.00	1.00
116.	Johnson Coal Mine.....	1914	306	25	26	6	2	11.92	3	1	.80	1.30	...
		1915	308	25	26	7	3	16.07	3	1	.80	1.20	...
117.	Klondike Coal Mine....	1914	47*	8	...	2	...	2.12	...	...	...	...	...
		1915	68	11	...	2	...	...	...	...	...	...	...
118.	Leeson Coal Mine No. 1.	1914	248	23	18	3	1	8.06	2	1	.75	1.00	2.00
		1915	312	26	26	3	1	11.25	1	...	.70	.70	1.50**
119.	Leeson Coal Mine No. 2.	1914	312	26	26	3	1	11.25	2	2	.75	1.00	2.50
		1915	151	25	...	2	1	9.75	2	...	.75	.75	1.50
120.	Lloyd Coal Mine.....	1914	167	24	20	12	7	59.88	8	5	.70	.90	2.50–3.00
		1915	200	20	13	10	5	36.75	9	6	.70	.90	2.50–3.00
121.	McClure Coal Mine.....	1914	263	22	21	11	5	...	7	4	.70	1.10	2.25–3.00
		1915	187	21	10	9	3	22.20	4	1	.70	.70***	2.50
122.	Mellon Coal Mine****...	1914	...	...	...	...	...	...	...	...	...	...	...
		1915	...	...	...	...	...	...	...	...	...	...	...
123.	Ogborn Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
		1915	98	25	4	2	1	4.08	1	...	1.00	...	2.00
124.	Pierce Coal Mine.....	1914	75	25	...	2	...	5.33	1	...	...	...	2.00
		1915	...	...	...	...	...	...	...	...	...	...	...
125.	Red Flag Coal Mine....	1914	50	8	...	1	...	...	...	...	.70	1.00	...
		1915	...	...	...	...	...	...	...	...	...	...	...
126.	Rich Coal Mine.....	1914	188	19	12	4	2	7.28	...	...	.90	1.25	2.00–3.00
		1915	216	18	18	3	3	7.80	...	...	.80	1.10	...
127.	Smith Coal Mine.....	1914	209	20	15	26	16	97.40	12	8	1.00	1.10	3.00
		1915	209*	20	15	19	12	71.77	8	6	1.00	1.10	3.00
128.	Square Deal Coal Mine.	1914	153	23	3	2	1	3.26	1	...	1.00	1.20	2.00
		1915	244	24	17	3	1	3.95	1	...	1.00	1.20	2.00
129.	Strong Coal Mine.....	1914	247	25	16	2	1	8.75	1	1	.70	1.00	2.00–3.00
		1915	312	26	26	5	2	12.11	1	1	.70	1.00	2.00**
130.	Tree-Bausch Coal Mine	1914	138*	19	4	1	...	3.26	...	2	...	...	2.00**
		1915	124	17	4	2	...	6.54	...	6	...	...	2.00**
131.	Vadnais Coal Mine.....	1914	139	22	2	5	2	4.49	2	...	.80	1.10	2.50
		1915	90	15	...	3	...	6.41	1	...	.90	.10††	2.50
132.	Wallace Coal Mine.....	1914	233	24	15	10	6	38.61	11	6	.70	.90	2.50–2.75
		1915	245	25	14	11	7	40.84	11	8	.70	.90	2.50–2.75
133.	Wallin Coal Mine.....	1914	...	...	...	...	...	...	...	...	...	...	...
		1915	312	26	26	3	2	5.77	...	...	.90	.90	2.50**

*Estimated. **And board. ***And 40c per foot. ****Opened in 1915. No coal sold.

WILLIAMS COUNTY

134.	Black Diamond Coal Mine	1914	287	25	23	6	2	17.42	1	...	.70	.90	40.00§
		1915	295	25	24	6	2	18.01	1	...	.70	.90	40.00§
135.	Big Four Coal Mine	1914	101	14	3	2	...	3.57	...	...	.80	1.00	2.00
		1915	49	8	...	3	...	3.63	1	...	.80	1.15	1.75–2.50
136.	Bryne Coal Mine	1914	156	21	5	2	1	4.48	1	...	.70	.90	40.00§
		1915	296	25	24	3	1	11.48	1	1	.70	.90	35.–40.§
137.	Ellithorpe Coal Mine	1914	176	25	4	4	2	19.58	2	1	.70	.90	2.50–2.75
		1915	192	26	6	4	2	19.98	2	1	.70	.90	3.00
138.	Falk Coal Mine	1914	284	25	22	3	1	7.04	1	...	1.00	1.10	.25¶
		1915	304	25	25	3	1	7.00	1	...	1.00	1.10	.25¶
139.	Folvog Coal Mine	1914	186	25	6	1	1	4.30	1	1	.80	1.00	...
		1915	198	26	7	1	1	4.29	1	1	.80	1.00	...
140.	Freeman Coal Mine	1914	42	7	...	1	...	1.90	...	...	1.00	1.00	...
		1915	127	21	...	2	...	3.54	...	...	1.00	1.00	...
141.	Head Coal Mine	1914	100	17	...	3	...	8.85	1	...	.80	1.00	2.00–2.50
		1915	154	21	4	3	1	11.03	1	1	.70	.90	30.00§*
142.	Husebye Coal Mine	1914	309	26	26	11	3	29.34	3	3	.70	.90	2.50–3.00
		1915	287	25	23	13	3	37.33	4	3	.70	.90	3.00
143.	Johnson Coal Mine	1914	191	20	7	2	1	1.73	...	...	.80	1.00	...
		1915	145	18	6	2	1	1.72	...	...	.80	1.00	...
144.	Miller Coal Mine	1914	150	20	5	1	1	3.66	1	...	.80	1.00	1.50
		1915	180	23	7	1	1	2.16	1	...	.90	1.05	1.50
145.	Moorman Coal Mine	1914	240	25	15	3	1	3.75	...	...	1.00	1.00	...
		1915	275	26	19	3	1	3.63	...	...	1.00	1.00	...
146.	Narveson Coal Mine	1914	175	20	9	3	1	6.85	1	...	1.00	1.00	...
		1915	190	23	9	3	1	6.84	1	...	1.00	1.00	...
147.	Powell Coal Mine	1914	228	24	14	3	1	8.77	1	...	.70	.90	2.50
		1915	207	15	19	5	2	14.49	1	1	.70	.90	2.50
148.	Reclamation Service Coal Mine	1914	325	26	28	3	7	27.90	2	5	.60	.80	2.60–3.00
		1915	283	25	22	3	3	23.38	2	2	.60	...	2.50–3.00
149.	Zahl Coal Mine	1914	209	20	15	1	1	2.39	...	2	...	...	2.50
		1915	215	21	15	1	1	2.79	...	2	...	...	2.50

*And board.

†Per hour in room and entry work.

‡Per day in room and entry work.

§Per month.

¶Per ton.

††Per foot.

TABLE NO. 4

ADAMS COUNTY

Name of Mine	Main Entry			Rooms			
	Length feet	Width feet	Height feet	Length feet	Width feet	Height feet	Width of pillar feet
1. Clermont Coal Mine	150	7	7	200	16	10	15
2. Farmers' Coal Mine	350	7	5	200	18	8½	8
3. Haynes Coal Mine	540	5	5	50	18	9—10	15
4. Leff Coal Mine*	...	..	..	...	..	..	..
5. Livingston Coal Mine	160	8	6	50	16	10	10—20
6. Pinkham Coal Mine**	...	..	..	...	..	..	..
7. Stevenson & Gunderson Coal Mine	150	7	7	110	14	9—10	11
BILLINGS COUNTY							
8. De Mores Coal Mine	172	7	5	140	18	5½	40—50
9. High Grade Coal Mine	650	5	6	...	26	7	..
BOWMAN COUNTY							
10. Bowman Coal Mine	150	8	7	100	25	10	..
11. Scranton Coal Mine	700	11	8	160	20	10	8
BURKE COUNTY.							
12. Domrese Coal Mine*	...	..	..	...	..	..	..
13. Fenster Coal Mine*	...	..	..	...	..	..	..
14. Gille Coal Mine*	...	..	..	...	..	..	..
15. Hagen Coal Mine	100	6	6	60	12	5½	8
16. Kielhack Coal Mine	100	7	5	...	12	6—7	6
17. Makee Coal Mine	350	6	6	40	16	5½	8—10
18. Souther Coal Mine	300	8—12	6	...	12—16	6—7	..
19. Vick Coal Mine*	...	..	..	...	..	..	..

*Strip Pit.

**Opened in 1915. No coal sold prior to January 1, 1916.

BURLEIGH COUNTY							
20. Anderson Coal Mine	250	6	6	75	15	6	10
21. Asplund Coal Mine	400	7	7	225	19	8	8—10
22. Backman Coal Mine	75	7	6	90	17	8	6—8
23. Lind Coal Mine	300	11	7	175	19	8	10—12
24. Peterson Coal Mine	200	8	7	150	20	7	8—12
25. Wilton Coal Mine	6,000	10	8	250	18	7	12—14
DIVIDE COUNTY							
26. Dougherty Coal Mine	750	8	6	120	14	6	6
27. Haught Coal Mine	750	6	6	120	16	6	6—10
28. Noonan Coal Mine	300	7	6	150	15	6	14—16
29. Truax Coal Mine	1,500	6	6	100	15	6	9
DUNN COUNTY							
30. Bang Coal Mine	40	15	7	...	..	..	..
31. Heiser Coal Mine*	...	..	..	...	..	..	..
32. High Grade Coal Mine	20	12	8	...	..	..	..
33. Paulson Coal Mine	350	9	7	90	24	7—8	12
GOLDEN VALLEY COUNTY							
34. Corliss Coal Mine*	...	..	..	...	..	..	..
35. Kussick Coal Mine	75	8	7	50	16	8	..
36. Madland Coal Mine	50	8	6	50	14	8	..
37. Porter Coal Mine	100	8	8	75	20	6	25
38. Sentinel Butte Coal Mine	200	8	7	35	15	11	35
HETTINGER COUNTY							
39. Arnold Coal Mine	200	12	8	60	16	9	25
40. Havelock Coal Mine	40	5	7	15	10	8	8
41. Merry Coal Mine*	...	..	..	...	..	..	..
42. Nelson Coal Mine*	...	..	..	...	..	..	..
43. Square Deal Coal Mine*	...	..	..	...	..	..	..

*Strip Pit.

Name of Mine	Main Entry			Rooms			
	Length feet	Width feet	Height feet	Length feet	Width feet	Height feet	Width of pillar feet
McLEAN COUNTY							
44. Bitumina Coal Mine	800	8	7	200	18	8	10
45. Borchardt Coal Mine	700	6	6	150	12	8	6
46. Fredrich Coal Mine	400	6	6	85	13	6	7
47. Hansen Coal Mine	800	7	6	135	12	7	10
48. Johnson Coal Mine	500	6	5	250	15	6	8
49. Kunkel Coal Mine	420	5	5	150	16	5½	6
50. Rupp Coal Mine*	...	..	..	...	..	..	..
51. Ulrich Coal Mine	380	5	5	175	17	5½	8
52. Youngquist Coal Mine	200	8	6	100	19	7	..
MERCER COUNTY							
53. Black Diamond Coal Mine	125	7	6	...	..	..	..
54. Keeley Coal Mine	450	6	4	100	10	4	13
55. Krem Coal Mine	100	6	6	85	19	7	10—12
56. Reichenberg Coal Mine	80	6	4	30	10	4	..
57. Schmidt Coal Mine	100	13	15	30	20	15	10
58. Standard Coal Mine	350	6	6	50	13	5½	6
MORTON COUNTY							
59. Black Diamond Coal Mine	...	5	5	100	18	5½	12—30
60. Coffin Butte Coal Mine*	...	..	..	...	..	..	..
61. Coopenhaver Coal Mine*	...	..	..	...	..	..	..
62. Garfield Coal Mine*	...	..	..	...	..	..	..
63. Hebron Coal Mine	1,800	6	7	300	20	7	15
64. Knutson Coal Mine*	...	..	..	...	..	..	..
65. Lindstrom Coal Mine	150	8	9	50	17	9	10
66. New Salem Coal Mine	2,300	8½	5	250	16	5	8
67. North Star Coal Mine	550	5	6	260	19	7	15
68. Ormiston Coal Mine	100	5	5	200	15	6	20
69. Pleasant Ridge Coal Mine	200	7	5	...	..	..	..
70. Ramsland Coal Mine*	...	..	..	...	..	..	..

*Strip Pit.

MOUNTRAIL COUNTY.							
71. Algers Coal Mine*	...	..	..	...	..	..	..
72. Barto Coal Mine	375	8	7	...	14	4	..
73. Blake Coal Mine	60	6	5	50	14	5	..
74. Bowman Coal Mine	200	8	6	75	13	6	9
75. Fraser Coal Mine	60	6	4½	60	17	4½	10
76. Hefte Coal Mine*	...	..	..	...	..	..	..
77. Hoppe Coal Mine*	...	..	..	...	..	..	..
78. Kale Coal Mine*	...	..	..	...	..	..	..
79. North Star Coal Mine*	...	..	..	...	..	..	..
80. Porger Coal Mine	60	6	4	...	..	..	..
81. Rogers Coal Mine*	...	..	..	...	..	..	..
82. Rosena Coal Mine*	...	..	..	...	..	..	..
83. Sellar Coal Mine	250	5	4	80	12	4	10
84. Stacy Coal Mine*	...	..	..	...	..	..	..
85. Sunday Coal Mine	75	6	6	...	..	..	..
86. Williams Coal Mine*	...	..	..	...	..	..	..
OLIVER COUNTY							
87. Flint Coal Mine*	...	..	..	...	..	..	..
88. Meyhoff Coal Mine*	...	..	..	...	..	..	..
89. Pleasant Valley Coal Mine*	...	..	..	...	..	..	..
90. Spring Valley Coal Mine*	...	..	..	...	..	..	..
91. Tripp Coal Mine*	...	..	..	...	..	..	..
RENVILLE COUNTY							
92. Tehelka Coal Mine	300	5	4	60	16	3½	10
93. Wooster Coal Mine	300	5	4½	...	13	3—4	..
STARK COUNTY							
94. Bunker Hill Coal Mine	60	5	5	30	16	5	..
95. Gross Coal Mine	120	6	6	...	10	5	..
96. Lehigh Coal Mine	2,640	7—10	6	200	18—25	6—7	6—25
97. North Creek Coal Mine*	...	..	..	...	..	..	..
98. North Star Coal Mine	300	5	6	150	17	6	30
99. Pittsburg Coal Mine	400	9	7	150	20	7	8
100. Zenith Coal Mine	3,500	9	8	200	20	9—10	8

*Strip Pit.

WARD COUNTY

Name of Mine	Main Entry			Rooms			
	Length feet	Width feet	Height feet	Length feet	Width feet	Height feet	Width of pillar feet
101. Bartoshivich Coal Mine	200	9	7	150	20	7	23
102. Brick Yard Coal Mine	1,500	6	5	200	18	3½—5	13
103. Burlington City Coal Mine	800	7	7	250	16	7	16
104. Caflisch Coal Mine	600	8	6	100	14	7	16
105. Christophson Coal Mine	150	5	5	...	..	..	..
106. Colton Coal Mine	700	7	6	140	14	7	12
107. Conan Coal Mine	300	6	6	200	14	7	..
108. Crosby Coal Mine	300	6	6	75	14	6	10
109. Davis Coal Mine	3,200	7	6	100	16	6	16
110. Diamond Coal Mine	250	7	4	75	13	4½	30
111. Farmers' Coal Mine	800	5	5½	20	8	5½	9
112. Forsythe Coal Mine**	...	..	..	...	..	..	..
113. Foxholm Coal Mine	700	7	6	100	16	7	15
114. Hot Blast Coal Mine	150	6	6	60	16	4	..
115. Hunnewell Coal Mine	800	5½	5½	100	15	6—7	8
116. Johnson Coal Mine	1,100	6	6	110	17	5½	9
117. Klondike Coal Mine	300	5	4	60	11	3	8—16
118. Leeson Coal Mine No. 1	200	8	8	150	15	8	24
119. Leeson Coal Mine No. 2	400	8	7	150	15	7	15
120. Lloyd Coal Mine	600	6	6	100	12	6	17
121. McClure Coal Mine	610	6	6	100	14	6—7	18—20
122. Mellon Coal Mine	100	7	5	...†	..	..	..
123. Ogborn Coal Mine	300	5	3½	30	10	3½	..
124. Pierce Coal Mine**	...	..	..	...	..	..	..
125. Red Flag Coal Mine**	...	..	..	...	..	..	..
126. Rich Coal Mine***	...	..	..	...	..	..	..
127. Smith Coal Mine	1,800	7	5½	100	13	5½	25
128. Square Deal Coal Mine	300	6	5½	65	11	3½	12
129. Strong Coal Mine	140	8	7	125	15	7	6
130. Tree-Bausch Coal Mine*	...	..	..	...	..	..	..
131. Vadnais Coal Mine	450	5	4	80	17	3½	12
132. Wallace Coal Mine	1,700	7	7	100	16	7½	16
133. Wallin Coal Mine	700	8	6	150	16	9	25

*Strip Pit.
†Now turned.
**Abandoned.
***New drift being started

WILLIAMS COUNTY

134.	Black Diamond Coal Mine	800	8	7	150	18	7	14
135.	Big Four Coal Mine	500	8	7	80	13	6	14
136.	Bryne Coal Mine	400	8	7	120	18	7	14
137.	Ellithorpe Coal Mine	600	8	6	125	16	7	10—16
138.	Falk Coal Mine	700	7	6	120	14	6	8
139.	Folvog Coal Mine	300	7	6	150	14	7	16
140.	Freeman Coal Mine	200	8	6	80	15	7	10
141.	Head Coal Mine	600	8	7	75	16	8	10
142.	Husebye Coal Mine	625	7	7	150	15	7	16
143.	Johnson Coal Mine	150	8	6	75	18	7	8—20
144.	Miller Coal Mine	200	6	6	100	16	6	18
145.	Moorman Coal Mine	350	7	7	100	16	8	14
146.	Narveson Coal Mine	400	8	6	...	15	6	..
147.	Powell Coal Mine	1,200	6	8	200	18	7	18
148.	Reclamation Service Coal Mine	1,149	6½	6½	150	15	7	15
149.	Zahl Coal Mine	150	8	5	70	14	5½	..

TABLE NO. 5

Name of Mine	Kind of Roof feet	Kind of floor	How drained	Kind of timber	Av. size inches	Approx. cost at mine
ADAMS COUNTY						
1. Clermont Coal Mine	5 — 6 coal	clay	Dry	Tamarack	6— 8	.50
2. Farmers' Coal Mine	3 — 4 coal	clay	Dry	Tamarack	6— 8	.35
3. Haynes Coal Mine	4 coal	clay	Dry	Cedar	8	.55
4. Leff Coal Mine		clay	Gas engine and centrifugal pump			
5. Livingston Coal Mine	2 — 3 coal	clay	Ditch	Tamarack	3— 6	.30
6. Pinkham Coal Mine						
7. Stevenson & Gunderson Coal Mine	2 — 3 coal	clay	Dry	Tamarack	8	.55
BILLINGS COUNTY						
8. De Mores Coal Mine	1 coal	3 in. clay 1 ft. coal	Dry	Cottonwood	6— 8	.25
9. High Grade Coal Mine	2 — 3 coal	clay	Dry	Cottonwood	8—10	.25
BOWMAN COUNTY						
10. Bowman Coal Mine	9 —10 coal	coal	Lift pump and small gas engine	Tamarack	6— 8	.65
11. Scranton Coal Mine	8 —10 coal	1 ft. coal	Buckeye pump and gas engine	Tamarack	6— 8	.40
BURKE COUNTY						
12. Domrese Coal Mine		clay	Windmill and lift pump.			
13. Fenster Coal Mine		clay	Gas driven centrifugal pump			
14. Gille Coal Mine		clay	Ditch			
15. Hagen Coal Mine	½— 1 coal	clay	Tank pump and gas engine	Cedar	5	.20
16. Kielhack Coal Mine	1 — 2 coal	clay	Lift pump and gas engine	Tamarack	6— 8	
17. Makee Coal Mine	1 — 1½ coal	clay	Tank pump	Cedar	5— 6	.20
18. Souther Coal Mine	1½— 2 coal	clay	Ditch	Tamarack	5— 6	.30
19. Vick Coal Mine		clay	Gas driven centrifugal pump			

				BURLEIGH COUNTY				
20.	Anderson Coal Mine	1	coal	clay	Dry			
21.	Asplund Coal Mine	3 — 4	coal	clay	Dry	Cottonwood	6— 8	.40
22.	Backman Coal Mine	2 — 3	coal	clay	Dry	Cottonwood	6—10	.35
23.	Lind Coal Mine	2	coal	clay	Dry	Cottonwood	6—10	.35
24.	Peterson Coal Mine	2	coal	clay	Dry	Elm and Cottonwood	6—10	.40
25.	Wilton Coal Mine	2	coal	clay	4 Deming Electric, 1 Emerson Steam and 3 other electric pumps.	Tamarack and Fir	6— 8	
				DIVIDE COUNTY				
26.	Dougherty Coal Mine	1	coal	clay	Dry	Tamarack	5	.15
27.	Haught Coal Mine	1	coal	clay	Dry	Tamarack	5— 6	.12
28.	Noonan Coal Mine	½	coal	clay	Dry	Tamarack	5— 6	
29.	Truax Coal Mine	1	coal	clay	Dry	Cedar and Tamarack	5— 8	.16
				DUNN COUNTY				
30.	Bang Coal Mine	1½	coal	coal	Gas driven centrifugal pump			
31.	Heiser Coal Mine			clay	Ditch			
32.	High Grade Coal Mine	12	coal	clay	Gas driven centrifugal pump			
33.	Paulson Coal Mine	7 — 8	coal	clay	Dry	Fir	6	.75
				GOLDEN VALLEY COUNTY				
34.	Corliss Coal Mine			clay	Dry			
35.	Kussick Coal Mine	4 — 6	coal	coal	Dry			
36.	Madland Coal Mine	4 — 5	coal	15-18 ft. coal	Ditch			
37.	Porter Coal Mine	8 —10	coal	coal	Ditch	R. R. ties	6— 8	
38.	Sentinel Butte Coal Mine	15 coal, 3 sandstone		1 ft. coal	Ditch			
				HETTINGER COUNTY				
39.	Arnold Coal Mine	1	coal	clay	Dry	Pine	4— 6	
40.	Havelock Coal Mine	3 — 4	coal	clay	Dry	Pine	6	.50
41.	Merry Coal Mine	1	coal	clay	Ditch			
42.	Nelson Coal Mine			clay	Gas driven tank pump			
43.	Square Deal Coal Mine			clay	Ditch			

Name of Mine	Kind of Roof feet	Kind of floor	How drained	Kind of timber	Av. size inches	Approx. cost at mine
McLEAN COUNTY						
44. Bitumina Coal Mine.....	3½ coal...	clay.....	American and Gardner steam pumps	Cottonwood	6— 8	.20
45. Borchardt Coal Mine.....	4 coal...	clay.....	Dry	Cedar	6	.25
46. Fredrich Coal Mine.....	clay...	clay.....	Dry	Cedar	5	.20
47. Hansen Coal Mine.....	3 — 4 coal...	clay.....	Dry	Cedar	6	.20
48. Johnson Coal Mine.....	3½ coal...	clay.....	Lift pump and windmill.	Cedar & Cottonwood	5	.20
49. Kunkel Coal Mine.....	½— 1 coal...	clay.....	Dry	Cedar	5	.18
50. Rupp Coal Mine.....	.....	clay.....	Nearly dry	.....	.....	.....
51. Ulrich Coal Mine.....	2½ coal...	clay.....	Lift pump and gas engine	Cedar	5	.20
52. Youngquist Coal Mine.....	2 — 2½ coal...	clay.....	Gas driven centrifugal pump	Cottonwood	6— 8	.20
MERCER COUNTY						
53. Black Diamond Coal Mine..	3 coal...	clay.....	Gas driven force pump..	.....	.....	.....
54. Keeley Coal Mine.....	clay...	clay.....	Augur hole to vein of coal 9 feet below.....	R. R. ties.....	6— 8	.10
55. Krem Coal Mine.....	clay...	clay.....	Lift pump and gas engine	Pine	4— 6	.....
56. Reichenberg Coal Mine.....	clay...	clay.....	Nearly dry	R. R. ties.....	6— 8	.....
57. Schmidt Coal Mine.....	8 coal...	clay.....	Lift pump and windmill.	.....	.....	.....
58. Standard Coal Mine.....	clay...	coal.....	Not drained	Pine	4— 6	.....
MORTON COUNTY						
59. Black Diamond Coal Mine..	2 — 3 coal...	clay.....	Gas driven pump.....	Cedar	4— 5	.35
60. Coffin Butte Coal Mine.....	.....	clay.....	Gas driven pump.....	.....	.....	.....
61. Coopenhaver Coal Mine....	.....	clay.....	Augur lift pump.....	.....	.....	.....
62. Garfield Coal Mine.....	.....	Slate.....	Dry	.....	.....	.....
63. Hebron Coal Mine.....	1 coal...	1 ft. coal...	Ditch	Tamarack	6— 8	.25
64. Knutson Coal Mine.....	.....	clay.....	Ditch	.....	.....	.....
65. Lindstrom Coal Mine.....	20 in. slate.	clay.....	Ditch	R. R. ties.....	6— 8	.20
66. New Salem Coal Mine.....	clay...	clay.....	Dry	Tamarack	4— 6	.18
67. North Star Coal Mine.....	1 coal...	clay.....	Dry	Tamarack	.....	.....
68. Ormiston Coal Mine.....	clay...	clay.....	Ditch	Oak and Cottonwood	4	.10
69. Pleasant Ridge Coal Mine..	1 —2 blackjack	clay.....	Dry	Tamarack	5— 6	.....
70. Ramsland Coal Mine.....	.....	clay.....	Ditch	.....	.....	.....

MOUNTRAIL COUNTY							
71. Algers Coal Mine	.....	clay	Ditch	.....	.....	.....
72. Barto Coal Mine	clay	clay	Dry	Poplar	4	.....
73. Blake Coal Mine	clay	clay	Ditch	Cedar	5	.17
74. Bowman Coal Mine	1½ coal	clay	Tank car	Cedar	5	.20
75. Fraser Coal Mine	clay	clay	Ditch	Cedar	5	.22
76. Hefte Coal Mine	.....	clay	Ditch	.....	.....	.....
77. Hoppe Coal Mine	.....	clay	Gas driven pump	.....	.....	.....
78. Kale Coal Mine	clay	clay	Ditch	.....	.....	.....
79. North Star Coal Mine	.....	clay	Ditch	.....	.....	.....
80. Porger Coal Mine	clay	clay	Dry	Tamarack	5	.20
81. Rogers Coal Mine	.....	clay	Ditch	.....	.....	.....
82. Roseno Coal Mine	.....	clay	Ditch	.....	.....	.....
83. Sellar Coal Mine	clay	clay	Dry	Tamarack	5	.20
84. Stacy Coal Mine	.....	clay	Ditch	.....	.....	.....
85. Sunday Coal Mine	clay	clay	Ditch	Cedar	8	.....
86. Williams Coal Mine	.....	clay	Ditch	.....	.....	.....
OLIVER COUNTY						
87. Flint Coal Mine	.....	clay	Ditch	.....	.....	.....
88. Meyhoff Coal Mine	.....	clay	Ditch	.....	.....	.....
89. Pleasant Valley Coal Mine	.....	clay	Ditch	.....	.....	.....
90. Spring Valley Coal Mine	.....	clay	Ditch	.....	.....	.....
91. Tripp Coal Mine	.....	clay	Ditch	.....	.....	.....
RENVILLE COUNTY						
92. Tehelka Coal Mine	clay	clay	Tank car	Tamarack	5	.....
93. Wooster Coal Mine	clay	clay	Dry	Tamarack	5	.....
STARK COUNTY						
94. Bunker Hill Coal Mine	1 coal	clay	Tank pump	Tamarack	6	.....
95. Gross Coal Mine	2½ coal	clay	Dry	R. R. ties	6— 8	.....
96. Lehigh Coal Mine	2 coal	clay	Dry	Tamarack	6	.40
97. North Creek Coal Mine	.....	clay	Ditch	.....	.....	.....
98. North Star Coal Mine	Sandy clay	clay	Dry	Tamarack	5	.....
99. Pittsburg Coal Mine	2 — 3 coal	clay	Steam driven centrifugal pump	Tamarack	6	.40–.45
100. Zenith Coal Mine	10 coal	clay	Cameron and Fairbanks steam pump	Tamarack	6— 8	.....

WARD COUNTY

	Name of Mine	Kind of Roof feet	Kind of floor	How drained	Kind of timber	Av. size inches	Approx. cost at mine
101.	Bartoshivich Coal Mine....	4 — 7 coal...	clay.....	Ditch	Cedar	8	.....
102.	Brick Yard Coal Mine.....	clay...	clay.....	Dry	Tamarack	5	.16–.20
103.	Burlington City Coal Mine.	3½ coal...	clay.....	Dry	Tamarack	6	.20
104.	Caflisch Coal Mine.....	3 — 4 coal...	clay.....	Ditch	Cedar and Elm.....	6— 8	.25
105.	Christophson Coal Mine....	clay...	clay.....	Dry	Cedar	4	.....
106.	Colton Coal Mine.....	3 coal...	clay.....	Gas driven pump.....	Tamarack	6	.20
107.	Conan Coal Mine.....	3 — 3½ coal...	clay.....	Dry	Tamarack	6	.21
108.	Crosby Coal Mine.....	clay...	clay.....	Gas driven pump.....	Tamarack	5	.20
109.	Davis Coal Mine.....	3 coal...	clay.....	Steam pump	Tamarack	6	.20
110.	Diamond Coal Mine.....	clay...	clay.....	Dry	Cedar & Tamarack.	5— 6	.16–.20
111.	Farmers Coal Mine.....	Sandy clay...	clay.....	Almost dry	Cedar	5	.....
112.	Forsythe Coal Mine.....	1 — 1½ coal...	clay.....	Gas engine and pump...	Tamarack	6	.22
113.	Foxholm Coal Mine.....	3 coal...	clay.....	Gas engine and pump...	Tamarack	6	.20
114.	Hot Blast Coal Mine.....	clay...	clay.....	Gas driven pump.....	.....	.....	.....
115.	Hunnewell Coal Mine.....	3 coal...	clay.....	Tank pump and siphon..	Tamarack	5	.25
116.	Johnson Coal Mine.....	clay...	clay.....	Dry	Tamarack	5— 6	.....
117.	Klondike Coal Mine.....	clay...	clay.....	Dry	Cedar	6	.....
118.	Leeson Coal Mine No. 1.....	3 — 4 coal...	clay.....	Ditch	Cedar and Elm.....	6	.25
119.	Leeson Coal Mine No. 2.....	5 — 6 coal...	clay.....	Ditch	.....	.....	.....
120.	Lloyd Coal Mine.....	3 coal...	clay.....	Tank car	Tamarack	6	.20
121.	McClure Coal Mine.....	2 coal and clay...	clay.....	Gas driven pump.....	Tamarack	6— 9	.25
122.	Mellon Coal Mine.....	clay...	clay.....	Dry	Tamarack	5— 6	.16–.20
123.	Ogborn Coal Mine.....	clay...	clay.....	Dry	.....	.....	.....
124.	Pierce Coal Mine.....	clay...	clay.....	Steam ejector	Tamarack	5— 6	.20
125.	Red Flag Coal Mine.....	3 — 4 coal...	1½ ft. coal...	Ditch	.....	.....	.....
126.	Rich Coal Mine.....	clay...	clay.....	Dry	Tamarack	6	.20
127.	Smith Coal Mine.....	clay...	clay.....	Dry	Tamarack and oak.	6— 8	.15
128.	Square Deal Coal Mine.....	clay...	clay.....	Dry	R. R. ties.....	5x8	.04
129.	Strong Coal Mine	3 coal...	4 ft. clay 4 ft. coal ..	Lift pump and windmill.	Cedar and Elm.....	6	.50
130.	Tree-Bausch Coal Mine.....	.....	clay.....	Tile drain	.....	.....	.....
131.	Vadnais Coal Mine.....	clay...	clay.....	Dry	Cedar and Tamarack	5	.16
132.	Wallace Coal Mine.....	3½ coal...	4 inches clay 2 ft. coal....	Gas engine and lift pump	Tamarack	6	.20
133.	Wallin Coal Mine.....	clay...	clay.....	Dry	Tamarack	6— 8	.25–.35

WILLIAMS COUNTY

134.	Black Diamond Coal Mine..	3	coal...	clay.....	Dry	Cottonwood	6—12	.20
135.	Big Four Coal Mine.....	1	coal...	clay.....	Dry	Cottonwood & Elm.	6— 8	.30
136.	Bryne Coal Mine.....	3	coal...	clay.....	Dry	Cottonwood	6—10	.20
137.	Ellithorpe Coal Mine.....	2	coal...	clay.....	Siphon	Cottonwood, Elm and Cedar	6— 8	.30
138.	Falk Coal Mine.....	2	coal...	clay.....	Drain pipe	Pine	4x6	.50
139.	Folvog Coal Mine.....	3	coal...	clay.....	Dry	Tamarack	6	.....
140.	Freeman Coal Mine.....	1	coal...	clay.....	Dry	Cottonwood & Elm.	6—10	.20
141.	Head Coal Mine.....	3 — 4	coal...	clay.....	Siphon	Cottonwood	6—10	.20
142.	Husebye Coal Mine.....	3	coal...	clay.....	Dry	Cottonwood & Elm.	6—12	.25
143.	Johnson Coal Mine.....	1	coal...	clay.....	Ditch	Cedar, Elm and Cottonwood	5— 8	.20–.60
144.	Miller Coal Mine.....	3	coal...	clay.....	Ditch	Cottonwood & Elm.	6—10	.20
145.	Moorman Coal Mine.....	1 — 7	coal...	clay.....	Dry	Elm & Cottonwood.	6— 8	.20
146.	Narveson Coal Mine.....	1½— 2	coal...	clay.....	Dry	Elm	6— 8	.....
147.	Powell Coal Mine.....	2	coal...	clay.....	Tank car	Cottonwood	6— 8	.....
148.	Reclamation Service Coal Mine	2	coal...	soft soap-stone	Tank car	Tamarack	6— 8	.29
149.	Zahl Coal Mine	1	coal...	clay.....	Ditch	Cedar	5	.....

TABLE NO. 6

ADAMS COUNTY

Name of Mine	Kind of track	No. of mine cars	Cap. of mine cars lbs.	Explosive Used	Means of ignition	Distance from shipping station	Railroad
1. Clermont Coal Mine	12 lb. steel	9	2,000	FFF	Fuse	2 mi. Haynes	C., M. & St. P.
2. Farmers' Coal Mine	12 lb. steel	3	1,500	FFF	Fuse	3 mi. Haynes	C., M. & St. P.
3. Haynes Coal Mine	12 lb. steel	7	1,600	FFF	Fuse	2½ mi. Haynes	C., M. & St. P.
4. Leff Coal Mine	.....	.....	....	Dynamite	Fuse and cap	2 mi. Reeder	C., M. & St. P.
5. Livingston Coal Mine	4x4 pine	1	1,000	FFF	Fuse	5 mi. Hettinger	C., M. & St. P.
6. Pinkham Coal Mine	.....	.....	....	Dynamite	Fuse and cap	10 mi. Haynes	C., M. & St. P.
7. Stevenson & Gunderson Coal Mine	12 lb. steel	6	2,000	FFF	Fuse	3½ mi. Haynes	C., M. & St. P.

BILLINGS COUNTY

8. De Mores Coal Mine	12–16 lb. steel	1	2,000	FF	Squib	At Medora	N. P.
9. High Grade Coal Mine	18–20–30 lb. steel	8	2,200	FFF	Fuse	At Medora	N. P.

BOWMAN COUNTY

10. Bowman Coal Mine	10 lb. steel	3	1,100	FFF and dynamite	Squibs fuse and cap	5 mi. Bowman	C., M. & St. P.
11. Scranton Coal Mine	16 lb. steel	20	3,000	FFF and dynamite	Squibs fuse and cap	At Scranton	C., M. & St. P.

BURKE COUNTY

12. Domrese Coal Mine	.....	.....	....	Dynamite	Fuse and cap	6 mi. Columbus	Soo
13. Fenster Coal Mine	.....	.....	....	Dynamite	Fuse and cap	5 mi. Larson	G. N.
14. Gille Coal Mine	.....	.....	....	Dynamite	Fuse and cap	5½ mi. Columbus	Soo
15. Hagen Coal Mine	2x4 in. pine	2	1,000	None	.....	4 mi. Atwood	Soo
16. Kielhack Coal Mine	12 lb. steel	7	1,800	Dynamite	Fuse and cap	4½ mi. Columbus	Soo
17. Makee Coal Mine	10 lb. steel	6	1,000	FFF	Squibs	7 mi. Columbus	Soo
18. Souther Coal Mine	2x4 in. pine	5	1,000	None	.....	4 mi. Larson	G. N.
19. Vick Coal Mine	.....	.....	....	Dynamite	Fuse and cap	6 mi. Larson	G. N.

BURLEIGH COUNTY

20. Anderson Coal Mine	8 lb. steel	2	1,000	FFF	Fuse and cap	10 mi. Wilton	Soo and N. P.
21. Asplund Coal Mine	8 lb. steel	5	1,000	FFF	Fuse and cap	4 mi. Still	N. P.
22. Backman Coal Mine	8 and 12 lb. steel	4	1,000	FFF	Fuse and cap	4 mi. Wilton	N. P. and Soo
23. Lind Coal Mine	12 lb. steel	6	1,000	FFF	Squibs	2½ mi. Wilton	N. P. and Soo
24. Peterson Coal Mine	12–16 lb. steel	6	1,000	FFF	Fuse & squibs	4 mi. Still	N. P.
25. Wilton Coal Mine	20–35 lb. steel	414	2,400	Dynamite	Electric detonators	1 mi. Wilton	N. P. and Soo

DIVIDE COUNTY

26. Dougherty Coal Mine	12 lb. steel	17	1,500	FFF	Squibs	1 mi. Noonan	G. N.
27. Haught Coal Mine	12 lb. steel	33	1,000	FFF	Squibs	1 mi. Noonan	G. N.
28. Noonan Coal Mine	12 lb. steel	7	1,000	FFF	Squibs	1 mi. Noonan	G. N.
29. Truax Coal Mine	12 lb. steel	90	1,000	FFF	Squibs	1 mi. Noonan	G. N.

DUNN COUNTY

30. Bang Coal Mine	None	None	.....	Dynamite	Fuse and cap	½ mi. Dunn Center	N. P.
31. Heiser Coal Mine	None	None	.....	Dynamite	Fuse and cap	12 mi. Killdeer	N. P.
32. High Grade Coal Mine	4x4 in. pine	2	2,000	Dynamite	Fuse and cap	2½ mi. Dunn Center	N. P.
33. Paulson Coal Mine	None	5 sledge	900	Dynamite	Fuse and cap	3¼ mi. Werner	N. P.

GOLDEN VALLEY COUNTY

34. Corliss Coal Mine	None	None	.....	Dynamite	Fuse and cap	9 mi. Sentinel Butte	N. P.
35. Kussick Coal Mine	None	None	.....	Dynamite	Fuse and cap	5 mi. Sentinel Butte	N. P.
36. Madland Coal Mine	None	None	.....	Dynamite	Fuse and cap	4 mi. Sentinel Butte	N. P.
37. Porter Coal Mine	None	1 sledge	900	Dynamite	Fuse and cap	9 mi. Sentinel Butte	N. P.
38. Sentinel Butte Coal Mine	None	None	.....	Dynamite	Fuse and cap	3 mi. Sentinel Butte	N. P.

HETTINGER COUNTY

39. Arnold Coal Mine	12 lb. steel	2	800–1,800	Dynamite	Fuse and cap	6 mi. Regent	C., M. & St. P.
40. Havelock Coal Mine	None	.....	.....	Dynamite	Fuse and cap	1 mi. Havelock	C., M. & St. P.
41. Merry Coal Mine	None	None	.....	Dynamite	Fuse and cap	12 mi. Mott	C., M. & St. P.
42. Nelson Coal Mine	None	None	.....	Dynamite	Fuse and cap	6 mi. Regent	C., M. & St. P.
43. Square Deal Coal Mine	None	None	.....	Dynamite	Fuse and cap	3 mi. Bentley	C., M. & St. P

McLEAN COUNTY

	Name of Mine	Kind of track	No. of mine cars	Cap. of mine cars lbs.	Explosive Used	Means of ignition	Distance from shipping station	Railroad
44.	Bitumina Coal Mine	12 lb. steel	12	2,000	Dynamite	Fuse and cap	3 mi. Bitumina	Soo
45.	Borchardt Coal Mine	12 lb. steel	4	1,000	Dynamite	Fuse and cap	3 mi. Underwood	Soo
46.	Fredrich Coal Mine	12 lb. steel	3	1,000	Dynamite	Fuse and cap	4½ mi. Underwood	Soo
47.	Hansen Coal Mine	12–16–20 lb. steel	5	1,500	Dynamite	Fuse and cap	4½ mi. Underwood	Soo
48.	Johnson Coal Mine	12–16 lb. steel	6	1,000	Dynamite	Fuse and cap	7 mi. Garrison	Soo
49.	Kunkel Coal Mine	8–16 lb. steel	5	1,000	Dynamite	Fuse and cap	1¼ mi. Garrison	Soo
50.	Rupp Coal Mine	None	None	....	Dynamite	Fuse and cap	3 mi. Garrison	Soo
51.	Ulrich Coal Mine	12 lb. steel	3	1,000	Dynamite	Fuse and cap	6½ mi. Garrison	Soo
52.	Youngquist Coal Mine	12 lb. steel	1	1,200	Dynamite	Fuse and cap	7 mi. Washburn	Soo

MERCER COUNTY

53.	Black Diamond Coal Mine	16 lb. steel	None	.....	Dynamite	Fuse and cap	At Beulah	N. P.
54.	Keeley Coal Mine	12 lb. steel	1	1,200	Dynamite	Fuse and cap	1½ mi. Hazen	N. P.
55.	Krem Coal Mine	12–16 lb. steel	2	1,500	Dynamite	Fuse and cap	6 mi. Hazen	N. P.
56.	Reichenberg Coal Mine	2x4 in. pine	1	1,500	Dynamite	Fuse and cap	1½ mi. Hazen	N. P.
57.	Schmidt Coal Mine	2x4 in. pine	1	2,000	Dynamite	Fuse and cap	7½ mi. Beulah	N. P.
58.	Standard Coal Mine	12 lb. steel	5	2,000	Dynamite	Fuse and cap	At Beulah	N. P.

MORTON COUNTY

59.	Black Diamond Coal Mine	12 lb. steel	7	1,000	FFF	Squibs	2½ mi. Leith	C. M. & St. P.
60.	Coffin Butte Coal Mine	None	None	.....	Dynamite	Fuse and cap	16 mi. Elgin	N. P.
61.	Coopenhaver Coal Mine	None	None	.....	Dynamite	Fuse and cap	2½ mi. Flasher	N. P.
62.	Garfield Coal Mine	None	None	.....	FFF	Squibs	7 mi. New Salem	N. P.
63.	Hebron Coal Mine	12 lb. steel	10	1,400	FFF	Fuse	5 mi. Hebron	N. P.
64.	Knutson Coal Mine	None	None	....	FFF	Fuse	4½ mi. Almont	N. P.
65.	Lindstrom Coal Mine	12 lb. steel	2	2,000	Dynamite	Fuse and cap	6 mi. Glen Ullin	N. P.
66.	New Salem Coal Mine	16–20 lb. steel	30	2,000	Dynamite	Fuse and cap	½ mi. New Salem	N. P.
67.	North Star Coal Mine	12 lb. steel	5	2,000	Dynamite	Fuse and cap	5 mi. Hebron	N. P.
68.	Ormiston Coal Mine	12 lb. steel	2	2,000	Dynamite	Fuse and cap	12 mi. Judson	N. P.
69.	Pleasant Ridge Coal Mine	16–20 lb. steel	3	2,000	FFF	Fuse & squib	1 mi. Glen Ullin	N. P.
70.	Ramsland Coal Mine	None	None	.....	Dynamite	Fuse and cap	6 mi. Almont	N. P.

	MOUNTRAIL COUNTY							
71.	Algers Coal Mine	None	None		FFF	Fuse	7 mi. Stanley	G. N.
72.	Barto Coal Mine	12 lb. steel	1	1,000	FFF	Fuse	3 mi. White Earth	G. N.
73.	Blake Coal Mine	2x4 in. pine	1	1,000			7 mi. Stanley	G. N.
74.	Bowman Coal Mine	8-10 lb. steel	4	1,000	FFF	Squibs	8½ mi. Parshall	Soo
75.	Fraser Coal Mine	2x4 in. pine	1	1,000			15 mi. Plaza	Soo
76.	Hefte Coal Mine	None	None		Dynamite	Fuse and cap	4 mi. White Earth	G. N.
77.	Hoppe Coal Mine	None	None		Dynamite	Fuse and cap	11 mi. Van Hook	Soo
78.	Kale Coal Mine	2x4 in. pine	1	1,000			7 mi. Stanley	G. N.
79.	North Star Coal Mine	None	None		Dynamite	Fuse and cap	11 mi. Van Hook	Soo
80.	Porger Coal Mine	12 lb. steel	2	1,500	Dynamite	Fuse and cap	3 mi. White Earth	G. N.
81.	Rogers Coal Mine	None	None		Dynamite	Fuse and cap	14 mi. Palermo	G. N.
82.	Roseno Coal Cine	None	None		Dynamite	Fuse and cap	11 mi. Van Hook	Soo
83.	Sellar Coal Mine	8 lb. steel	2	800			16 mi. Palermo	G. N.
84.	Stacy Coal Mine	None	None				8 mi. Stanley	G. N.
85.	Sunday Coal Mine	8 lb. steel	1	1,000			11 mi. Van Hook	Soo
86.	Williams Coal Mine	None	None				7 mi. White Earth	G. N.
	OLIVER COUNTY							
87.	Flint Coal Mine	None	None				17 mi. Stanton	N. P.
88.	Meyhoff Coal Mine	None	None				20 mi. Judson	N. P.
89.	Pleasant Valley Coal Mine	None	None				14 mi. Ft. Clark	N. P.
90.	Spring Valley Coal Mine	None	None				14 mi. Judson	N. P.
91.	Tripp Coal Mine	None	None				12 mi. Ft. Clark	N. P.
	RENVILLE COUNTY							
92.	Tehelka Coal Mine	12 lb. steel	3	1,000	Dynamite	Fuse and cap	3½ mi. Carpio	Soo
93.	Wooster Coal Mine	None	3	800	Dynamite	Fuse and cap	3 mi. Carpio	Soo
	STARK COUNTY							
94.	Bunker Hill Coal Mine	12 lb. steel	2	1,000	Dynamite	Fuse and cap	1 mi. Richardton	N. P.
95.	Gross Coal Mine	12 lb. steel	1	1,400	Dynamite	Fuse and cap	3 mi. Belfield	N. P.
96.	Lehigh Coal Mine	25 lb. steel	36	4,000	Dynamite	Fuse and cap	At Lehigh	N. P.
97.	North Creek Coal Mine	None	None		Dynamite	Fuse and cap	3 mi. South Heart	N. P.
98.	North Star Coal Mine	12 lb. steel	4	1,800	Dynamite	Fuse and cap	At Richardton	N. P.
99.	Pittsburg Coal Mine	20 lb. steel	32	2,000	Dynamite	Fuse and cap	At Lehigh	N. P.
100.	Zenith Coal Mine	12-18-24 lb. steel	25	2,000	Dynamite	Fuse and cap	At Zenith	N. P.

WARD COUNTY

	Name of Mine	Kind of track	No. of mine cars	Cap. of mine cars lbs.	Explosive Used	Means of ignition	Distance from shipping station	Railroad
101.	Bartoshivich Coal Mine....	12 lb. steel.....	2	2,000	Dynamite	Fuse and cap	16 mi. Max	Soo
102.	Brick Yard Coal Mine.....	12-16 lb. steel.....	20	1,600–2,000	FFF	Squibs	Spur 3 mi. Kenmare	Soo
103.	Burlington City Coal Mine.	12-16 lb. steel.....	16	3,000	FFF	Squibs	At Burlington	Soo
104.	Caflisch Coal Mine.....	12 lb. steel.....	3	1,500	Dynamite	Fuse and cap	9 mi. Sawyer	Soo
105.	Christophson Coal Mine....	2x4 in. pine.....	2	1,000	.....	.....	1½ mi. Carpio	Soo
106.	Colton Coal Mine.....	10-16 lb. steel.....	17	1,000	FFF	Squibs	1½ mi. Burlington	Soo
107.	Conan Coal Mine.....	12-16 lb. steel.....	5	2,000	FFF	Squibs	1 mi. Burlington	Soo
108.	Crosby Coal Mine.....	12 lb. steel.....	14	2,000	FFF	Squibs	6 mi. Kenmare	Soo
109.	Davis Coal Mine.....	14 lb. steel.....	50	2,000–2,700	FFF	Squibs	Spur 1 mi. Burlington	Soo
110.	Diamond Coal Mine.....	12 lb. steel.....	12	1,200–1,500	.....	.....	1 mi. Kenmare	Soo
111.	Farmers' Coal Mine.....	Pine with steel strap	5	1,000	.....	.....	7 mi. Bowbells	Soo
112.	Forsythe Coal Mine.....	16 lb. steel.....	10	2,000	FFF	Squibs	4 mi. Burlington	Soo
113.	Foxholm Coal Mine.....	14 lb. steel.....	15	2,000	FFF	Squibs & fuse	½ mi. Foxholm	Soo
114.	Hot Blast Coal Mine.....	None	None..	.....	.....	.....	3 mi. Donnybrook	Soo
115.	Hunnewell Coal Mine.....	None	12	2,000	FFF	Squibs	1½ mi. Burlington	Soo
116.	Johnson Coal Mine.....	2x4 in. pine.....	36	1,000	FFF	Squibs	6 mi. Kenmare	Soo
117.	Klondike Coal Mine.....	12 lb. steel.....	3	1,000	.....	.....	5 mi. Donnybrook	Soo
118.	Leeson Coal Mine No. 1....	None	1 Sledge	600	Dynamite	Fuse and cap	12 mi. Velva	Soo
119.	Leeson Coal Mine No. 2.....	12 lb. steel.....	4	2,000	Dynamite	Fuse and cap	9 mi. Sawyer	Soo
120.	Lloyd Coal Mine.....	16-20 lb. steel.....	36	2,000	FFF	Squibs	1 mi. Paradise	Soo
121.	McClure Coal Mine.....	12-20 lb. steel.....	18	2,000	FFF	Fuse & squibs	At Tasker	Soo
122.	Mellon Coal Mine.....	12 lb. steel.....	6	1,000	.....	.....	2 mi. Kenmare	Soo
123.	Ogborn Coal Mine.....	10 lb. steel.....	3	1,000	.....	.....	1 mi. Baden	Soo
124.	Pierce Coal Mine.....	12 lb. steel.....	10	1,000	.....	.....	2 mi. Kenmare	Soo
125.	Red Flag Coal Mine.....	None	None..	...	Dynamite	Fuse and cap	11 mi. Velva	Soo
126.	Rich Coal Mine.....	12 lb. steel.....	8	1,000	FFF	Squibs	8 mi. Bowbells	Soo
127.	Smith Coal Mine.....	16-40 lb. steel.....	60	2,000	FFF	Fuse	2 mi. Kenmare	Soo
128.	Square Deal Coal Mine.....	12 lb. steel.....	4	1,000	.....	.....	3 mi. Baden	Soo
129.	Strong Coal Mine.....	8-12-16 lb. steel...	4	2,000	Dynamite	Fuse and cap	11 mi. Velva	Soo
130.	Tree-Bausch Coal Mine.....	None	None..	.....	Dynamite	Fuse and cap	14 mi. Velva	Soo
131.	Vadnais Coal Mine.....	8-12 lb. steel.....	10	1,000	FFF	Squibs	2 mi. Kenmare	Soo
132.	Wallace Coal Mine.....	12-16 lb. steel.....	20	3,000	FFF	Squibs	At Burlington	Soo
133.	Wallin Coal Mine.....	12 lb. steel.....	6	2,000	FFF	Squibs	3 mi. Burlington	Soo

WILLIAMS COUNTY

134.	Black Diamond Coal Mine..	12 lb. steel.....	8	3,000	FFF	Fuse	2 mi. Miller Spur	G. N.
135.	Big Four Coal Mine.....	12 lb. steel.....	3	2,000	FFF	Fuse	24 mi. Williston	G. N.
136.	Bryne Coal Mine.....	12 lb. steel.....	4	2,500	FFF	Fuse	2½ mi. Miller Spur	G. N.
137.	Ellithorpe Coal Mine.....	12 lb. steel.....	10	2,000	FFF	Fuse	3 mi. Miller Spur	G. N.
138.	Falk Coal Mine.....	10 lb. steel.....	6	1,000	Dynamite	Fuse and cap	4 mi. Howard	.....
139.	Folvog Coal Mine.....	12 lb. steel.....	3	1,000	FFF and Dynamite	Fuse and cap	8 mi. Gladys	.....
140.	Freeman Coal Mine.....	12 lb. steel.....	3	2,000	FFF	Fuse	5 mi. Marmon	.....
141.	Head Coal Mine.....	.....	4	2,000	FFF	Fuse	5½ mi. Williston	G. N.
142.	Husebye Coal Mine.....	12-20 lb. steel.....	18	2,800	FFF & FF	Fuse	½ mi. Miller Spur	G. N.
143.	Johnson Coal Mine.....	12 lb. steel.....	3	1,000	Dynamite	Fuse and cap	5 mi. Marmon	.....
144.	Miller Coal Mine	12 lb. steel.....	1	1,500	FFF	Fuse	12 mi. Williston	G. N.
145.	Moorman Coal Mine.....	2x4 in. pine.....	2	1,000	FFF	Fuse	8 mi. Wheelock	G. N.
146.	Narveson Coal Mine.....	12 lb. steel.....	2	1,800	Dynamite	Fuse and cap	5 mi. Marmon	.....
147.	Powell Coal Mine.....	12 lb. steel.....	7	3,000	FFF	Fuse	2½ mi. Miller Spur	G. N.
148.	Reclamation Service Coal Mine	16-30 lb. steel.....	20	2,000	Dynamite	Fuse	4½ mi. Williston	G. N.
149.	Zahl Coal Mine.....	None	1	1,000	.....	.....	3 mi. Howard	.....

TABLE NO. 7

ADAMS COUNTY

Name of Mine.	1914			1915		
	Production	Av. price per ton at mine	Total value	Production	Av. price per ton at mine	Total value
1. Clermont Coal Mine	3,594	1.40	5,031.60	4,074	$1.40	$5,703.00
2. Farmers' Coal Mine	851	.50	425.50	741	.50	370.50
3. Haynes Coal Mine	3,891	1.98	7,704.18	3,768	1.45	5,463.60
4. Leff Coal Mine	2,140	1.40	2,996.00	2,143	1.40	3,000.20
5. Livingston Coal Mine	850	1.50	1,275.00	900	1.50	1,350.00
6. Pinkham Coal Mine*	.....	....	.....	....	....	.....
7. Stevenson & Gunderson Coal Mine	3,153	1.51	4,761.03	2,969	1.39	4,126.91
Total	14,479		22,193.31	14,595		$20,014.21
BILLINGS COUNTY						
8. De Mores Coal Mine	454	1.75	794.50	443	$2.50	$1,107.50
9. High Grade Coal Mine	6,877	1.50	10,315.50	10,590	1.50	15,885.00
Total	7,331		$11,110.00	11,033		$16,992.50
BOWMAN COUNTY						
10. Bowman Coal Mine	.....	....	.....	1,500	$1.50	$2,250.00
11. Scranton Coal Mine	7,908	1.50	11,862.00	8,576	1.56	13,378.56
Total	7,908		11,862.00	10,076		$15,628.56
BURKE COUNTY						
12. Domrese Coal Mine	2,000**	1.42	2,840.00	2,000	$1.42	$2,840.00
13. Fenster Coal Mine	4,000	1.87	7,480.00	5,400	1.72	9,288.00
14. Gille Coal Mine	1,000**	1.30	1,300.00	1,975	1.30	2,567.50

*Opened in 1916.
**Estimated.

15. Hagen Coal Mine	.....	....	.....	285	1.00	285.00
16. Kielhack Coal Mine	9,000	1.20	10,800.00	10,555	1.37	14,460.35
17. Makee Coal Mine	100	1.50	150.00	500	1.50	750.00
18. Souther Coal Mine	300	1.50	450.00	2,506	1.16	2,906.96
19. Vick Coal Mine	1,000*	1.12	1,120.00	850	1.82	1,547.00
Total	17,400		24,140.00	24,071		$34,644.81
BURLEIGH COUNTY						
20. Anderson Coal Mine	480	1.75	840.00	210	$1.75	$367.50
21. Asplund Coal Mine	2,445	1.64	4,009.80	2,207	1.81	3,994.67
22. Backman Coal Mine	592	1.59	941.28	724	1.71	1,238.04
23. Lind Coal Mine	2,650	1.75	4,637.00	2,175	1.75	3,806.25
24. Peterson Coal Mine	2,400*	1.75	4,200.00	607	1.75	1,061.75
25. Wilton Coal Mine No. 1	194,918	1.448	282,241.26	183,895	1.349	248,074.35
Total	203,485		296,869.34	189,818		$258,542.56
DIVIDE COUNTY						
26. Dougherty Coal Mine	26,720	2.00**	53,440.00	15,000*	$1.90	$28,500.00
27. Haught Coal Mine	7,400	1.85	13,690.00	13,204	1.81	23,899.24
28. Noonan Coal Mine	3,766	1.85*	6,967.10	8,500	1.98	16,830.00
29. Truax Coal Mine	27,200	1.90	51,680.00	26,000	1.90	49,400.00
Total	65,086		125,777.10	62,704		$118,629.24
DUNN COUNTY						
30. Bang Coal Mine	400	$1.50	$600.00	280	$1.50	$420.00
31. Heiser Coal Mine	.....	....	.....	300	2.50	750.00
32. High Grade Coal Mine	.....	....	.....	100	1.75	175.00
33. Paulson Coal Mine	1,000	1.50	1,500.00	1,167	1.50	1,750.50
Total	1,400		2,100.00	1,847		$3,095.50

*Estimated.
**On track.

GOLDEN VALLEY COUNTY

Name of Mine.	1914 Production	1914 Av. price per ton at mine	1914 Total value	1915 Production	1915 Av. price per ton at mine	1915 Total value
34. Corliss Coal Mine	500	1.50	750.00	200	$1.50	$300.00
35. Kussick Coal Mine	180	1.50	270.00	200	1.50	300.00
36. Madland Coal Mine	150	1.50	225.00	150	1.50	225.00
37. Porter Coal Mine	260	1.65	429.00	250	1.65	412.50
38. Sentinel Butte Coal Mine	990	1.70	1,683.00	1,000	1.70	1,700.00
Total	2,080		3,357.00	1,800		$2,937.50

HETTINGER COUNTY

39. Arnold Coal Mine	800	1.25	1,000.00	1,275	$1.17	$1,491.75
40. Havelock Coal Mine	400	1.19	476.00	1,000	1.10	1,100.00
41. Merry Coal Mine	1,072	1.35	1,447.20	1,077	1.35	1,453.95
42. Nelson Coal Mine	.....	....	.....	300	1.50	450.00
43. Square Deal Coal Mine	.....	....	.....	1,165	1.76	2,050.40
Total	2,272		2,923.20	4,817		$6,546.10

McLEAN COUNTY

44. Bitumina Coal Mine	6,231	$1.46	9,097.26	6,457	$1.36	$8,781.52
45. Borchardt Coal Mine	930	1.60	1,488.00	392	1.60	627.20
46. Fredrich Coal Mine	1,038	1.60	1,660.80	544	1.60	870.40
47. Hansen Coal Mine	3,000	1.60	4,800.00	2,883	1.60	4,612.80
48. Johnson Coal Mine	900	1.50	1,350.00	332	1.50	498.00
49. Kunkel Coal Mine	2,000	1.60	3,200.00	2,840	1.75	4,970.00
50. Rupp Coal Mine	1,200	1.75	2,100.00	2,396	1.75	4,193.00
51. Ulrich Coal Mine	2,400	1.50	3,600.00	1,684	1.50	2,526.00
52. Youngquist Coal Mine	140	1.60	224.00	320	1.60	512.00
Total	17,839		27,520.06	17,848		$27,590.92

MERCER COUNTY

53. Black Diamond Coal Mine*	.....	....	.....	....	....	.....
54. Keeley Coal Mine	200	2.00	400.00	657	$2.00	$1,314.00
55. Krem Coal Mine	2,000	2.00	4,000.00	2,000	2.00	4,000.00
56. Reichenberg Coal Mine	.....	....	.....	20	2.00	40.00
57. Schmidt Coal Mine	850	1.25	1,062.50	750	1.25	937.50
58. Standard Coal Mine	.....	....	.....	1,000	1.50	1,500.00
Total	3,050		5,462.50	4,427		$7,791.50

MORTON COUNTY

59. Black Diamond Coal Mine	900	2.00	1,800.00	1,964	$2.00	$3,928.00
60. Coffin Butte Coal Mine	1,400	1.35	1,957.50	1,500	1.35	2,025.00
61. Coopenhaver Coal Mine	800	1.50	1,200.00	....	....	.....
62. Garfield Coal Mine	1,660	1.40	2,324.00	1,726	1.40	2,416.40
63. Hebron Coal Mine	10,000	1.40	14,000.00**	23,800	1.40	**33,320.00
64. Knutson Coal Mine	.....	....	.....	250	1.00	250.00
65. Lindstrom Coal Mine	1,230	1.50	1,845.00	901	1.50	1,351.50
66. New Salem Coal Mine	16,705	1.80	30,069.00	12,243	1.80	22,037.40
67. North Star Coal Mine	2,460	1.40	3,444.00	5,054	1.40	7,075.60
68. Ormiston Coal Mine	500	1.75	875.00	500	1.75	875.00
69. Pleasant Ridge Coal Mine	.....	....	.....	900***	1.50	1,350.00
70. Ramsland Coal Mine	1,500	1.20	1,800.00	1,500	1.20	1,800.00
Total	37,205		59,314.50	50,338		$76,428.90

MOUNTRAIL COUNTY

71. Algers Coal Mine	450***	1.50	675.00	....	....	.....
72. Barto Coal Mine	300	1.50	450.00	250	$1.50	$375.00
73. Blake Coal Mine	.....	....	.....	500	2.00	1,000.00
74. Bowman Coal Mine	150	2.00	300.00	100	2.00	200.00
75. Frazer Coal Mine	.....	....	.....	52	2.00	104.00
76. Hefte Coal Mine	100	1.50	150.00	100	1.75	175.00
77. Hoppe Coal Mine	.....	....	.....	300	1.50	450.00

*Opened in 1916.
** No coal sold; estimated value.
***Estimated.

Name of Mine.	1914			1915		
	Production	Av. price per ton at mine	Total value	Production	Av. price per ton at mine	Total value
78. Kale Coal Mine	.....	....	.....	200	2.00	400.00
79. North Star Coal Mine	200	1.50	300.00	....	....	.....
80. Porger Coal Mine	500*	1.50	750.00	60	1.75	105.00
81. Rodgers Coal Mine	1,165	2.00	2,330.00	350	2.00	700.00
82. Roseno Coal Mine	.....	....	.....	150	1.50	225.00
83. Sellar Coal Mine	200*	1.50	300.00	250*	1.50	375.00
84. Stacy Coal Mine	213	1.75	372.75	....	....	.....
85. Sunday Coal Mine	103	2.00	206.00	....	....	.....
86. Williams Coal Mine	.....	....	.....	600*	1.75	1,050.00
Total	3,381		7,233.75	2,912		$5,159.00
OLIVER COUNTY						
87. Flint Coal Mine	105	$1.50	$157.50	205	$1.50	$307.50
88. Meyhoff Coal Mine	150	1.50	225.00	14	1.00	14.00
89. Pleasant Valley Coal Mine	1,000*	1.00	1,000.00	1,000*	1.00	1,000.00
90. Spring Valley Coal Mine	2,341	1.00	2,341.00	2,448	1.00	2,448.00
91. Tripp Coal Mine	1,000	1.00	1,000.00	1,000*	1.00	1,000.00
Total	4,596		4,723.50	4,667		$4,769.50
RENVILLE COUNTY						
92. Tehelka Coal Mine	522	2.00	1,044.00	385	$2.50	$962.50
93. Wooster Coal Mine	270	2.00	540.00	230	2.00	460.00
Total	792		1,584.00	615		$1,422.50
STARK COUNTY						
94. Bunker Hill Coal Mine	.....	....	.....	200	$1.75	$350.00
95. Gross Coal Mine	400	1.60	640.00	200	1.60	320.00

*Estimated.

96. Lehigh Coal Mine	18,823	1.75	32,940.25	14,453	1.75	25,292.75
97. North Creek Coal Mine	200*	1.50	300.00	240	1.50	360.00
98. North Star Coal Mine	1,500	1.80	2,700.00	2,040	1.80	3,672.00
99. Pittsburg Coal Mine	24,047	1.71	41,120.37	13,539	1.48	20,037.72
100. Zenith Coal Mine	12,000*	1.50	18,000.00	25,876	1.46	37,778.96
Total	56,970		95,700.62	56,548		$87,811.43
WARD COUNTY						
101. Bartoshivich Coal Mine	500	1.50	750.00	600	$1.50	$900.00
102. Brick Yard Coal Mine	3,132	2.20	6,890.40	1,831	2.04	3,735.24
103. Burlington City Coal Mine	300	2.00	600.00	5,711	1.94	11,079.34
104. Caflisch Coal Mine	2,000	1.50	3,000.00	1,500	1.50	2,250.00
105. Christophson Coal Mine	180	2.25	405.00	....	....	.....
106. Colton Coal Mine	1,600*	1.75	2,800.00	1,575	1.75	2,756.25
107. Conan Coal Mine	700*	1.75	1,225.00	403	1.75*	705.25
108. Crosby Coal Mine	200*	2.00	400.00	....	....	.....
109. Davis Coal Mine	9,045	2.00	18,090.00	8,000*	2.00	16,000.00
110. Diamond Coal Mine	1,000*	2.00*	2,000.00	1,725	2.00	3,450.00
111. Farmers' Lignite Coal Mine	1,285	1.80	2,313.00	760	1.80	1,368.00
112. Forsythe Coal Mine	3,020	1.85	5,587.00	1,690	2.00	3,380.00
113. Foxholm Coal Mine	1,000*	2.00*	2,000.00	4,055	2.00	8,110.00
114. Hot Blast Coal Mine	435	2.00	870.00	150*	2.00	300.00
115. Hunnewell Coal Mine	2,000	1.75	3,500.00	1,657	1.75	2,899.75
116. Johnson Coal Mine	3,650	2.00	7,300.00	4,950	2.00	9,900.00
117. Klondike Coal Mine	100*	2.25	225.00	151	2.25	339.75
118. Leeson Coal Mine No. 1	2,000	1.50	3,000.00	3,511	1.50	5,266.50
119. Leeson Coal Mine No. 2	2,000	1.50	3,000.00	1,472	1.50	2,208.00
120. Lloyd Coal Mine	10,000	2.00	20,000.00	7,350	2.00	14,700.00
121. McClure Coal Mine	8,702	1.84	16,011.68	4,152	1.50	6,228.00
122. Mellon Coal Mine**	.....	....	.....	....	....	.....
123. Ogborn Coal Mine	.....	....	.....	400	1.00	400.00
124. Pierce Coal Mine	300	1.50	450.00	....	....	.....
125. Red Flag Coal Mine	50	1.50	75.00	....	....	.....
126. Rich Coal Mine	1,369	2.00	2,738.00	1,686	2.00	3,372.00
127. Smith Coal Mine	20,357	1.65	33,589.00	15,000*	2.00	30,000.00
128. Square Deal Coal Mine	500	2.25	1,125.00	965	2.25	2,171.25
129. Strong Coal Mine	2,162	1.50	3,243.00	3,780	1.50	5,760.00
130. Tree-Bausch Coal Mine	450*	1.50*	675.00	811	1.50	1,216.50
131. Vadnais Coal Mine	625	2.00	1,250 00	577	1.75	1,009.75
132. Wallace Coal Mine	9,000	1.87	16,830.00	10,006	1.88	18,811.00
133. Wallin Coal Mine	.....	....	.....	1,800	1.08	1,944.00
Total	87,662		159,942.08	86,268		$160,260.58

*Estimated.
**Opened in 1916.

WILLIAMS COUNTY

Name of Mine.	1914			1915		
	Production	Av. price per ton at mine	Total value	Production	Av. price per ton at mine	Total value
134. Black Diamond Coal Mine	5,000*	1.50*	7,500.00	5,315	$1.69	$8,982.35
135. Big Four Coal Mine	361	1.82	639.12	178	1.90	338.20
136. Bryne Coal Mine	700*	1.60*	1,120.00	3,400	1.73	5,882.00
137. Ellithorpe Coal Mine	3,448	1.60*	5,516.00	3,837	1.77	6,791.49
138. Falk Coal Mine	2,000	2.00	4,000.00	2,130	2.00	4,260.00
139. Folvog Coal Mine	800*	1.50	1,200.00	850	1.50	1,275.00
140. Freeman Coal Mine	80	1.50	120.00	450	1.50	675.00
141. Head Coal Mine	885	1.60	1,416.00	1,700	1.60	2,720.00
142. Husebye Coal Mine	9,067	1.67	15,141.89	10,714	1.90	20,356.00
143. Johnson Coal Mine	350	1.60	560.00	250	1.60	400.00
144. Miller Coal Mine	570	1.94	1,105.80	390	2.00	780.00
145. Moorman Coal Mine	900	1.50	1,350.00	1,000	1.50	1,500.00
146. Narveson Coal Mine	1,200*	1.50	1,800.00	1,300	1.50	1,950.00
147. Powell Coal Mine	2,000*	1.50	3,000.00	3,000	1.75*	5,250.00
148. Reclamation Service Coal Mine	9,072**	1.50	13,608.00	6,618**	1.73*	11,449.14
149. Zahl Coal Mine	500	1.60	800.00	600	1.60	960.00
Total	36,933		58,876.81	41,732		$73,569.18

*Estimated.
**Not sold; estimated value.

PRODUCTION AND VALUE BY COUNTIES.

County	1914		1915	
	Output	Value	Output	Value
Adams	14,479	$22,193.31	14,595	$20,014.21
Billings	7,331	11,110.00	11,033	16,992.50
Bowman	7,908	11,862.00	10,076	15,628.56
Burke	17,400	24,140.00	24,071	34,644.81
Burleigh	203,485	296,869.34	189,818	258,542.56
Divide	65,086	125,777.10	62,704	118,629.24
Dunn	1,400	2,100.00	1,847	3,095.50
Golden Valley	2,080	3,357.00	1,800	2,937.50
Hettinger	2,272	2,923.20	4,817	6,546.10
McLean	17,839	27,520.06	17,848	27,590.92
Mercer	3,050	5,462.50	4,427	7,791.50
Morton	37,205	59,314.50	50,338	76,428.90
Mountrail	3,381	7,233.75	2,912	5,159.00
Oliver	4,596	4,723.50	4,667	4,769.50
Renville	792	1,584.00	615	1,422.50
Stark	56,970	95,700.62	56,548	87,811.43
Ward	87,662	159,942.08	86,268	160,260.58
Williams	36,933	58,876.81	41,732	73,569.18
Total	569,869	$920,689.77	586,116	$921,835.49

MINES THAT SHIP COAL.

Name of Mine.	Tons shipped	
	1914	1915
ADAMS COUNTY		
1. Clermont Coal Mine	.....	1,371
2. Haynes Coal Mine	2,172	2,136
7. Stevenson & Gunderson Coal Mine	1,697	684
BILLINGS COUNTY		
9. High Grade Coal Mine	*8,000	10,590
BOWMAN COUNTY		
11. Scranton Coal Mine	3,946	4,398
BURKE COUNTY		
12. Domrese Coal Mine	.....	600
13. Fenster Coal Mine	2,960	2,400
14. Gille Coal Mine	.....	1,000
16. Kielhack Coal Mine	6,200	4,230
18. Souther Coal Mine	.....	1,696
19. Vick Coal Mine	.....	600
BURLEIGH COUNTY		
21. Asplund Coal Mine	550	300
22. Backman Coal Mine	50	.....
25. Wilton Coal Mine	182,759	170,644

Name of Mine.	Tons shipped 1914	Tons shipped 1915
DIVIDE COUNTY		
26. Dougherty Coal Mine	24,115	*14,000
27. Haught Coal Mine	7,400	10,398
28. Noonan Coal Mine	.....	7,835
29. Truax Coal Mine	27,200	25,000
HETTINGER COUNTY		
40. Havelock Coal Mine	250	750
43. Square Deal Coal Mine	.....	608
McLEAN COUNTY		
44. Bitumina Coal Mine	2,809	1,929
49. Kunkel Coal Mine	.....	90
MERCER COUNTY.		
58. Standard Coal Mine	.....	95
MORTON COUNTY		
66. New Salem Coal Mine	13,175	8,274
STARK COUNTY		
96. Lehigh Coal Mine	*17,500	*13,000
99. Pittsburg Coal Mine	24,047	12,079
100. Zenith Coal Mine	*11,000	25,142
WARD COUNTY		
102. Brick Yard Coal Mine	2,057	1,196
103. Burlington City Coal Mine	.....	3,225
106. Colton Coal Mine	.....	1,375
109. Davis Coal Mine	2,962	*3,000
110. Diamond Coal Mine	.....	100
113. Foxholm Coal Mine	.....	500
120. Lloyd Coal Mine	10,000	7,350
121. McClure Coal Mine	8,701	4,000
127. Smith Coal Mine	14,754	*14,000
131. Vadnais Coal Mine	260	.....
132. Wallace Coal Mine	8,000	8,000
WILLIAMS COUNTY		
134. Black Diamond Coal Mine	*1,000	1,080
142. Husebye Coal Mine	975	2,656
Total	384,539	366.331

*Estimated.

MINES OPERATING IN 1912-1913 AND CLOSED IN 1914-1915.

Name of Mine	Owner	Lessee	Post Office	Location			
				Subdiv.	Sec.	Twp.	Rge.
BILLINGS COUNTY							
Jackson Coal Mine	O. Jackson		Bowman	NW¼	9	133	102
BURKE COUNTY							
Olson Coal Mine	Anders Olson		Larson	SW¼	14	162	94
BURLEIGH COUNTY							
Johnson Coal Mine	A. M. Johnson		Wilton	S½ SE¼	1	142	78
McLEAN COUNTY							
Hill Coal Mine	P. A. Hill		Garrison	E½ NE¼	25	148	85
MORTON COUNTY							
Feland Coal Mine	Theo. Feland		Sims	SW¼	13	138	86
MOUNTRAIL COUNTY							
Blickre Coal Mine		Andrew Blickre	White Earth	SW¼ NW¼	30	158	93
Hardman Coal Mine		W. J. Blake	Stanley		13	155	92
John Coal Mine	A. D. John		Epworth	SE¼	33	154	89
White Earth Coal Mine	Corkhill & Ferguson Co., Rochester, N. Y.		White Earth	NW¼ NW¼	15	156	94
WARD COUNTY							
Baden Coal Mine	Herb French	Gilbert Mahlun	Baden	NW¼ SE¼	26	159	88
Bertelson Coal Mine No. 2	B. J. Bertelson		Kenmare	NE¼ NE¼	26	161	89
Fihelly Coal Mine	Pat Fihelly	Jno. Murphy & Jos. Harper	Carpio		..	...	..
WILLIAMS COUNTY							
Low Level Coal Mine	John Bruegger		Avoca	SW¼	5	154	100
Sharpe Coal Mine	School Land	Wm. Penman	Williston, No. 64		16	154	100

LIST OF CHANGES IN NAMES OF MINES.

BURKE COUNTY

Name 1912-1913	Owner	Name 1914-1915	Owner
Greenup Coal Mine	Zimdas Bros. & Kielhack	Kielhack Coal Mine	Zimdas & Kielhack

STARK COUNTY

Wiley Coal Mine	C. H. Wiley	North Creek Coal Mine	C. H. Wiley

WARD COUNTY

Bertelson Coal Mine No. 1	Jonas Johnson	Johnson Coal Mine	Jonas Johnson
Des Lacs Coal Mine	F. L. Simmons	Foxholm Coal Mine	Foxholm Coal Co.

WILLIAMS COUNTY

Cow Creek Coal Mine	H. H. Skogberg	Big Four Coal Mine	Ben Fedge
Brown Coal Mine	J. T. Brown	Ellithorpe Coal Mine	Mabel B. Ellithorpe
Husebye & Ellithorpe Coal Mine	Husebye & Ellithorpe	Husebye Coal Mine	J. A. Husebye
Government Coal Mine	U. S. Reclamation Service	Reclamation Service Coal Mine	U. S. Reclamation Service

FATAL ACCIDENTS 1914.

WARD COUNTY

Name of Mine	Name of Employee	Address	Married	Nature of Accident	Cause	Date
Farmers' Coal Mine.....	John Olson	Bowbells	No	.....	Caving of clay.....	Aug. 10
Foxholm Coal Mine.....	Ewald Carlson*.	Foxholm	No	Skull crushed	Cage was lowered on his head while he was looking into shaft....	Dec. 16

FATAL ACCIDENTS 1915

McKENZIE COUNTY

Name of Mine	Name of Employee	Address	Married	Nature of Accident	Cause	Date
Snyder Coal Mine**.....	Charley Smith...	East Fairview	.....	.....	Unknown	Jan.

*Not an employee.

**This mine was not in operation when inspection was made.

NON-FATAL ACCIDENTS-1914.

BURLEIGH COUNTY

Name of Mine	Name of Employee	Address	Married	Nature of accident	Cause	Date
Wilton Coal Mine	Roy Krouple	Wilton	No	Electrical burn on hands and face.	Short circuit	Jan. 4
Wilton Coal Mine	Raymond McCall	Wilton	No	Finger nail torn off and finger bruised.	Another workman threw tie in car and hit him.	Jan. 27
Wilton Coal Mine	Joe Wiercinski	Wilton	No	Back bruised	Fall of coal	Feb. 18
Wilton Coal Mine	H. W. Brownson	Wilton	Yes	Toe bruised	Chunk of coal fell off car	.....
Wilton Coal Mine	Joe Barinuke	Wilton	Yes	Left shoulder fractured and head cut.	Squeezed between car and rib	Mar. 20
Wilton Coal Mine	Wasyl Snour	Wilton	No	Leg broken between knee and hip.	Fell under car	Sept. 3
Wilton Coal Mine	Mike Snour	Wilton	Yes	Face skinned and body sore.	Fell off railroad car when stopping	Oct. 26
Wilton Coal Mine	Harry Hyresko	Wilton	Yes	Thumb squeezed and nail torn.	Another workman let board drop, catching his thumb between it and car	.....
Wilton Coal Mine	Alfred Foster	Wilton	No	Finger pinched and nail torn.	Was jacking up cutting machine; jack slipped and caught his finger.	.....
Wilton Coal Mine	Joe DeRose	Wilton	No	Head cut and muscles of shoulder torn.	Squeezed between car and rib	Nov. 9
Wilton Coal Mine	F. Nafretchuck	Wilton	No	Bruised about head and shoulders.	Fall of coal	Nov. 10
Wilton Coal Mine	Joe Kettichuck	Wilton	Yes	Foot bruised	Let boiler flue drop on foot	Dec. 5
Wilton Coal Mine	Alex Mandiago	Wilton	Yes	Little toe on right foot crushed.	Another workman run box car loader over foot	.....
Wilton Coal Mine	John W. Black	Wilton	Yes	Strained back	Slipped on rail while pushing car of manure out of barn	Dec. 28

DIVIDE COUNTY

Dougherty Coal Mine	Mike Heddie	Tioga	.....	.....	Fall of clay	Dec. 13
Truax Coal Mine	Fred Long	Noonan	No	Bruised finger	Caught in gear	Nov. 25

McLEAN COUNTY						
Hansen Coal Mine	Ira Foster	Underwood	Yes	Bruised and burned about face and body.	Explosion of dynamite struck by pick	Oct. 21
MORTON COUNTY						
New Salem Coal Mine	Anton Kosemark	New Salem	No	Leg broken	Happened at passing track when mule got scared	.....
New Salem Coal Mine	E. Christienson	New Salem	No	Shot in arm	Premature explosion of dynamite	.....
STARK COUNTY						
Pittsburg Coal Mine	S. Danuser	.....	No	.....	Accidental discharge of blast	Dec.
WARD COUNTY						
Davis Coal Mine	Otto Casperson	Burlington	No	Broken leg	.....	Mar. 23
Lloyd Coal Mine	John Crockin	Burlington	No	Broken arm, fractured skull and internal injuries.	Accidental discharge of shot	Nov. 4
McClure Coal Mine	Chas. Verzatt	Tasker	No	.....	Crushed between car and timber	Nov. 3
Smith Coal Mine	Chas. Walker	Kenmare	No	Shot	Not known	.....
WILLIAMS COUNTY						
Reclamation Service Coal Mine	L. D. Lynch	Fairview, Mont.	Yes	.....	Falling coal	.....
Husebye Coal Mine**	.....	.....	.....	Miner badly burned by explosion, supposedly caused by a spark from opening can with a pick.	.....	.....

**Details lacking.

NON-FATAL ACCIDENTS--1915

Name of Mine	Name of Employee	Address	Married	Nature of accident	Cause	Date
BURLEIGH COUNTY						
Wilton Coal Mine	Fred Ashanyk	Wilton	No	Bone in right arm broken between elbow and wrist.	Door of mine car caught when dumped, then fell on arm	Jan. 29
Wilton Coal Mine	John Hickola	Wilton	No	Compound fracture of right leg between knee and ankle.	Coal fell on him in mine.	Jan. 29
Wilton Coal Mine	Fred Butula	Wilton	Yes	Left ankle sprained	Stepped on chunk of coal and slipped	Mar. 2
Wilton Coal Mine	J. J. Noya	Wilton	No	Right thumb broken	Standing on some loose coal, working, and slipped	Mar. 9
Wilton Coal Mine	H. C. Iverson	Wilton	Yes	Rupture, right side, near groin.	Slipped on iron floor on tipple when pushing car	Apr. 1
Wilton Coal Mine	I. G. Iverson	Wilton	Yes	Left ankle hurt and back wrenched.	Fell off electric light pole	July 23
Wilton Coal Mine	A. B. Wells	Wilton	No	Muscles in back strained	Was bending over, working, and happened when straightening up	July 26
McLEAN COUNTY						
Bitumina Coal Mine	Jas. Kastalla	.....	No	No report on nature of accident.	Miner lit fuse before loading shot; explosion occurred while loading	Dec. 1
Fredrich Coal Mine	Emil Fredrich	Underwood	No	No report on nature of accident.	Fall of roof	Jan. 12
MORTON COUNTY						
Black Diamond Coal Mine	Geo. Dowbrasky*	Leith	No	Thumb and fore finger taken off at first joint.	Fooling with detonating cap when it exploded	.....
New Salem Coal Mine	Aug. Sundstrom	New Salem	No	Broken leg	Anvil fell on his leg	Mar. 30
OLIVER COUNTY						
Flint Coal Mine	Olaf Flint	Hannover	Yes	Part of finger cut off	Done by pick when picking coal	Oct. 30
WARD COUNTY						
Farmers' Coal Mine	Hans Myhre	Bowbells	No	Back hurt	Fall of clay from roof	Feb. 25
Square Deal Coal Mine	Steph. Hodgson	Donnybrook	Yes	No record on nature of accident.	Fall of clay from roof	Mar. 1

*Not an employee of mine.

ADDITIONAL COAL MINE DATA

ADAMS COUNTY

1. Clermont Coal Mine

The Clermont Coal Mine is worked and operated by the Clermont Coal Company of Haynes and is situated about two miles northwest of Haynes, on the south side of a small hill. Mr. A. W. Peterson is in active charge of this mine.

The coal bed is about 16 feet thick and from five to six feet of coal is left for the roof, and very little timbering is required, excepting in the slope and occasionally in the rooms. The tipple, with two stationary screens and with storage bins having a combined capacity of 20 tons, was completed in 1914. A steam hoist is used for hauling cars from the mine, the hoist being made of a traction engine, one wheel of which is firmly anchored, the other being converted into a drum. Well water in this vicinity is suitable for steam purposes. This mine was inspected December 10, 1915, and was found to be in good condition throughout.

2. Farmers' Coal Mine

The Farmers' Coal Mine is owned by an association and operated chiefly for the benefit of the members, the coal being sold to them at about the cost of production. This mine has not been operated since the last of April, 1915, due chiefly to the fact that a deal has been pending whereby it is proposed to sell the property to the Haynes Co-operative Coal & Mining Company, of Haynes, N. D., and Aberdeen, S. D. This company owns the Haynes Coal Mine, situated on 40 acres immediately adjoining this mine on the west side. Should this sale be consummated, the workings of the Farmers' Mine will be abandoned. The mine was not in operation in December, and no inspection of the underground workings was made.

3. Haynes Coal Mine

The Haynes Coal Mine, formerly owned by W. H. Brown and J. B. Slosson, has been purchased by the Haynes Co-operative Coal & Mining Company, incorporated under the laws of South Dakota, with a capitalization of $200,000, approximately $70,000 to be invested in surface equipment and it is expected that about $15,000 will be spent in underground equipment. The mine is situated two and one-half miles northeast of Haynes and the company has begun the construction of a spur from the main line of the C., M. & St. P., three miles of grading being finished in December, 1915. Owing to the delays the track was not laid and none of the proposed extensive improvements at the mine have been started. Mr. Slosson, as president of the company, is in active charge of the work. At the present time coal is delivered at the surface through

a slope, by horses. The tipple consists of two loading dumps for wagons, stationary screens being used to separate the slack from the coal. The coal averages about 14 feet in thickness, and as four feet is left to strengthen the roof, only a small amount of timber is necessary, excepting in the slope. The slope is very well timbered. It is stated that the company intends to equip the mine electrically throughout, and the plans include an automatic hoist, undercutters and motor-haulage, etc. The conditions about the mine were found to be first-rate on December 10, 1915.

4. Leff Coal Mine

The Leff Coal Mine is located one and one-half miles southeast of Reeder and is owned and operated by Albert Leff. As the coal occurs close to the surface, the mine is operated as a strip pit, the over-burden being clay and from two to fourteen feet in thickness. The coal bed is eight feet thick. The stripping operations are carried on during the summer months. A small amount of top coal is of poor quality, due to slacking.

5. Livingston Coal Mine

The Livingston Coal Mine is owned and operated by William Livingston. It is located five miles north of Hettinger. One slope has been driven about 160 feet, including the main entry. Off from this main entry six rooms have been worked out, and at the present time the underground work has been abandoned. In 1915 the mine had been operated only as a strip pit, an occasional small entry being driven underground.

No general system of mining ever has been adopted and generally the workings are in poor condition. The drainage ditches are not deep enough to permit mining to the bottom of the coal bed.

6. Pinkham Coal Mine

William Pinkham owns and operates this mine, which is located ten miles northeast of Haynes. He formerly operated a mine on school land adjoining the present property, which had to be abandoned on account of a fire.

In December, 1915, the mine was being opened and, while the slope had been driven about 50 feet, the coal had not yet been reached. The coal bed here is about 13 feet in thickness. The slope is being timbered with four-inch, three-piece sets, placed four feet center to center, with one-inch boards used for lagging.

7. Stevenson & Gunderson Coal Mine

Mr. Stevenson and Mr. Gunderson own and operate this mine, which is located about three miles northeast of Haynes. The coal bed averages 12½ feet in thickness. From two to three feet is left for a roof, and little timbering is necessary except in the slope. However, good judgment has been used, and wherever there is any indication of a weakness in the roof, good substantial timbering is placed. The coal is hauled through the slope by horses. The tipple consists of a loading chute and has a very substantial stationary screen made of inverted steel rails

placed about an inch apart, which separates a portion of the slack from the coal. The chute has a capacity of about three tons.

Mr. Stevenson's farm buildings are located near the mine and very few mine buildings are necessary, excepting the scale house, blacksmith shop and bunk house. On December 10, 1915, the mine was inspected and found to be in good condition.

BILLINGS COUNTY

8. De Mores Coal Mine

The De Mores Coal Mine is located at the edge of the town of Medora and is owned by the N. P. Refrigerator Car Company. It is leased and operated by H. G. Kinmarck of Medora. Mr. Kinmarck operates the mine only to supply local demand. The coal bed is about eight feet thick and from one to two feet is left for the roof. Railroad ties are used to timber the entry and six to eight-inch cottonwood posts are used in the rooms.

A small tipple permits the dumping of coal directly into wagons or sleighs. No screening of the coal is done excepting that forks are used to load the cars in the mine. One room was lost by a cave-in, due to shooting down too much of the roof coal. The mine is well ventilated with an airshaft, and was found to be in a satisfactory condition when inspected on January 19, 1916.

9. High Grade Coal Mine

N. D. Nichols owns and operates the High Grade Coal Mine. It is located on the edge of the town of Medora on the southeast side of a large butte. A large tipple provides for loading the coal into box cars, being arranged so that one loading chute is used for mine run coal, one for lump coal and the other for slack coal.

During the fall of 1915 the drift caved in, on account of insufficient timbering, and had to be abandoned. A new drift was driven not far from the original one. A single entry system of mining is being used. The new drift is well timbered. Practically no timbering is done in the entry, the coal being nine feet thick and approximately two feet being left for the roof. Two rows of timbers are placed in the rooms. Some of the rooms are found to be wider than good mining practice permits, being 30 feet in width. The mine is well ventilated, an air shaft five feet in diameter being used. The new workings are connected with the old workings in such a way that the old air shaft also aids in ventilating. The mine was inspected January 20, 1916, and was found to be in good condition, with the exception of those rooms which were too wide.

BOWMAN COUNTY

10. Bowman Coal Mine

The Bowman Coal Mine was opened in October, 1914, and is owned by James Touhey. Mr. Peterson had leased the mine and operated it until about two weeks prior to the time of its inspection. At that time the lease was transferred to J. W. Gilfillan, who continued the operation

of the mine. The property is located five miles north of Bowman in a bed of coal of unknown thickness. A well driven near the mine is reported to have gone through a 29-foot vein, underlaid with a few feet of sand, followed by another bed of coal 35 feet in thickness.

There was no practical way in which the inspector could verify this information. The upper vein of coal is worked, leaving from nine to ten feet of coal for a roof and from nine to ten feet for a floor. When inspected December 15, 1915, the ventilation was found to be poor on account of the air shaft being located at the foot of the slope and there being no adequate provision for the circulation of air through the workings. One room was found to be 40 feet wide, although fairly well timbered. The new lessee agreed to drive narrower rooms. These wide rooms are not safe.

11. Scranton Coal Mine

The Scranton Coal Mine is owned by the Scranton Coal Company and is located at the town of Scranton. A spur connects the mine with the Milwaukee Railway, which allows the coal to be loaded directly into box cars from the tipple. No screen is used. The slack is removed when forked into the car. The coal bed is 19 feet thick and is reached by a slope. From eight to ten feet of coal is left for the roof and one foot for the floor. Very little timbering is done in the entries. The slope is well timbered. One row of props with caps are placed in the rooms. Ventilation is secured by means of an air shaft. About 20 gallons of water is removed per minute by means of a Buckeye pump and gasoline engine placed in the mine. The mine buildings consist of a hotel, office, scale room, dwelling house, stable, powder magazine and granary. The company is incorporated under the laws of North Dakota, with a capitalization of $50,000. Six thousand dollars has been invested in surface equipment and $2,500 in underground equipment. Chas. A. Liddell is superintendent and active manager of the mine. On December 14, 1915, conditions in and about the mine were very good.

BURKE COUNTY

12. Domrese Coal Mine

H. J. Domrese owns and operates this strip mine. About nine feet of clay is removed by teams and scrapers during the summer. The coal bed is nine feet thick and a considerable amount of water has to be removed with a windmill and a gas engine driven centrifugal pump. Work was seriously handicapped on account of snow during the winter of 1915 and 1916. A thin bed of clay which was left on the coal when stripping was done was undermined by rooms of considerable width, and as no timbering was done this was a very dangerous place for miners to work. Inspected February 23, 1916.

13. Fenster Coal Mine

The Fenster Mine is owned by Fred Fenster, who has Clifford Moss helping him as a partner in the operation of the mine. After March 1, 1916, Ed Fenster and Clifford Moss will lease the mine. It is worked

largely as a surface mine except during the winter months, when some underground work is done. A steep slope is driven to the coal, under which was an old room which had caved, making a hole in the floor of the slope near the portal, about 16 inches in diameter. This was in a dangerous condition on date of inspection. No definite system of mining is followed and no ventilation is provided. Very little timber is used in the slope and entry, but the rooms are fairly well timbered. Inspected February 24, 1916, and conditions generally were poor.

14. Gille Coal Mine

This mine is operated as a surface mine. The coal bed is nine feet thick and the overlying clay, which is from three to eight feet thick, is removed during the summer months by teams and scrapers. However, during the summer of 1915 very little stripping was done and what coal was mined during the winter was taken from rooms from 15 to 20 feet in width driven into the coal from the face of the strip mine. The room being worked when the mine was inspected, February 23, 1916, was in a rather dangerous condition, no timbering having been done. Sleighs are backed into the rooms to the face of the coal, where they are loaded.

15. Hagen Coal Mine

This is a small mine which supplies a local trade. It is located nine miles east of Noonan. Hagen Brothers own the mine. The coal bed is six feet thick and is reached by a slope, up which the coal is hauled to a tipple by a seven-H.P. "Economy" gas engine. This engine is also used to drive a tank pump in the mine. Very little timbering is done in the entry, but a considerable amount is done in the rooms. Most of the pillars have been pulled, only a few days' work being left. The mine will then be abandoned. Inspected February 24, 1916, and found to be in fair condition, considering the fact that it is to be abandoned soon.

16. Kielhack Coal Mine

The Kielhack Mine, formerly known as the Greenup Coal Mine, is owned and operated by H. Zimdas and T. Kielhack. It is situated in a shallow coulee about four and one-half miles south of Columbus. The coal bed is from nine to eleven feet thick and is covered with eighteen feet of clay. The mine has been operated chiefly as a surface mine until the past year, when underground mining was done. The coal is hauled from the entry by means of an eight-H.P. gasoline engine to a tipple equipped with a scale house. The coal is dumped directly into the wagons or sleighs from the tipple. Water is pumped from the mine with a gas engine driven pump. As the entry was only driven 100 feet, no large air shaft was sunk. A six-inch air shaft is provided near the end of the entry and the ventilation seemed good. From one to two feet of coal is left for the roof, and no timbering is done in the entries. The rooms, however, are well timbered. Inspected February 23, 1916, and found satisfactory.

17. Makee Coal Mine

The Makee Coal Mine is located about seven miles due north of

Columbus, a short distance from the Canadian line. It is owned by the S. G. Ruffcorn Estate, and operated by the administrators, with Chas. Tenber in charge. The old slope has been abandoned for hauling purposes, but is used as a man way. It is in bad condition. A six by eight-foot shaft has been sunk, through which the coal is hoisted a distance of 36 feet. A team of horses is used to pull the coal out by means of a tipple purchase block and cable, and it is dumped directly into wagons. The top of the shaft has not been covered and considerable trouble has been experienced on account of snow. The coal vein is six feet thick with a small vein of clay one and one-half feet from the top. From one to one and one-half feet of coal is left in the roof and the entry is not well timbered. The rooms are well propped with cedar posts with caps. Ventilation is secured through the old slope and air shaft. With the exception of the top of the shaft the mine was found to be in first-class condition. Inspected February 24, 1916.

18. Souther Coal Mine

This mine is located four miles southwest of Larson in a small coulee and is owned and operated by P. J. Souther. The coal is nine feet thick and is reached by a slope. The coal is hauled from the mine by a horse hitched to a long rope, and is dumped directly from the tipple into wagons. This is the second slope that has been driven. Little timbering has been done in the entries, but the rooms are timbered with posts. No definite system of mining is followed, and the ventilation is very poor. A small air shaft, four inches in diameter, was provided to furnish air for five men. Some water is encountered, which is drained by a ditch. Inspected February 24, 1916, and found fairly safe. Before further work is done adequate ventilation should be provided.

19. Vick Coal Mine

The Vick Coal Mine is a small surface mine operated by H. F. Vick and located six miles southwest of Columbus. The coal bed is from seven to eight feet in thickness and underlies four to ten feet of clay. Considerable water is encountered, which is removed by means of a gas engine driven centrifugal pump. When inspected, February 23. 1916, the mine was badly drifted with snow.

BURLEIGH COUNTY

20. Anderson Coal Mine

The Anderson Coal Mine is located 11 miles southeast of Wilton and is owned by V. L. Anderson. It was closed down in January for the winter. It had been operated as an underground mine, the coal bed being reached with a slope. The coal seam is seven feet thick and occurs at a depth of 40 feet. This mine was not in operation at the time of inspection in February, 1916. A report was obtained January 14, 1916.

21. Asplund Coal Mine

This mine is owned by William Asplund and leased to T. J. Asplund.

31. Wilton Coal Mine, Located at Wilton, Burleigh County. View of the Power House on a Frosty Day.

It is located four miles southeast of Wilton. The coal vein is 12 feet thick, with 70 feet over-burden of clay. From three to four feet is left for the roof and very little timbering is done except in the slope, which is well timbered. An air shaft is provided, but this is too close to the bottom of the slope to be of much use, as the air has no means of circulation through the mine. Coal is hauled from the mine by a team, with a long cable. Then it is dumped directly into wagons. The mine buildings consist of dwelling, bunk house and barn. Inspected February 7, 1916, and found fairly satisfactory except that the ventilation was poor.

22. Backman Coal Mine

The Backman Coal Mine is owned and operated by Emil Backman. It is located four miles southeast of Wilton near the Peterson Mine. The coal bed is from 10 to 12 feet thick and is reached with a slope. The old mine has been abandoned and a new slope driven near by. From two to three feet of coal is left for the roof and not much timbering is done except in the slope, which is well timbered. No water is encountered. An air shaft furnishes the ventilation. A four-H.P. I. H. C. gas engine with a homemade hoist is used to haul the coal from the mine. Conditions in and about the mine were satisfactory. Inspected February 7, 1916.

23. Lind Coal Mine

The Lind Coal Mine is located two and one-half miles southeast of Wilton. It is owned by Mrs. Anna C. Lind and was operated by O. E. Anstrom until February 23, 1916, after which J. Johnson leased the mine. The coal bed, which is from 10 to 11 feet thick, occurs at a depth of 40 feet, and is reached by a steep slope. Two feet of coal is left for the roof and not a great deal of timbering is done. Ventilation is secured by means of an air shaft and the mine is dry. The coal is hauled from the mine by a team, on a long cable. On February 7, 1916, conditions were satisfactory.

24. Peterson Coal Mine

The Peterson Coal Mine is located four miles southwest of Still and is owned and operated by C. J. Peterson. A local trade is supplied. The coal bed is from 9 to 13 feet thick and is reached by a steep slope, through which the coal is hauled to the surface by a team on the outside hitched to a long cable. Two feet of coal is left in the roof, and no timbering is done in the entries. The slope is well timbered. Some timbers with caps are placed in the rooms. Ventilation is secured by means of an air shaft. No means has been provided to circulate the air through the mine, other than the slope and a short part of the entry. The air was very poor where the miners were working. No definite system of mining is followed. Inspected February 7, 1916. Excepting lack of ventilation this mine was found to be in a satisfactory condition.

25. Wilton Coal Mine

The Wilton Coal Mine, the largest coal mine in the state, is owned and operated by the Washburn Lignite Coal Company. W. P. Macomber is manager and P. J. Cahill is superintendent.

The coal bed is from 10 to 15 feet thick and occurs at a depth of 65 feet. The panel system of mining is followed and the coal is hoisted to the surface with a steam hoist through a 14 by 7½-foot double compartment shaft, using the balanced system of hoisting.

An electric power plant is in use at the mine, which supplies the town of Wilton with electricity, and power at the mine for cutting machines, box-car loaders, haulage motors, light and so forth. Nine Jeffrey undercutters are in use and three Christy box-car loaders. Three electric motors are used in haulage and all important points in the mine are electric lighted. A motor repair pit is provided in the mine. Ventilation is secured by means of air shafts equipped with electric fans, and all doors and brattices are kept tight and in good condition. Some water is encountered in the mine, which is removed by one steam pump and three smaller electric pumps. Thirty per cent dynamite with electric detonators is used for blasting the coal, and no miner is allowed to connect wires until all is in readiness. Miners are required to keep at a safe distance. A man way is provided, and no one except the superintendent or pit bosses are allowed to enter the cages. Two wash rooms with shower baths are provided for employees. Other buildings consist of power house, blacksmith shop, office and store house, tipple, and so forth. The company is incorporated under the laws of Minnesota, with a capitalization of $500,000; $58,000 has been invested in surface equipment and $82,000 in underground equipment. The mine was found to be in very good condition on January 29, 1916.

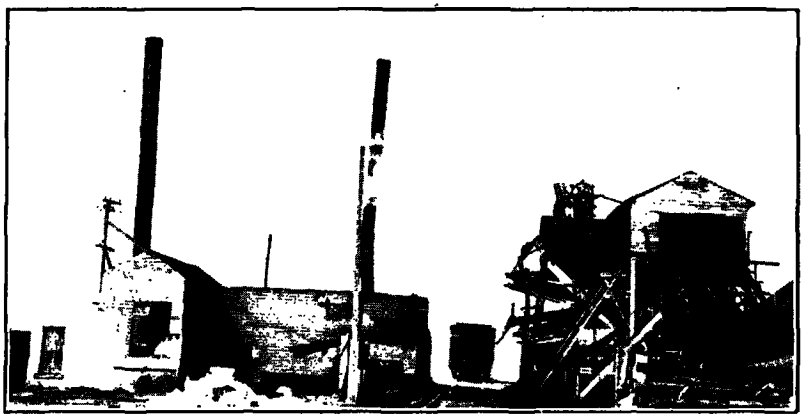
DIVIDE COUNTY

26. Dougherty Coal Mine

This mine is located just across the coulee from the Truax Mine. The coal bed is seven feet thick and is reached by means of a double-tracked slope. A traction engine is used to haul the coal from the mine, an endless chain being used. The mine is owned and operated by Chas. Dougherty of Minot, with W. A. Anderson in active charge of the mine. Previous to this year no definite system of mining has been followed. However, a double track is being installed for about 700 feet from the slope, and from this point the double entry system will be used. An air shaft is provided, which supplies ample ventilation. Very little timbering is done in the entries except where double track exists, where a row of props is placed between the tracks. Two rows of props with caps are used in the rooms. No water is encountered in this mine. The tipple provides a chute with 1¼-inch screen over which the coal is dumped into wagons. On February 25, 1916, the mine was found in a satisfactory condition.

27. Haught Coal Mine

This mine is owned and operated by J. E. Haught. The coal bed is from six to seven feet thick and reached by a slope. Horses are used to haul the coal from the mine. Ventilation is secured by means of an air shaft, and when the mine was inspected a strong wind was



Truax Coal Mine, Tipple and Power Plant Shown. Mine Located Near Noonan, Divide County.

blowing, which caused a considerable current of air in the mine. However, the canvas doors were not tight enough to carry good air to the working faces. Timbering is confined mostly to the slope and rooms. No water occurs in the mine. If tight canvas curtains were used in the air ways the conditions in this mine would be very satisfactory. Inspected February 25, 1916.

28. Noonan Coal Mine

This mine is owned and operated by John Lobeski and is located one mile east of Noonan. It was found practically worked out and the owner expects to sink another slope just across the coulee from the present one, during the summer of 1916. The present slope is very steep and the coal is hauled from the mine by a gas engine and a homemade hoisting apparatus with a cable. Timbering is chiefly confined to the rooms. Ventilation is secured by means of an air shaft which is properly placed for good circulation through the present works. Some parts of the present entry are in need of timbering. Inspected February 25, 1916.

29. Truax Coal Mine

The Truax Coal Mine is owned and operated by E. M. Truax and A. H. Truax as superintendent with A. M. Legelon as pit boss. It is located about one mile southeast of Noonan and is connected to the Great Northern Railroad by a spur built by Mr. Truax at a cost of about $13,000. The coal vein is from six to seven feet in thickness and is reached by a double track slope. No timbering is done in the entries; a double row of props with caps are placed in the rooms. A 100-H.P. electric plant has been installed at the mine to furnish power for hauling of the coal from the mine, driving the fan, undercutter and shaker screen. An eight-foot force fan driven by a 15-H.P. motor is used to ventilate the mine. A Jeffrey undercutter and an Ottumwa box-car loader are used. The coal passes over a homemade shaker screen, with three sizes of screens, before going into the box-car loader. Water for the boilers is pumped from a 210-foot well by means of a compressed air jet. The cars have a derailing attachment on them calculated to derail them in case the hoisting apparatus should fail. Mr. Truax intends moving his plant during the summer of 1916 to a shaft about 1/4 miles farther south so as to lessen the underground haul. The mine was found in a very satisfactory condition on February 25, 1916.

DUNN COUNTY

30. Bang Coal Mine

This mine is owned by John Bang and is located one-half mile south of Dunn Center in a shallow ravine. The coal vein is over 14 feet thick. It is apparently in the same vein as the High Grade Mine, about three miles down the creek, which is in coal 20 feet thick. This mine was formerly operated as a strip mine, but when visited, February 1, 1916, an entry or room was being driven. Considerable water is encountered which is removed with a centrifugal pump driven by a 2½-H.P. gasoline

engine. The coal is not mined to the bottom on account of this water. Wagons are backed to the entry of the mine and the coal is shoveled into them. The owner plans on driving a slope entry and building a loading dump for screening and loading the coal. Only a small local trade is supplied. This mine was not in good condition on February 1, 1916, as considerable water had accumulated in the entry.

31. Heiser Coal Mine

This mine is owned by the Northwest Abstract Company of Manning and leased by J. O'Grady and L. P. Allen. It is located two miles south of Manning in a small ravine and is worked as a strip mine. The coal is six feet thick and 10 feet of clay has to be removed. Some water is encountered, which drains out of the pit through a ditch. The operators haul all coal mined to the town of Manning and none is sold at the mine. All stripping is done during the summer months. Considerable snow drifts into the mine during stormy weather.

32. High Grade Coal Mine

This mine is owned by A. H. Pelton, formerly connected with the Lehigh Coal Mine, and O. R. Chamberlain. A shaft eight by twelve feet has been sunk and the entry way only well started. The shaft is well-timbered and a wooden head frame constructed with two compartments for cages. Two cages are used, being raised and lowered with a cable hauled by a horse. No tipple has been constructed, the coal being dumped on the ground and forked into wagons. The frame is constructed so that a tipple can be built to load directly into box-cars. The shaft is within a few hundred feet distance from the Northern Pacific Railroad. Considerable water is encountered, the mine being drained by a centrifugal pump driven by a 6-H.P. gasoline engine. The coal bed is 20 feet thick and as 12 feet is left for the roof, no timbering has been done. The shaft and apparatus were found to be in first-class condition on February 1, 1916.

33. Paulson Coal Mine

This mine is owned by Paul Paulson. It is located three and one-fourth miles southwest of Werner and on the bank of Spring Creek. The coal is 16 to 18 feet thick and reached by a drift driven into the bank a few feet above the water level of the creek. From seven to eight feet of coal is left for the roof. No timbering is done in the entry, which is driven about 10 feet wide at the bottom and arched at the top. A few six by six-inch timbers are placed where necessary in the rooms. The coal is hauled to the surface in sledges with a horse, and shoveled into wagons. No definite system of ventilation is used; air is supplied to the workings through two old entries that open into the present workings. No water is encountered and the mine is situated so that a spur could be built from the Northern Pacific Railroad with little expense. The mine was in satisfactory condition February 1, 1916.

GOLDEN VALLEY COUNTY

34. Corliss Coal Mine

This mine is owned and operated by I. J. Corliss and is situated on the side of a butte near Sentinel Butte, nine miles south of the town of Sentinel Butte. Heretofore this mine has been operated as a strip pit and a considerable amount of clay had to be removed before the coal was exposed. Now a drift is being driven into the coal, which is 20 feet thick. This work was only started a few days before the mine was inspected, December 16, 1915, and little progress had been made.

35. Kussick Coal Mine

The Kussick Coal Mine is leased from the Hunter Land Company by Mr. Kussick. It is situated upon the south side of Sentinel Butte in a bed of coal 28 feet thick. No definite method or system of mining is used. Two drifts are driven into the bed to afford ventilation. At the time of inspection, December 17, 1915, the entry was driven in 100 feet deep. Teams with wagons are driven to the face, where the coal is mined. No timbering is used because of the thickness of coal left for the roof, which is of a stable character. No water is encountered in this mine, although there is a fine spring just below the mine.

Inspected December 17, 1915, and found to be in a satisfactory condition.

36. Madland Coal Mine

This mine is situated four miles south of the town of Sentinel Butte and is located upon the south side of Sentinel Butte. Rooms are driven into the coal bed, which is well exposed, and at the time of inspection, December 16, 1915, were in 40 feet. The vein is 30 feet thick and no timbering is done. Conditions were found fairly satisfactory, though no definite system of mining was followed.

37. Porter Coal Mine

This coal mine is located nine miles southwest of the town of Sentinel Butte, and is on the side of a sloping hill. For some time the cave has been mined by stripping, but due to the increasing depth of clay to be removed before the coal was exposed, this method has been abandoned. A drift is driven into the coal, which is 30 feet in thickness, the top six or seven feet being of poor quality. At the time of inspection, December 16, 1915, the mine was found to be in very good condition.

38. Sentinel Butte Coal Mine

This mine is situated three miles south of the town of Sentinel Butte. It is high up on the east side of Sentinel Butte in a 30-foot vein of coal. Ten feet of coal is left on the top and 10 feet at the bottom and no timbering is required. Teams and wagons drive into the mine and load at the face. Rooms are worked off the one entry, with room necks and break-throughs large enough to allow teams and wagons to pass through. There was no provision for ventilation. Inspected December 16, 1915, and found to be in a satisfactory condition.

HETTINGER COUNTY

39. Arnold Coal Mine

The Arnold Coal Mine is owned by Chas. T. Arnold and is leased and operated by John Weinandy. It is located six miles northwest of Regent by Coalbank Creek. It is operated as an underground mine. The coal is 10 feet thick with 40 feet of clay above. One foot of coal is left for the roof and considerable timbering is done in the entry and rooms. The mine is entered by a drift and the coal is hauled to the dump by a horse, where it is loaded into wagons. A 50-ton storage bin has been recently built. Local trade only is supplied. The mine was found in good condition January 14, 1916.

40. Havelock Coal Mine

Mrs. E. W. Adams of Northfield, Minnesota, owns this mine and it is leased and operated by Jack Strosser. It is situated one mile northeast of Havelock, operated as a drift mine, and the coal bed is 11 feet thick. The old mine, which was formerly worked by Mr. Adams, has been abandoned and a new drift driven which at the time of inspection was 40 feet in length. It is timbered where necessary. Considerable coal is shipped at the present time. Inspected January 14, 1916. The mine was found to be in fair condition.

41. Merry Coal Mine

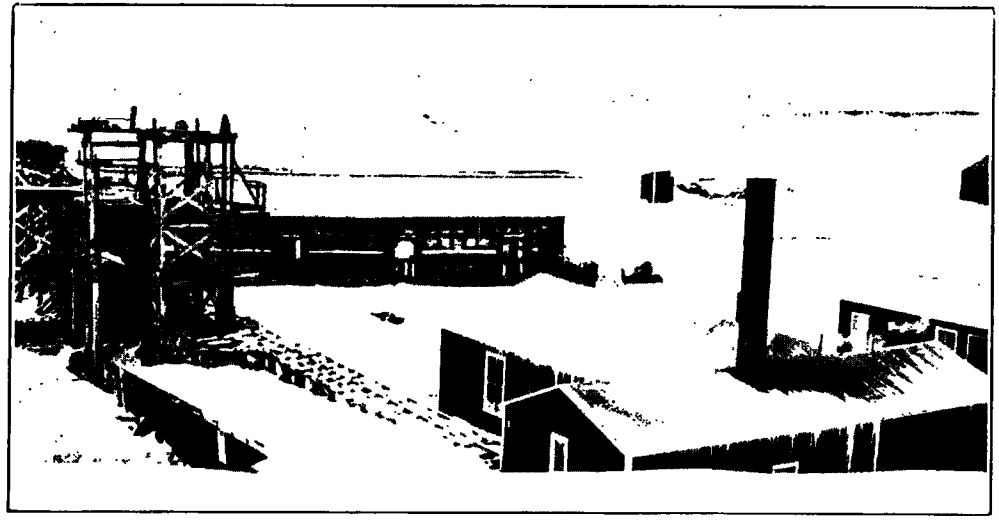
The Merry Coal Mine is owned and operated by Chas. Merry. It is located 12 miles southeast of Mott. The coal bed is 10 feet thick and is operated as a surface mine. In the winter months one foot of coal is left in the bottom because of water. This layer of coal is worked during the summer months. The mine is drained by a ditch and from 10 to 20 feet of clay has to be removed before the coal is exposed. Only local trade is supplied. Inspected January 13, 1916, and conditions about the mine were found to be very satisfactory.

42. Nelson Coal Mine

This coal mine is located five miles southwest of Regent in a gumbo flat. It is operated as a surface mine and five feet of gumbo clay has to be removed before the coal is exposed. The coal bed is six feet thick, the top being mostly slack. Some water is pumped from the mine by means of a small gas engine and tank pump. The mine is owned by the W. H. Brown Land Company of Chicago, and leased by Mons Nelson. Only local trade is supplied. Inspected January 14, 1916. Conditions were found to be satisfactory.

43. Square Deal Coal Mine

This is a surface mine, owned and operated by Crary Brothers. It is located two and one-half miles south of Bentley. The coal bed is 5½ feet thick and from three to eight feet of clay has to be removed before the coal is exposed. During 1914 and to about September, 1915, the mine was leased and not a great deal of coal was removed. In the fall of 1915 Crary Brothers began operating the mine and as the coal was too thin to warrant working underground, they will abandon the



Bitumina Coal Mine Northwest of Washburn, McLean County.

mine until summer. Crary Brothers are planning on more extensive operations in the fall of 1916. At present considerable coal is being shipped. Inspected January 13, 1916, and found almost worked out.

McLEAN COUNTY.

44. Bitumina Coal Mine

The Bitumina Coal Mine is located three miles west of Bitumina. It is owned by John Satterlund of Washburn and operated by Ed Kugler. The coal bed, which is 9½ to 11 feet thick, is entered by a drift. The coal is hauled to the mouth of the drift, where it is hoisted to the tipple by a steam hoist. The tipple is provided with scales and two chutes of 10 tons capacity each. Here the coal is loaded into wagons. A storage bin is also provided, having a capacity of from 350 to 400 tons. This is the only mine in the state using compressed air machinery, a Norwalk compressor and a Goodman air breast under-cutting machine being in use. Ventilation is obtained by means of two air shafts. These, however, were closed when the mine was visited, February 8, 1916, and air was obtained from the compressed air pipes leading into the rooms. Considerable water is encountered in the mine; about 4,000 gallons are pumped daily. Steam pumps are used. Three and one-half feet of coal is left for the roof and no timbering is done in the entries and very little in the rooms. The mine buildings consist of power house, boarding house, two dwellings, barn, blacksmith shop, bunk house, tipple and coal shed. When visited, February 8, 1916, conditions in and about the mine were very satisfactory.

45. Borchardt Coal Mine

This mine is located three miles south of Underwood and is owned and operated by E. G. Borchardt. The coal bed is 12 feet thick with a clay parting from seven inches to one foot thick, five feet from the bottom. It occurs at a depth of 38 feet, and is reached by a shaft. The owner has made the shaft a double compartment part of the way down from the top and has started lining it with concrete and is putting in a very substantial iron rung ladder. The ladder below this was flimsy and dangerous. A whim is used to elevate the coal from the mine. Ventilation is secured by means of two air shafts and the mine is dry. On February 9, 1916, conditions were fairly satisfactory.

46. Fredrich Coal Mine

The Fredrich coal mine is owned and operated by Wm. Fredrich and is located nine miles east of Underwood. The coal bed is six feet thick at the present place of mining, and no coal is left for the roof. A 60-foot shaft leads to the coal, the top of which is badly caved, as no lagging has been put in. The timbers were at the mine ready to be used. The coal is hauled to the surface by means of a horse whim. Ventilation is secured by means of an air shaft. No water is encountered in the mine. Conditions in the mine were satisfactory February 9, 1916.

47. Hanson Coal Mine

This mine is owned by Peter Hanson and operated by Fred Wagner. It is located on the west bank of a deep coulee, four and one-half miles east of Underwood. The coal bed is from 9 to 11 feet thick and the entry is driven directly into the bed from the bank. Ventilation is secured by means of two air shafts. No water is encountered in the mine. When the mine was inspected the miners were engaged in robbing pillars along a side entry. It is expected that this mine will be abandoned and a new drift driven during the coming summer. Inspected February 9, 1916. Conditions in and about the mine were found to be satisfactory.

48. Johnson Coal Mine

S. A. Johnson owns and operates this mine, which is situated seven miles east of Garrison. The coal bed is reached through a steep slope and is from six to eight feet thick with another vein three feet thick above and separated by four feet of clay. Very little timbering is done in the entries; the rooms are well timbered with cedar and cottonwood posts. A windmill and gasoline engine are used to drain the mine. The coal is hauled from the mine by a team, and is dumped directly into wagons, no storage room being provided. Local trade only is supplied. The mine was found to be in good condition when inspected, February 10, 1916.

49. Kunkel Coal Mine

This mine is owned by J. A. Kunkel and was leased by Al Glover, William Hyser becoming a partner January 24, 1916. The mine is located one and one-fourth miles southwest of Garrison. The coal bed is from six to seven feet thick and is reached through a slope. A double entry system of mining is used. Very little timber is needed in the entries, while a row of cedar props are used in the rooms, which are 16 feet wide. From one-half to one foot of coal is left for the roof. Air is provided by an air shaft and the circulation through the mine is good. Scales are in use and the mine cars are weighed before being dumped. The mine buildings consist of boarding house, powder house, barn and scale room. Only local trade is supplied. The mine was in good condition February 11, 1916.

50. Rupp Coal Mine

The Rupp Mine is located about three miles southwest of Garrison in a small coulee. It is owned by Frank Seibel and leased by E. R. Rupp. The coal bed is six and one-half feet thick and an overburden of eight feet of clay has to be removed before the coal is exposed. Some water is encountered, which is not drained out of the pit. Two men are employed the year around. Stripping is done during the summer months with teams and scrapers. Local trade only is supplied. Inspected February 11, 1916, and found to be in fair condition.

51. Ulrich Coal Mine

The Ulrich Coal Mine was formerly owned by A. G. Anderson, and is now owned by the U. S. Government and is leased by John Ulrich,

Geo. Touser and Chas. Kingsley, under the name of the Ulrich Coal Co. The coal is from five to six feet in thickness and is reached by a steep slope. The coal is hauled to the surface by a team of horses, hitched to a long cable. The mine is drained by means of a lift pump driven by a five horse power gas engine. The double entry system of mining is followed. The mine is well ventilated by means of two air shafts. At the surface each shaft is equipped with four doors: the taller shaft has one door open to the wind and the shorter shaft has one door open on the leeward side, which allows the warm air to escape. On February 10, 1916, the mine was found to be in very satisfactory condition.

52. Youngquist Coal Mine

The Youngquist Coal Mine is located in a deep coulee seven miles northwest of Washburn. It is owned by Ed Youngquist and leased and operated by Fred Phister. The coal vein is eight feet thick and is worked through a drift which is 200 feet long. The only room being worked was a continuation of the entry. A gas engine driven rotary pump was used to drain the mine. No means of ventilation was provided. Inspected Februray 8, 1916. More timber should be used to hold the roof in this mine.

MERCER COUNTY.

53. Black Diamond Coal Mine

This mine is located on the edge of Beulah. It is owned by Carl Semmler of Stanton.. Charles Westmark is the superintendent. The coal vein, 11 feet thick, is reached by a six by ten foot, two compartment shaft 46 feet in depth. The shaft was sunk and the tipple built during the fall and winter and entry driving was begun about the middle of January, 1916. When visited, February third, the entry had been advanced 125 feet and two rooms were started. A 600-gallon force pump attached to a three-horsepower I. H. C. gas engine was placed along near the bottom of the shaft to remove the water from the mine. An eight-horsepower Olds gas engine is used to hoist the coal in 600-pound buckets. Cages have been built, but the engine and cable are not strong enough to lift them, together with a carload of coal. No man ways as yet are provided and the men are lowered into the mine in the buckets. Inspected February 3, 1916. Man ways should be provided and a larger cable drum installed.

54. Keeley Coal Mine

This mine is operated in a vein of coal five feet thick. It is one and one-half miles north of Hazen. It is owned by Ed Oster and leased to John Keeley. Due to the thinness of the coal vein little or no coal is left in the roof, and the clay overburden is held from caving with much difficulty, a great deal of timbering having to be done. The mine is entered through a drift. Only local trade is supplied. Inspected February 5, 1916, and conditions were found to be fair.

55. Krem Coal Mine

The Krem Coal Mine is owned by Fred Malke, while the machinery

is owned by the Krem Roller Mill. The mine is leased by Philip Sayler. It is located three and one-half miles southwest of Krem, an inland town. The coal bed, 10 feet in thickness, is reached by a 46-foot single compartment. The coal is hoisted by an eight-horsepower Olds gasoline engine operating a gear-driven drum, a one-inch steel cable being used. An air shaft with fan supplies air for the mine. The water is removed by a lift pump driven by the hoisting engine. The coal is used in supplying the power plant of the Krem Roller Mills, and local trade. The mine was found to be in fair condition, although it is recommended that more timbers be used in the rooms. Inspected February 4, 1916.

56. Reichenberg Coal Mine

This mine is located alongside the Keeley Mine on land belonging to Jack Reichenberg. It is leased and operated by Tony Gawlona and has been in operation but a short time. The vein of coal is from four and one-half to five feet thick and little timbering has been done. Much more timbering should be done, as no coal is left in the roof and the overlying clay is very unstable. Wagons are loaded direct from the dump. Inspected February 5, 1916.

57. Schmidt Coal Mine

The Schmidt Coal Mine is owned and operated by Geo. G. Schmidt of Beulah. It is located in a small ravine seven and one-half miles northwest of Beulah. The coal bed, which is 23 feet thick, is reached by a slope and the coal is hauled up the incline by means of a whim, an inch and a half manila rope being used. No timbering is done except in the slope and about 15 feet of coal is removed. A two-inch vein of coal dust extends through the coal bed near the middle. This dust layer is used as a parting for the roof. When the rooms have been driven full length the roof coal is shot down and the remaining coal in the floor of the room is recovered. In this way a large portion of the thick vein is secured. Some water is encountered, which is removed by means of a lift pump and wind mill. Only local trade is supplied. This mine was not inspected. Reported February 3, 1916.

58. Standard Coal Mine

The Standard Coal Mine is owned and operated by George G. Schmidt. It is located at Beulah and supplies mostly a local trade, only a small amount being shipped. The coal bed is 12 feet thick and is reached by a steep slope through which the coal is hauled to the surface by means of a horse-propelled whim. On February 3, 1916, when this mine was visited, no means of ventilation was provided and only the top five and one-half feet of coal was being recovered, the coal being mined to the roof clay, which is very difficult to hold. As soon as a pump can be installed the bottom coal can be taken out and some coal left for a roof. The conditions in this mine were very bad, no air being provided and not enough timbering being done to make it reasonably safe.

MORTON COUNTY.

59. Black Diamond Coal Mine

This mine is owned by Mamie M. Dunn of Leith and leased and operated by J. W. Zimmerman. It is located two and one-half miles southwest of Leith. The coal bed is eight feet thick. A six-horsepower gas engine is used to hoist the coal up a 41-foot shaft. A 1,500-pound car can be elevated. A tipple is arranged to dump directly into wagons through a chute over a one-inch screen. Another dump is provided for waste slack. A storage bin of 25 tons capacity is also provided alongside the tipple. A stairway is built in a separate compartment of the shaft. Some water is encountered, which is pumped out by a three-horse-power gas engine and force pump, placed in the mine. The double entry system is used. Cars underground are handled by a mule, which is kept in the mine. With the exception of one room, which was found to be too wide, the mine was in good condition when inspected, January 16, 1916.

60. Coffin Butte Coal Mine

This mine is situated 18 miles south and west of Elgin, near the north base of Coffin Butte. This coal is obtained by stripping from 10 to 15 feet of clay overlying the 10-foot bed of coal. This mine supplied a very large local trade. The farmers come from all directions to obtain fuel from this mine, as no other mine is operated in this locality. Some water is encountered and is removed by pumping. The dangerous practice so often found in strip pit work, of undermining the frozen overburden, was exemplified here, about four feet of coal being taken from under a high bank in one place, leaving no support for the overhanging clay. Inspected January 12, 1916.

61. Coopenhaver Coal Mine

This strip pit is two and one-half miles southeast of Flasher. The coal is four and one-half feet thick and has a parting of clay one foot thick near the middle. An average of 12½ feet of clay overlies the coal bed. The mine was formerly operated by Mr. Coopenhaver, the coal being stripped during the summer months by team and scraper. No coal was mined in 1915 as no stripping was done the fall before. In the spring of 1915 a company was incorporated under the laws of North Dakota, with a capitalization of $25,000, and known as the Coopenhaver Mining Company. During the summer of 1916 the company plan on using a drag line excavator for stripping the coal and working the mine more extensively than it has been worked heretofore. There is a large local demand for coal in this vicinity and the mine is near enough to town so that coal can be shipped. Inspected January 17, 1916.

62. Garfield Coal Mine

The Garfield Coal Mine is a strip pit located seven miles northwest of New Salem. It is owned by Carl Leuder. Local trade is supplied. The coal bed is six feet thick, overlaid by from six to 12 feet of clay. Water is encountered, which is removed by a gas engine driven augur lift pump. On January 27, 1916, the mine was not in operation, as all the stripped coal had been mined.

63. Hebron Fire and Pressed Brick Company Coal Mine

This mine is located five miles north of Hebron and is connected to the brick plant at Hebron by a narrow gauge track, where all the output is consumed. The coal seam is eight feet thick and is reached through a drift. The coal is hauled to the dump by horses and loaded directly into cars on the narrow gauge road. No screens are used, as the slack is used in the plant with the rest of the coal. A double entry room and pillar system is followed and ventilation is secured by means of an air shaft and furnace. A gas engine driven fan is also provided in the air course which is used to increase the circulation of air when necessary. One foot of coal is left for the roof and one foot on the floor. Some timbering is done in the entries and the rooms are well timbered. On January 24, 1915, the mine was found in a very satisfactory condition.

64. Knutson Coal Mine

This is a small strip mine owned by John Knutson and located four and one-half miles west of Almont. The coal vein is from seven and one-half to eight feet thick and considerable clay has to be removed before the coal is exposed. Some water collects in the mine, which is ditched off. On January 26, 1916, some coal was being dug by under-mining, as no coal had been stripped.

65. Lindstrom Coal Mine

This mine is located in a deep ravine six miles southeast of Glen Ullin and is entered by a drift. The mine is owned by Mrs. Lindstrom and leased by Mr. Brown, who is in active charge. During the summer of 1915 a new drift was driven and two dumps built, where the coal is dumped directly into wagons. The chutes will hold about five tons each. No screens are used, the coal being forked into the mine cars. The coal bed is nine feet thick and very little timbering is required. One foot of coal is left for the roof. The mine is drained by a ditch and the water is fit for steam purposes. Ventilation is secured by means of a break through into the workings of the old mine, which affords plenty of circulation. When inspected, January 25, 1916, the mine was found to be in satisfactory condition. Only local trade is supplied, most of the coal being hauled to town.

66. New Salem Coal Mine

This mine is located three-fourths of a mile east of New Salem on a spur of the Northern Pacific Railroad. It is owned by R. W. Webb and Company of Minneapolis and leased by M. Tousend. The coal vein is from five and one-half to six feet thick and occurs at a depth of 50 feet. The company owns its own electric power plant, which is located near the tipple. Two Morgan and Gardner undercutters are used. A steam hoist delivers the coal up a slope to the tipple. Mules are used underground for haulage. Ventilation is secured by means of an air shaft, and an electric fan is provided which is used when necessary. The mine is dry. It is thought that the mine will be abandoned the coming season. On January 27, 1916, the last rooms were being driven and the miners had begun pulling pillars and stumps, which work would be con-

tinued through the winter months. The company contemplates mining a vein of coal 200 feet below the present one. The mine buildings consist of office and scale room, power plant, blacksmith shop, boarding house, powder magazine and tipple. A. J. Gray is general manager of the mine. On January 27, 1916, the conditions were found to be very satisfactory.

67. North Star Coal Mine

The North Star Coal Mine is located five miles north of Hebron. It supplies a local trade. It is owned by Murray and Haven and leased and operated by Ignat Ostendorf. The coal bed is eight feet thick and is reached by a steep slope. The coal is hauled in the mine to the surface by a horse. The tipple is provided with two dumps of two and five tons capacity where the coal is loaded into wagons. Ventilation is secured by means of an air shaft, and on January 24, 1916, it was very poor as no break throughs were driven between the rooms, some of which were 270 feet long. No water is encountered in the mine. One foot of coal is left for the roof and very little timbering is done in the entry. Two rows of props with caps are placed in the rooms. Inspected January 24, 1916. More adequate means of ventilation should be provided.

68. Ormiston Coal Mine

This mine, owned and operated by George Ormiston, is situated 12 miles southwest of Judson. The coal vein is seven feet thick and entered by a drift in the side of a small hill. The mine was formerly located on the opposite side of a spring, but due to a cave-in and trouble in draining the mine, these workings were abandoned and the present drift started. The coal is pushed from the mine by hand in cars and shoveled into wagons. When inspected, January 26, 1916, the entry was driven 100 feet and two rooms were being worked. No artificial means of ventilation were provided. The condition of the mine otherwise was satisfactory.

69. Pleasant Ridge Coal Mine

This mine is located one mile north of Glen Ullin. It is owned by A. L. Tavis of Glen Ullin and was opened in 1914. The coal bed is six feet thick and is reached by a slope opening. The coal is hauled to the surface by means of a windlass and horse. At present the mine is leased and run by Louie Kwako and supplies only a local demand. Two cars only have been shipped. When inspected, January 25, 1916, the ventilation was found to be very good, but some of the rooms were too wide and insufficiently timbered.

70 Ramsland Coal Mine

The Ramsland Coal Mine is a strip pit located six miles west of Almont. It is owned by George Reichel. The coal is from four to four and one-half feet thick and 14 feet of clay has to be scraped off. A ditch is used to drain the water from the mine. Inspected January 26, 1916.

MOUNTRAIL COUNTY.

71. Algers Coal Mine

The Algers Coal Mine, owned by Fred Algers and located seven miles southwest of Stanley, has been abandoned and was not in operation when inspected. It was formerly operated as a strip pit supplying a local trade.

72. Barto Coal Mine

This mine supplies only a local trade. It is situated on the west bank of White Earth Creek, three miles south of White Earth. It is in a three foot vein of coal. Joseph Barto owns and operates the mine. The present mine is practically worked out and a new entry is being driven a short distance south of the present one. No means of ventilation are provided. Considerable timbering is done in the entry and rooms and the part being worked was in a safe condition. Inspected March 12, 1916.

73. Blake Coal Mine

The Blake Mine was formerly operated on land belonging to Fred Alger, as a strip pit. The strip mine has been abandoned and underground work begun on land belonging to F. E. Blake. The coal bed is four feet thick with an eight inch parting of clay 10 inches from the top. The entry had been driven 60 feet when inspected, March 13, 1916, and one room was being driven. Some water is encountered, which is ditched off. No means of ventilation is as yet provided.

74. Bowman Coal Mine

Charles H. Bowman of Madrid, Iowa, owns this land and leases it to Joe Landaker. Isaac Allison is at present operating it. The coal bed is seven feet thick and is reached by a shaft. This shaft should be retimbered. The coal is hoisted from the mine by horse power and dumped onto a platform, where it is shoveled into wagons. Ventilation is secured by means of an air shaft. One and one-half feet of coal is left for the roof and very little timbering is done. One row of props with caps are placed in the rooms. Some water is encountered, which is removed in a tank. Inspected March 14, 1916, and with the exception of the timbering in the shaft was found to be in good condition.

75. Frazer Coal Mine

Wm. M. Frazer operates this mine. It was opened in October, 1915 and supplies a local trade. The entry has been driven 60 feet and the rooms turned off from it. The vein is four and one-half feet thick and all the coal is mined. Considerable timbering has been done and the mine is kept in good condition. Some water is encountered, which is ditched off. Inspected March 14, 1916.

76. Hefte Coal Mine

The Hefte Coal Mine is owned by Ole Hefte and located on the east bank of the White Earth Creek, four miles north of White Earth. During the summer of 1915, 600 tons of coal was uncovered to within three feet of the coal, but because of the great amount of water collecting in the mine very little of this coal could be mined during the fall and winter of

1915-16. The coal bed is five feet thick. During the coming season Mr. Hefte plans on properly draining the mine, which can be done by ditching. When inspected, March 11, 1916, the mine was drifted full of snow.

77. Hoppe Coal Mine

This is a strip mine owned by Henry Hoppe of Gaylord, Minnesota, and leased and operated by Herman Moerke. The coal bed is from three to five feet thick and from four to five feet of clay has to be removed before the coal is exposed. The mine had to be abandoned during the winter of 1915-1916 on account of water which could be removed only with great difficulty. Inspected March 15, 1916.

78. Kale Coal Mine

The Kale Coal Mine is owned by F. L. Alger and leased and operated by H. Hale. It is located about seven miles southeast of Stanley in a deep coulee, and is generally operated as a strip pit, although during the winter months some under-ground mining is done. No definite system of work is followed. The coal bed is five feet thick with an eight inch parting of clay eight inches from the top. Only a local trade is supplied. Inspected March 13, 1916, and found to be in fair condition.

79. North Star Coal Mine

This mine is owned by Herman Moerke. It is located 11 miles north of Van Hook. The coal vein is seven feet thick and the coal is mined by stripping. Water is encountered which is ditched off. The mine had to be abandoned early in the winter, due to the freezing up of the ditch. Inspected March 15, 1916.

80. Porger Coal Mine

This mine is run as a side issue to farming. It is owned by George Porger, who does some mining during the winter months. Very little coal has been taken out this season. Practically all the work has been confined to driving a new entry, as the old mine has been abandoned. The coal vein is five feet thick and the mine is situated one-half mile below the Barto Coal Mine. It is three and one-half miles south of White Earth. Inspected March 13, 1916.

81. Rodgers Coal Mine

The Rodgers Coal Mine is a strip pit owned by G. S. Rodgers. The coal vein is seven feet thick and 10 feet of clay has to be removed before the coal is exposed. Some water is encountered, which is ditched off. During 1914 an under-ground mine was operated just across the coulee from the present mine, but this was abandoned on account of water. Inspected March 14, 1916. In this mine, as in many of the strip mines, the dangerous practice of undermining the clay bank was found.

82. Roseno Coal Mine

The Roseno Coal Mine is owned by Albert Roseno, who leases it to Herman Moerke. The coal bed is seven feet thick and from five to 15 feet of dirt is removed to expose the coal. Water is ditched from the pit. Inspected March 15, 1916.

83. Sellar Coal Mine

This mine is owned and operated by W. L. Sellar. The coal bed is four feet thick and is worked from an entry driven from an old strip pit. On March 14, 1916, no one was found at the mine and the entry was about half full of water which had seeped in from melting snow on the surface.

84. Stacy Coal Mine.

This is a small strip mine owned by the State Bank of Crary. During the season of 1915 very little coal was taken out. The coal bed is three feet thick and too much clay has to be removed to warrant its being run on a commercial scale.

85. Sunday Coal Mine

This mine was owned by Albert Roseno and operated by Herman Moerke until the spring of 1914, when it was abandoned. Under-ground mining was done until the mine was abandoned, when a new strip mine was opened about a half mile north, known as the Roseno Mine.

86. Williams Coal Mine

The Williams Coal Mine is a strip pit owned by B. D. Williams. The coal bed is eight feet thick and considerable clay has to be removed before the coal is exposed. Some water is encountered, which is drained off by means of a ditch. The mine is located seven miles south of White Earth and supplies only a local trade.

OLIVER COUNTY.

87. Flint Coal Mine

The Flint Coal Mine is a small strip mine owned and operated by Mrs. Henregetta Flint. It is located near Hannover and supplies only a local trade. The coal vein is three feet thick and the mine is drained by means of a ditch. Reported January 17, 1916.

88. Meyhoff Coal Mine.

The Meyhoff Coal Mine is a small surface mine located near Center, which supplies a small local trade. It is owned by Dick Meyhoff. The coal vein is 10 feet thick and covered with a considerable amount of clay. Reported January, 1916.

89. Pleasant Valley Coal Mine

The Pleasant Valley Coal Mine is located two and one-half miles west of Center. It is a surface mine, the coal occurring in two seams. The top seam is about six feet thick and the bottom seam 10 feet thick. They are separated by a layer of clay three feet thick. About six feet of over-burden has to be removed before the coal is exposed. Some water is encountered, which is removed by a ditch. The mine was not inspected and it is one of the very few that did not return a report for the year 1915.

90. Spring Valley Coal Mine

This mine is located about six miles southeast of Center. It supplies quite a large local trade. The coal vein is nine feet thick and is mined

by stripping, eight feet of clay having to be removed. Reported February 1, 1916.

91. Tripp Coal Mine

The Tripp Coal Mine is owned by M. N. Tripp and located five miles southeast of Center. The coal vein is seven feet thick and is exposed by stripping. This mine was not inspected and no report was received for the year 1915.

92. Tehelka Coal Mine

The Tehelka Coal Mine is owned by P. P. Tehelka and is located three and one-half miles north of Carpio. The coal is about 30 inches thick and is reached by a short slope, through which the coal is hauled to the surface by a horse. Very little timbering is done in the entries. The slope is well timbered. More timbers should be used, as no roof coal is left in the entries. No means of ventilation were provided. The inspector was assured that a new slope would be driven during the summer months, as the roof is in bad condition. Inspected February 19, 1916.

93. Wooster Coal Mine

This mine is situated just across the Des Lacs Valley from the Tehelka Mine and is owned by Bert Wooster. The coal bed is three feet thick, into which a drift has been driven from the face of the bluff. On March 19, 1916, this mine was found abandoned and in very poor condition. If it is to be further used considerable timbering will have to be done in the entry, as a large amount of the roof has caved.

STARK COUNTY.

94. Bunker Hill Coal Mine

This is a small mine owned by Benjamin Webb and located in a deep coulee one mile northeast of Richardton. At present John Gavin has it leased and is doing a small amount of work under-ground. This is not being done in a permanent manner. The coal bed is six and one-half feet thick and outcrops on the side of the coulee. The coal is hauled from the mine by a horse and dumped directly into wagons. Inspected January 23, 1916, and found to be in bad condition.

95. Gross Coal Mine

The Gross Coal Mine, situated three miles northeast of Belfield, was formerly owned by Paul Gross, but is now owned by Carl Podolanchuk, who operates it. The coal bed is from six to eight feet thick and is entered by a slope. No definite system of mining is followed and only a small local trade is supplied. No water is encountered and an air shaft provides ventilation. Coal is hauled to the tipple by a horse, where it passes over a screen into wagons. On January 21, 1916, conditions were fairly satisfactory.

96. Lehigh Coal Mine

The Lehigh Coal Mine is located on a spur of the Northern Pacific at

Lehigh. It is owned by the Consolidated Coal Company of Dickinson and is operated by James Brody and A. P. Peake. J. H. Schistok acts as superintendent. The coal vein is nine feet thick and is reached by a slope. The slope and entries are driven wider than is necessary and parts of the roof have caved a great deal. Haulage in the mine and to the tipple is done by mules. The tipple is equipped with two chutes with screens where the coal is dumped directly into wagons or into box cars, where a Christy box car loader is used. Two Jeffrey electric undercutters are operated. Ventilation is secured by means of two air shafts. An electric fan was formerly used but has now been discarded; air was good except in the main entry, which had been driven about 400 feet beyond the air course. The company operates its own power plant, and intended making a double entry of the main, but it was found that the coal just east of the present entry had a steep dip and much water was encountered so the plan was abandoned. All other parts of the mine were dry. The mine buildings consist of office, hotel, power house, powder magazine and tipple. Inspected January 22, 1916.

97. North Creek Coal Mine

This is a strip mine owned and operated by C. H. Wiley. It is located about three miles north of South Heart and supplies only a local trade. Most of the mining is done in the fall of the year. The coal bed is 20 feet thick and from six to eight feet of dirt has to be removed before the coal is exposed. Not inspected; reported January 26, 1916.

98. North Star Coal Mine

This mine is located just north of Richardton. It is owned by Albert Koesel and leased and operated by Aug. Windhaus. The coal is six feet thick and contains a five-inch parting of clay six inches from the bottom. The coal is hauled up the slope by horse to the tipple, which is provided with a chute of three ton capacity, where wagons are loaded. No water is encountered, and ventilation is secured by means of an air shaft. However, no means of circulating the air through the room is provided. No coal is left in the roof and considerable timbering has been done. Only local trade is supplied. On January 23, 1916, this mine was found to be in a satisfactory condition.

99. Pittsburg Coal Mine

This mine is located three-quarters of a mile west of Lehigh, with the mine and tipple on opposite sides of the Heart River. It is owned by the Dakota Lignite Mines Company of Dickinson, with Henry Truelson as manager and Edward Summers as superintendent. A spur of the Northern Pacific has been built to the mine. The coal bed is from 10 to 11 feet thick and from two to three feet is left for a roof, making very little timber necessary in the entries. A steam driven fan is used to furnish ventilation. The main entry is drained by means of a steam pump. Haulage under-ground is done by mules and a steam hoist delivers the coal to the tipple, where it is screened. An Ottumwa box car loader is used, and a dump provided for loading into wagons. The mine build-

ings consist of six dwellings, office and scale room, boiler and engine rooms, two barns, powder house and tipple. The company is capitalized at $200,000. On January 22nd, 1916, conditions in and about the mine were satisfactory, except that ventilation was slow, as the fan was out of order. This condition was temporary.

100. Zenith Coal Mine

The Zenith Coal Mine, located at Zenith on a spur of the Northern Pacific Railroad, is owned and operated by the Dakota Lignite Mines Company of Dickinson, with Henry Truelson acting as superintendent and general manager. The coal bed is from 20 to 22 feet thick and reached by a slope 1,000 feet long, up which the coal is hauled by a steam hoist. Ten feet of coal is left for the roof and no timbering is done in the entries. Two rows of props are placed in the rooms. Considerable water is encountered and two steam pumps have been installed, one of which is kept in operation day and night. Ventilation is secured by means of three air shafts, and an old caved in room permits the miners to enter the mine near the present works. Two tipples allow the loading of two box cars at once, and have a storage capacity of 20 tons each. On January 21, 1916, conditions in and about the mine were found very satisfactory.

WARD COUNTY.

101. Bartoshivich Coal Mine

The Bartoshivich Coal Mine is located in a deep ravine 10 miles south of Sawyer. It is owned by Mary Bartoshivich of Max and leased by Geo. Buchler of Sawyer. The entry is driven into the coal from the coulee bank, where the coal outcrops. No definite system of mining is followed and very little timbering is done. The coal is 18 feet thick and from four to seven feet is left for the roof. The mine is drained by a ditch. No artificial ventilation is provided. The mine was in good condition except for the lack of system in driving the work. Just across the coulee from this mine a small mine has been started and the outcropping coal vein was burning at a brisk rate. This vein is reported as having burned for several years and the fire had just reached the outcrop at this point. No attempt had been made to extinguish the fire. Inspected February 12, 1916.

102. Brick Yard Coal Mine

The Kenmare Coal and Brick Company of Kenmare owns and operates this mine, with R. T. Lewis as superintendent and J. B. Foster as pit boss. It is located two miles southeast of Kenmare. The coal vein is from three to four feet thick and is reached by a drift. The coal is hauled to the surface by mules and delivered at the tipple, where it passes through a chute over a one inch screen into freight cars. A spur connects the mine with the Soo Railroad. A brick plant is run in connection with the mine. The buildings consist of scale house, blacksmith shop, powder house, six dwellings and a boarding house. The company

is incorporated under the laws of Iowa at $150,000, including mine, real estate and brick plant. Ventilation is secured by means of an air shaft and furnace, and considerable timbering is done, some of which will be replaced in the spring. The conditions in the mine were very good February 21, 1916.

103. Burlington City Coal Mine

The Burlington City Coal Mine is located just west of Burlington. It is owned and operated by J. W. Perlechek on land owned by Foot and Brunner of Minot. The coal bed, which is from 10 to 11 feet thick, is reached by a slope and the coal is delivered to the surface by horses. No water is encountered in the mine. Ventilation is secured by means of an air shaft. A double entry system of mining is followed, with a 60 foot pillar between the two entries. Rooms are turned from the entry. The rooms are driven 16 feet wide with 16 foot pillars left between and are 250 feet in length. Due to no provision being made for forced circulation, the air was not good. In the extreme cold weather experienced this season circulation was plentiful, but with the sudden rise of temperature at this time, February 16, 1916, circulation almost ceased. In general the conditions about the mine were very good. The operator intends to install an electric fan.

104.—Caflisch Coal Mine

The Caflisch Coal Mine, formerly owned by W. D. Caflisch is now owned and operated by H. E. Christianson. It is located in a deep coulee nine miles south of Sawyer. The entry is driven directly into the coal seam, which is 12 feet thick and outcrops in an old strip pit. No timbering is done in the entry except at the opening and this will need retimbering before spring. Few timbers are necessary in the rooms as from three to four feet of coal is left for the roof. When inspected the air shaft was partly clogged with snow, preventing circulation. The mine is drained by means of a ditch. When the air shaft is free from obstruction the condition of this mine should be very satisfactory. Inspected February 12, 1916.

105. Christophson Coal Mine

This mine, owned by C. Christophson, was abandoned in the spring of 1915. It is located one and one-half miles north of Carpio. The coal bed is less than three feet thick and difficult to work.

106.—Colton Coal Mine

The Colton Coal Mines are owned and operated by L. D. Colton of Burlington and are located one and one-half miles southeast of that town. The shaft mine is located on top of the Valley Bluffs, the shaft being 112 feet deep and equipped with a steam hoist, steam driven fan for ventilation and a No. 7 Cameron pump is used to drain the mine. This mine has not been operated for two years, but the machinery and shaft are in good condition and will be put into operation in a short time. The present works in the same vein of coal are reached by a slope, situated in a small coulee a quarter of a mile west of the shaft

mine. The coal is hauled from this mine to the tipple by horse. The vein is 10 feet thick and water is encountered, which is removed by a gas engine driven pump. An air shaft is provided which is of little value on account of a squeeze near the lower end, which almost closed it. The old hoist shaft is used instead, and affords good circulation. The mine buildings consist of bunk house, boarding house, barn, tipple and power house. Inspected February 15, 1916 and found to be in a satisfactory condition.

107. Conan Coal Mine

This mine is owned by D. A. Conan, Sr. The old mine has been abandoned and a new one opened by J. F. Casteel. No prospecting was done at the new site and as a consequence the first slope was driven a considerable distance into the hillside before it was discovered that it was beneath the vein of coal. Another slope had to be driven. The coal is 10 feet thick. Double entries were being driven and only one room was opened and the air shaft was not completed. The mine buildings consist of boarding house, blacksmith shop and bunk house. Inspected February 17, 1916 and found in fair condition.

108. Crosby Coal Mine

The Crosby Coal Mine, formerly owned and operated by John Crosby, is owned by H. E. Peck of Kenmare, and leased by John A. Pohe. This mine was not operated during the year of 1915. However, in November Mr. Pohe took charge of the mine and spent the remainder of the year in cleaning out entries and retimbering. It was found that the entries were in such bad shape that the face workings could not be reached, so the winter months have been confined to pulling pillars and stumps. The mine buildings consist of office, bunk house, boarding house, blacksmith shop, barn and storage bin. On February 28, 1916 two men were at work. Work for this season will cease as soon as the storage bin is filled to be used by Mr. Pohe in operating his steam plow engine in the spring. A new entry will be driven during the summer of 1916, if it is considered advisable to re-open the mine.

109. Davis Coal Mine

The Northern Briquetting Company of Minot owns and operates the Davis Coal Mine, which is located one mile south of Burlington. The coal bed is nine feet thick, and is reached by an 800 foot slope. A large steam hoist is used to haul the coal to the surface, and a steam pump is used to keep the mine dry, 25,000 gallons being pumped daily. The double entry room and pillar system of mining is used. Ventilation is provided by means of an air shaft and steam jets are used to force circulation during the summer months. A brick plant is operated in connection with the mine, the clay used overlying the coal vein. Carbonizing ovens used in connection with this company's briquetting plant in Minot are situated at the mine and the tipple is so constructed that coal can be dumped at the brick plant, carbonizing ovens, freight cars, farmers' loading dump and boiler house. A spur from the Soo Railroad leads to the mine. The mine buildings consist of boiler house, hoist house,

blacksmith shop, barn, scale house, boarding house, five dwellings, five bunk houses, and office and store room. Conditions were very satisfactory. Inspected February 17, 1916.

110. Diamond Coal Mine

H. E. Peck owns this mine and it has been operated by several different parties in the last year. It is located about one mile south of Kenmare. The coal bed is about five feet thick and is reached by a slope, through which the coal is hauled to the tipple by horse. The old works were abandoned in the spring of 1915 and the present slope driven. Air is supplied by an air shaft. The coal is dumped directly into wagons. On February 2, 1916 the mine was found to be in good condition.

111. Farmers' Coal Mine

This mine is owned by the Farmers' Lignite Coal and Transportation Company of Bowbells and is located on the west bank of the upper Des Lacs Lake, about six miles southeast of town. Jack Hanson is operating the mine, with O. P. Hanson as superintendent. The coal bed, which is five feet thick, is entered by a drift. Considerable timbering has been done in the entry and rooms. The roof is hard to hold. The entry has caved considerably and is in such bad condition that the mine will be abandoned. The last rooms were being worked when inspected, February 28, 1916. A new entry will be driven during the summer of 1916, a quarter of a mile further up the lake. At present the cars are pushed from the mine by hand to the tipple, where the coal is dumped directly into wagons. A storage bin of 100 tons capacity is provided at the tipple. The mine buildings consist of office, boarding house, bunk house, storage bin and barn.

112. Forsythe Coal Mine

A. P. Forsythe of Minneapolis owns this mine. During the season of 1915 T. H. Peterson of Burlington had it leased. It is located just across the coulee from the Lloyd mine, and is a mile from the Paradise spur. The coal is reached through a slope. Only local trade is supplied. The coal is nine feet thick and contains two small layers of clay close together and near the center of the coal vein. On February 20, 1916, the mine was abandoned, practically all the coal available being taken out, and the entries were caved to within 50 feet of the opening.

113. Foxholm Coal Mine

The Foxholm Coal Mine, located at Foxholm, is owned by the Foxholm Coal Company with Mack Hendricks acting as superintendent. A new shaft has been sunk and equipped with an air compartment for ventilation, a tipple of 100 tons capacity and a 25 horse power Fairbanks and Morse gas hoisting engine. Considerable water is encountered, which is removed by a force pump, driven from the power plant above, by means of a long transmission belt running through the air shaft. The mine buildings consist of power house, tipple, office and scale room, blacksmith shop, barn, washroom and powder magazine. On February 18, 1916, the mine was found to be very wet, due to the poor drainage

system. Not enough timbers were being set for entire safety or permanent works.

114. Hot Blast Coal Mine

The Hot Blast Coal Mine is a small mine supplying a local trade and located three miles northwest of Donnybrook. Mr. Miller operates the mine in a three and one-half foot vein of coal, and experiences considerable trouble on account of water, a tank pump being operated almost continually by a gas engine. The mine is entered by a short slope and is much in need of timbering, as are the entries. Inspected February 29, 1916.

115. Hunnewell Coal Mine

The Hunnewell Coal Mine is owned and operated by R. J. Hunnewell and is located one and one-half miles southeast of Burlington. The coal is 10 feet thick and is reached by a slope. A double entry system is used. The coal is hauled from the mine by means of a horse, and two chutes are provided to dump the coal directly into wagons. A siphon is used to drain the mine, a hand pump being used to start the water. Ventilation is secured by means of an air shaft, which was very poor because the cross cuts were not properly bratticed. Miners were quitting the day the mine was visited because of the owner's failure to provide brattices. Inspected February 17, 1916.

116. Johnson Coal Mine

The Johnson Coal Mine is located about six miles north of Kenmare and is on the east bank of the Upper Des Lacs Lake. It is owned and operated by Jonas Johnson of Kenmare. The coal bed, which is from five to five and one-half feet thick, is reached by a drift driven from the lake bank and also by a shaft sunk on top of the bluffs. A steam hoist is used to deliver the coal to the surface through the shaft, which is 110 feet deep, and horses are used to haul the coal to the surface through the drift. It is then hauled over the lake to Kenmare during the winter months. The mine was found to be well timbered. Ventilation is secured by means of the drift and the shaft, and the air was found to be good in all parts of the mine except one entry, which was abandoned a short time ago, partly because of poor ventilation and partly because of difficulty in holding the roof. Hauling is done under-ground by mules and horses. The mine buildings consist of power house and tipple, bunk house, barn, boarding house and storage bin. Conditions in and about the mine were satisfactory. Inspected February 28, 1916.

117. Klondike Coal Mine

The Klondike Coal Mine is owned by Wm. Spencer and supplies a small local trade. It is leased and operated by Wm. Lloyd Spencer. The coal bed is three feet thick and is reached by a drift. The clay roof is good and not a great deal of timbering has been done. No means of ventilation has been provided. The air, however, seemed to be good, due to the fact that the entry was not long. Inspected February 22, 1916.

118. Leeson Coal Mine No. 1

This mine is located about 11 miles southwest of Velva. It is owned and operated by J. J. Leeson of Velva. The coal is 12 feet thick, four feet being left for the roof. The mine is entered by a drift, and no definite system whatever is followed. Very little timbering is done in either the entry or rooms and the coal is hauled from the mine in stone boats and piled on the ground outside for storage. Pillars and roof were being pulled. The mine in general was in a fair condition, except for the lack of system in mining. Inspected February 12, 1916.

119. Leeson Coal Mine No. 2

J. J. Leeson owns this mine, which is located nine miles south of Sawyer. It is leased and operated by Henry Greenvold and is situated in a deep drain. The coal outcrops in an old strip pit and is 14 feet thick. The main entry is driven from this outcrop and the seam slopes up from the entrance into the mine, which allows the coal to be run from the mine by gravity to the dump, where it is dumped directly into wagons or piled on the ground for storage. A single entry system is used and from four to five feet of coal is left for the roof. The rooms are driven from 14 to 16 feet wide and no timbering is done. Ventilation is secured by means of a break through into the old mine, where an air shaft is provided. All water encountered in the mine is readily drained out the incline. Inspected February 12, 1916 and it was found that the rooms should be timbered. In other respects conditions were good.

120. Lloyd Coal Mine

The Lloyd Coal Mine is located four miles northwest of Burlington and is in a coulee tributary to the Des Lacs River. The coal bed is reached by a six per cent slope and is situated one and one-half miles from the Soo Railroad. The tipple is located on a spur by the main right of way and this is connected with the mine by a narrow gauge track, over which the coal is hauled by horse from the mine. A large percentage of the coal is shipped. The Lloyd Coal Company of Minot owns and operates the mine, with H. T. Stewart as superintendent. Two mines were in operation, one being practically worked out. All the pillars and stubs were being drawn. The other mine was opened during the winter months, mostly entry work being done. A double entry room and pillar system of mining is used. The main entry is driven 600 feet, with cross entries driven 200 feet apart, from which rooms are driven each way 100 feet long. Air is furnished by means of an air shaft. Very little water was encountered. A seven foot fault in the coal was struck close to the main entry in the west side entries, which stops the work in that direction. Conditions in general were very satisfactory. Inspected February 18, 1916.

121. The McClure Coal Mine

The McClure Coal Mine is located at Tasker. It is owned by the McClure Company and leased and operated by W. J. Verzatt, with George

E. McClure as general manager. The tipple is situated on a spur of the Soo Railroad and is connected with the mine by a long covered track, over which the coal is hauled by mules. The coal bed is seven feet thick and a foot is left for the roof. Some timbering is done in the entries and two rows of props are placed in the rooms. Some water collects in the mine and is pumped out by a small gas engine driven pump. Ventilation is secured by means of an air shaft. When the mine was visited, February 18, 1916, the air was poor, due to a cave-in in the air courses. A new air course was being driven around this. Practically all the coal mined is shipped to the McClure Company's yard at Minot.

122. Mellon Coal Mine

The Mellon Coal Mine was being opened by John Mellon and Son of Kenmare. It is located on the bank of the Des Lacs Lake two miles southeast of Kenmare. The coal is reached by a steep slope 200 feet in length. Considerable timbering has been done in the slope but it was evident that much more and heavier timbering will be required to hold it. Inspected February 21, 1916.

123. Ogborn Coal Mine

This is a small mine owned by Otis Ogborn and operated by Peter Anderson. It is located near the old Baden Mine, one mile south of Baden. The coal bed is from two and one-half to three feet thick and is reached by a slope. Very little timbering has been done in any part of the mine. No regular system of mining has been followed and no means of ventilation have been provided. If operations are continued considerable timbering must be done and an air shaft provided. Inspected February 22, 1916.

124. Pierce Coal Mine

This mine, located two miles south of Kenmare, and owned by Fox and Cole, was abandoned during the spring of 1914.

125. Red Flag Coal Mine

The Red Flag Mine, formerly owned by the late Jed Knowles, has not been operated during the past year. It is located 11 miles southwest of Velva, and was not inspected.

126. Rich Coal Mine

The Rich Coal Mine, owned and operated by R. W. Rich, is located on the west bank of the Upper Des Lacs Lake, eight miles southeast of Bowbells. It is just across the lake from the Johnson Mine. When visited, February 28, 1916, this mine could not be inspected because the entry was half full of water at a point 250 feet from the entrance. Most of the timbers and steel had been pulled in the mine, and it will be permanently abandoned. A new drift was being driven a short distance from the old one. The owner intends to sink a shaft in the top of the hill and install a steam hoist during the coming summer.

127. Smith Coal Mine

The National Briquetting Company of Minneapolis owns and oper-

ates this mine, which is located two miles north of Kenmare. It is on the east bank of the Upper Des Lacs Lake. The Company is incorporated under the laws of South Dakota, with a capitalization of $1,500,000. The power plant which supplies the city of Kenmare with electricity, is situated beside the mine and was formerly owned by the Northern Briquetting Company but has lately been sold to a different concern. J. W. Deemy is secretary and general manager and C. Tester is pit boss. The coal bed is from five to six feet thick and is reached by two well timbered drifts. Only one drift, the longer, is used for haulage, the other being used as a manway and a means of ventilation. The management plans to abandon the present drift for haulage purposes and to move the tipple and loading apparatus to the entry of the shorter drift, so the haulage distance will be shortened. A rather soft clay overlies the coal bed, and considerable timbering has been done in all the entries and rooms. Ventilation is secured by means of an air shaft and two electric driven fans are placed in the airway to assist the air shaft. Very little water is encountered in the mine. A Morgan Gardner electric cutting machine is used and a General Electric Company motor is used to haul the coal to the surface, from where it is hauled to the tipple by means of an electric hoisting apparatus. An Ottumwa shaker screen is installed on the tipple and an Ottumwa box car loader is also used. The mine is connected to the Soo by a spur on which the Mining Company operate their own engine to haul the coal to the Soo right of way. On February 29, 1916 the mine was found to be in very good condition.

128. Square Deal Coal Mine

The Square Deal Coal Mine is located three miles south of Baden, and is owned by the Minnesota Loan and Trust Company. Stephen Hodgson leases and operates the mine. The coal bed is three and one-half feet thick and is reached by a slope. The present mine is practically all worked out, only three rooms being left when the mine was inspected, February 22, 1916. A new slope has been driven a few hundred feet east of the present one, which will be used when the old mine is abandoned. An air shaft is provided but is too small to supply a sufficient quantity of air. Other conditions in and about the mine were satisfactory.

129. Strong Coal Mine

The Strong Coal Mine is owned by F. F. Finnegan of Denhoff and is leased by Milo G. Woods of Velva. It is located ten miles southwest of Velva. The coal bed is 10 feet thick and is reached by a slope. Three feet of coal is left for the roof and very little timbering is done other than in the slope. A row of props with caps are placed in the rooms and no timbering is done in the entries. A single entry system of mining is used and the mine is drained by a windmill and gas engine driven pumps, an ordinary deep well pump being used. The coal is hauled from the mine by a six horse power gas engine driven hoist with drum and cable, and dumped directly into wagons. When inspected, February 12, 1916, no means of artificial ventilation had been provided, but the

air was apparently in good condition. With the exception of one room which was too wide the conditions about the mine were satisfactory.

130. Tree-Bausch Coal Mine

The Tree-Bausch Mine is a strip pit, but due to a lack of time no stripping had been done in the fall of 1915, and consequently very little coal has been taken out this season. Some local trade is supplied, however, by partially undermining the clay bank. Rufus Tree and Jacob Bausch of Velva own the mine, and since November William Harden has been operating it. Previous to that time Lawrence Marleme was the operator. All the coal can not be taken from the mine on account of water, as the tile put in to drain it is too high. This mine was not visited, as a snow storm prevented the inspector from reaching it on the 12th and 14th of February, 1916.

131. Vadnais Coal Mine

This mine is owned by O. Adams and leased by O. Tisdall. It is located just across a small flat from the Kenmare Coal and Brick Company Mine, three and one-half miles south of Kenmare. The coal is three feet thick. It is hauled to the surface through a slope by horses. Ventilation is secured by means of an air shaft in an old room near the foot of the slope. Brattices are needed in order that the air current may be carried to the working faces. The mine buildings consist of bunk house, scale room, dwelling and barn. Inspected February 21, 1916 and found to be in good condition aside from the lack of brattices.

132. Wallace Coal Mine

J. S. Wallace owns and operates this mine. It is situated just south of Burlington. The coal, which is 11 feet thick, is reached by a drift. A double entry room and pillar retreating system of mining is used. Double entries are driven and from these double cross entries and again from the cross entries a stub entry is driven and three rooms worked at a time, beginning at the extreme end of this stub. Canvas partition is used to force the air to the end of the stub entry. A 50 foot pillar is left between the entries with crosscuts every 50 feet. Chain pillars are left 50 feet wide to protect the entries. Rooms are driven from 15 to 16 feet wide with 16 foot pillars left between. Some water is encountered in the mine and is removed by a deep well pump driven by a two horse power gas engine. An electrically driven fan with 12,000 cubic feet per minute capacity furnishes air for the mine. A furnace is also provided in case of emergency. The air in this mine was excellent and conditions in general first rate. The mine buildings consist of scale room and office, wash room, barn, three rooming houses, fan house, and pump house. Inspected February 16, 1916.

133. Wallin Coal Mine

The Wallin Coal Mine is owned by John Wallin of Minot and leased and operated by J. Hoeck. It is located three miles southeast of Burlington. The coal vein is nine feet thick and is reached by a drift driven into a small hill. Very little coal of good quality has been mined,

a greater part of it, approximately sixty per cent, being slack. The mine has been operated 14 months and practically all the available coal has been mined and the operator planned on abandoning it in two weeks time. A new drift will be driven in the spring in another location. Conditions were satisfactory. Inspection was made February 15, 1916.

WILLIAMS COUNTY

134. Black Diamond Coal Mine

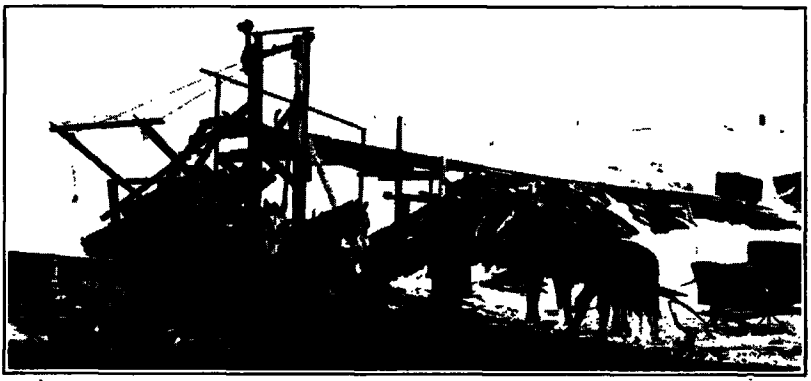
J. W. Jackson owns the Black Diamond Mine, which is located three miles southeast of Williston. Thompson and Frye have the mine leased and F. W. Frye is in active charge. The 10 foot vein of coal is reached by a drift driven into the bluff, which is on the east side of the Missouri River Valley. The entry has been driven 800 feet and cross entries are driven from this, from which rooms are worked. No timbering is done in the entries after the solid coal is reached. The roof of the mine is good, three feet of coal being left. Some of the rooms are well timbered, but one in particular where one man was working was driven wide and without any timber to support the roof. Ventilation is secured by means of an air shaft. No water is encountered in the mine. The tipple is provided with a chute having a one and one-fourth inch screen and a 25 ton storage capacity. From the storage bin the coal is dumped into wagons. The mine was found to be in a satisfactory condition on March 3, 1916, with the exception of a lack of timbers in some of the rooms.

135. Big Four Coal Mine

The Big Four Coal Mine, formerly known as the Cow Creek Mine and owned by H. H. Skogberg, is now owned and operated by Ben Fedge. It is located 24 miles northwest of Williston, on the bank of Cow Creek. The coal bed is seven feet thick and outcrops on the bank of the creek. The entry is driven directly into the coal and one foot of coal is left in the roof for support. Most of the entry is timbered and lagged on top with two inch planks. Ventilation is secured by means of an air shaft which is too far from the face of the coal to do much good, and it was clogged at the bottom. A new and larger air shaft is to be sunk during the summer. A bin provided a storage capacity of 20 tons. Inspected March 9, 1916.

136. Bryne Coal Mine

The Bryne Coal Mine is owned by the Harry Hanson Estate, with Ole Bryne as administrator. Ole Bryne leases and operates the mine. It is located one-half mile below the Black Diamond Mine. The coal bed is 10 feet thick and is reached by a drift driven in the side of the river bluff. The main entry and parallel entry are driven in about 400 feet. The circulation of air was not good, as there were no doors in the crosscuts. No water is encountered. Three feet of coal is left for the roof, which is good. No timbering is done in the entries. More timbering should be done in the rooms than had been done up to March 31, 1916. The tipple



Falk Coal Mine Located Near Howard, Williams County. Illustrating Typical Surface Equipment of the Smaller Mines.

has two loading chutes equipped with one and one-half inch screens and of four tons capacity each. The mine buildings consist of tipple, bunk house, boarding house, barn and powder house. Inspected March 3, 1916.

137. Ellithorpe Coal Mine

This mine was formerly owned by J. T. Brown and known as the Brown Coal Mine. It is now owned by Mabel B. Ellithorpe and operated by C. Ellithorpe. It is located two and one-half miles northeast of Williston near the Reclamation Service Mine. The mine is reached by a slope. The coal is nine feet thick. Seven feet is mined and two feet left for the roof. Most of the entries and all of the rooms are substantially timbered. Ventilation is secured by means of an air shaft. This is too small to provide sufficient air. Some water is encountered in the mine and is drawn off by means of a siphon. Two chutes are provided with a storage capacity of 20 tons from which the coal is forked into wagons. The mine buildings consist of boarding house and scale room, bunk house, storehouse, wash room and barn. With a larger air shaft this mine would be in first class condition. Inspected March 3, 1916.

138. Falk Coal Mine

Ole Falk owns this mine and leases it to J. H. Boardman. It is located in a deep coulee four miles northeast of Howard, an inland town, and supplies a large local trade. The coal vein is eight feet thick and outcrops on the side of the coulee. The entry is driven directly into the vein. Timbering is confined to a row of props in the rooms and an occasional prop set in the entry, part of which is an old room. This part has begun to cave and a new entry will have to be driven soon. Ventilation is secured by means of an air shaft. Some water is encountered, which is piped from the mine. A tipple provided with a one-inch screen allows the coal to be dumped directly into wagons. On March 8, 1916 this mine was found to be in a satisfactory condition with the exception of those rooms in which more props should be placed.

139. Folvog Coal Mine

Lucy Dacoteau, an Indian, of Belcourt, owns this mine, which is leased and operated by H. C. Folvog. It is located 45 miles northwest of Williston and eight miles west of Gladys. The mine is situated in a deep coulee and is entered by a slope. The coal is 10 feet thick and is found at a depth of 50 feet. With the exception of a few timbers near the entrance the timbering is confined to the rooms, where one row of props are used. Ventilation is secured by means of an air shaft, which at present is too far away from the miners to do much good, as no means of circulation is provided. The coal is hauled from the mine by a horse. The tipple has two dumps for loading the coal directly into wagons. No water is encountered in the mine. The mine was found to be in a safe condition on March 8, 1916.

140. Freeman Coal Mine

The Freeman Coal Mine is located just across the coulee from the Narveson and Johnson Coal Mines, and is 32 miles north of Williston.

It is owned by Tom J. Freeman and has been leased by several different persons in the past few years. At present John Erickson has the mine leased and is operating it. The coal bed is from seven to eight feet thick and is reached by a drift. No timbering is done in the entries and one row of props with caps is used in the rooms. It is the intention of Mr. Erickson to timber the entry and drive a parallel entry, in which an air shaft will be driven. No means of ventilation is provided at present. The mine is dry. One foot of coal is left for the roof, but more timbering should be done and an air shaft provided before further work is done. The coal is hauled to the tipple with a horse, and is dumped directly into wagons. Inspected March 7, 1916.

141. Head Coal Mine

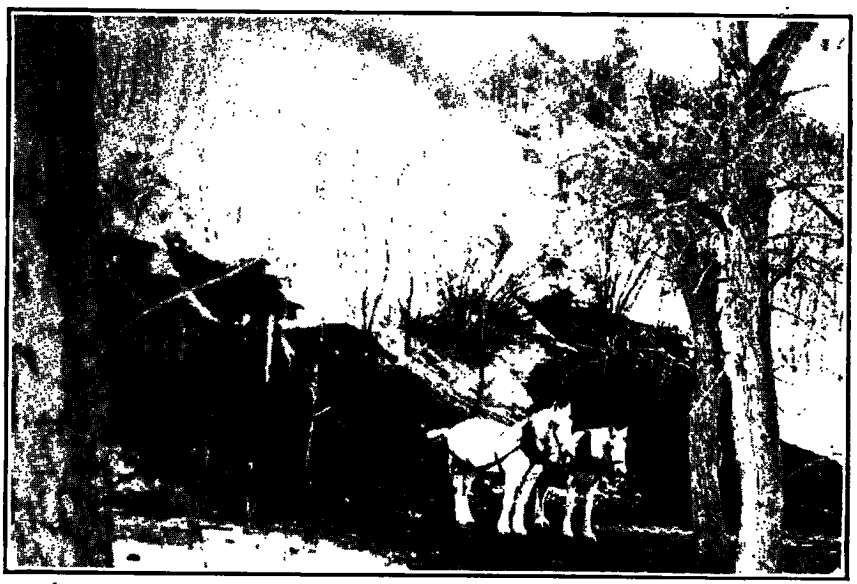
The Head Coal Mine is owned and operated by P. G. Head. It is located five and one-half miles northwest of Williston. The coal bed is from 11 to 15 feet thick and is reached by a short slope. A single entry system of mining is used, the entry being driven 600 feet. An air shaft is provided. From three to four feet of coal is left for the roof, and no timbering is done in the entry except in the slope. One row of props is placed in the rooms. Water is encountered and is removed by a siphon. The coal is dumped through a chute to the ground, where it is forked into wagons. The mine buildings consist of office and scale room. Conditions were fairly satisfactory in and about the mine, March 4, 1916.

142. Husebye Coal Mine

This mine, formerly owned by Husebye and Ellithorpe, is now owned and operated by J. A. Husebye. It is located three miles east of Williston near Miller's spur. The coal bed, which is 10 feet thick, is reached by a shaft 60 feet in depth. A drift was formerly used for haulage, but is now used as an air way and as a means of entering the mine. A manway is also provided beside the shaft. Very little timbering is done in the entries and one row of props about five feet center to center is used in the rooms. Occasionally other props are set in where necessary. The hoisting shaft is used as an air shaft and the drift as the intake. A steam jet is provided in the shaft to aid in ventilation during warm weather. The coal is delivered to the tipple by means of a steam hoist. The tipple is provided with a scale and two chutes of 25 tons capacity. These chutes are provided with one inch screens, over which the coal passes into wagons. The mine buildings consist of office and scale room, boarding house, bunk house, power house, powder house, store house, barn, and work room. The ventilation was good on March 2, 1916, but more timbering should be done in the mine and wider pillars left between the rooms.

143. Johnson Coal Mine

The Johnson Coal Mine is a small mine supplying a local trade, and located 32 miles north of Williston and eight miles north of Howard. It is owned and operated by John Johnson. Very little coal is taken out



View of the Moorman Coal Mine in Hungry Gulch, Williams County.

during the summer months. The coal bed is eight feet thick and a little over a foot of coal is left for the roof. Very little timbering is done in the entry. More props should be set in the rooms, as the roof is poor. No method of ventilation is provided. The coal is hauled from the mine in a car and loaded into wagons by hand. This mine is run as a side issue to farming and Mr. Johnson's farm buildings are situated near the mine. Inspected March 7, 1916.

144. Miller Coal Mine

This mine, owned by A. C. Miller, is in a nine foot vein of coal. The mine is entered by a drift into the outcrop. A two inch clay parting occurs three feet from the bottom of the coal. Some water is encountered in the mine and is ditched from a sump to the outside. Timbering is confined to the first few feet of the entry and the rooms. No means of ventilation have been provided. An air shaft should be provided before further work is done. On March 6, 1916 the mine was found to be in a safe condition.

145. Moorman Coal Mine

The Moorman Mine is situated in a deep coulee known as Hungry Gulch. seven miles southeast of Wheelock. It is owned and operated by J. M. Moorman, and supplies a local trade. The coal bed is 10 feet thick and outcrops on the bank of the gulch. Two entries have been driven into the coal bed. Rooms are driven off the entries and very little timbering is done either in the rooms or entries. A good dry clay overlies the coal and from one to three feet of coal is left for support. Ventilation is secured by means of an air shaft in an old room between the two entries. Inspected March 10, 1916 and conditions were satisfactory except that it is suggested that more props be set in the rooms.

146. Narveson Coal Mine

This mine is located a few hundred feet up the creek from the Johnson Mine and is 32 miles north of Williston. It is owned and operated by N. T. Narveson and supplies a local demand. The coal bed is eight and one-half feet thick and is reached by a drift. Two feet of coal is left for the roof, and no timbering is done in the entries. One row of props with caps is placed in the rooms. The coal is hauled from the mine in a car and dumped directly into wagons, or a storage bin of 25 tons capacity. No water is encountered and no means of ventilation are provided. An air shaft should be provided before further work is done. A dangerous condition exists at the entrance to this mine. A clay bank 20 feet high overhangs the entrance and no means are provided to support it or to protect the entrance in case it caves off, as it is likely to do at any time. Inspected March 7, 1916.

147. Powell Coal Mine

The Powell Coal Mine is situated between the Bryne and Black Diamond Mines, three miles south of Williston. It is owned by Mary S. Powell and leased by John Penson, but is no longer operated. It has

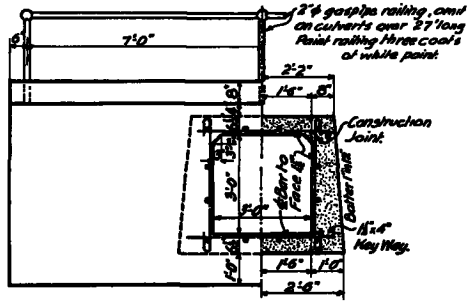
been closed since October, 1915, and on March 3, 1916 the main entry was found partially caved.

148. Reclamation Service Mine

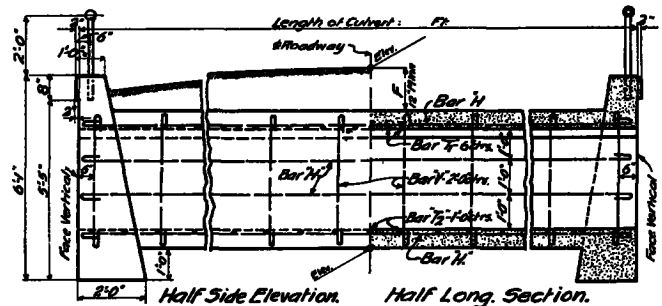
The U. S. Reclamation Service owns and operates this mine, for the purpose of supplying fuel for the power plant, which is used for irrigation purposes. Light is also supplied to the city of Williston. The mine is located on the bank of the Little Muddy Creek, four and one-half miles northeast of Williston. Wm. S. Arthur is general superintendent and S. L. Sinclair superintendent of the power plant and mine, while A. M. Innis acts as pit boss. The double entry continuous room and pillar system is used in the present works, where a small block of coal is being recovered. Fifteen foot rooms are driven with pillars of equal width, the full length of the block of coal with break through every 50 feet. When the end of the block is reached a "dummy" room is driven clear through the middle of the pillars, which are pulled where the ends of the block are reached. Cross roads for haulage are driven through the pillars at an angle of 45 degrees. Ventilation is secured by means of two air shafts, one two feet in diameter and the other two feet by six feet. An electric fan is placed in the smaller shaft and is used only during the summer months. Another electric fan is to be placed in the larger air shaft. Forty per cent Red Cross dynamite is used and is stored in a suitable powder house 200 feet from the portal. Fuse and caps are used for ignition and the miners have to use wooden tampers. In case of a missed shot no place can be used for 24 hours afterwards, and in no case can more than three shots be fired at once. Each miner is allowed to take 25 pounds of dynamite into the mine. Very little water is encountered and what does accumulate in the sump is hauled out in a tank car. Rooms and entries are well timbered, and two feet of coal is left for the roof. Five concrete storage bins of 100 tons capacity each are provided for cases of emergency. The coal is dumped into a storage bin, where it is fed to a crusher before going to the boiler rooms. No coal is sold except to employees. The mine buildings consist of mess house, three bunk houses, blacksmith shop, powder house and bath house. On March 4, 1916, the conditions in and about the mine were found to be excellent. This is the best timbered mine in the state.

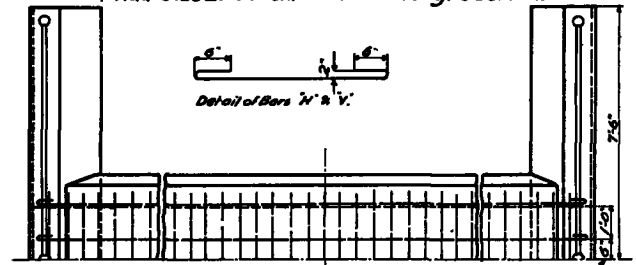
149. Zahl Coal Mine

This is a small strip mine supplying a local trade. It is owned by Mrs. M. E. Zahl of Williston and is located three miles east of Howard. James Seabrook has the mine leased. During part of the winter some coal is removed by undermining. The coal vein is six to seven feet thick and from six to 15 feet of sandy clay has to be removed before the coal is exposed. A thick layer of very hard clay lies near the top of the coal seam, which helps in holding the roof when under-ground mining is done. Some water is encountered, which is removed by a ditch. Inspected March 7, 1916 and found to be in fair condition.



Half End Elevation. Half Section.





Half Plan. Culvert symmetrical about ℄

General Notes:—

Concrete to consist of one part Portland Cement, two parts of sand and not to exceed four parts of broken stone or screened gravel rejected on a quarter inch screen and passing a one and one half inch screen.

All material to be measured by volume and to be subject to test before being used.

All ingredients to be entirely free from vegetable matter and other impurities and not to contain more than five percent clay. Water not to be excessively alkaline.

Reinforcement to be medium open hearth steel, placed exactly as shown in the details and securely wired before concrete is placed.

Forms to be light and substantial, dressed for exposed surfaces and free from set concrete.

The bed under culvert shall be properly finished to correct grade. Minimum grade ⅛" per foot.

Filling must be thoroughly tamped around sides of culvert.

Rip rap slopes and ends when necessary.

Length of culvert to equal width of roadway + 3:(F-1).

Minimum length of culvert to be 22 ft.

Bill of Material.

Bar	No.	Length	Shape	Location.
H	12	*	Bent	Longitudinal.
V	*	5'-0"	"	Sides - Vert.
T1	*	4'-2"	Str.	Slab - Trans.
T2	*	4'-10"	"	Floor "
Total Wght. of steel:				
Total Concrete:				
Total Wght. of Railing:				170 Lbs.

* Length of "H" Bars = L+1', * No. of T2 Bars = 2L-2.
* No. of "V" Bars = L+1, * No. of T1 Bars = L.
All bars ½" ϕ
L = Length of Culvert in Feet.

STANDARD REINF'D CONCRETE CULVERT.

3'x3' BOX CULVERT LENGTH FT.

_____ SEC. ___ T. ___ N. - R. ___ W.

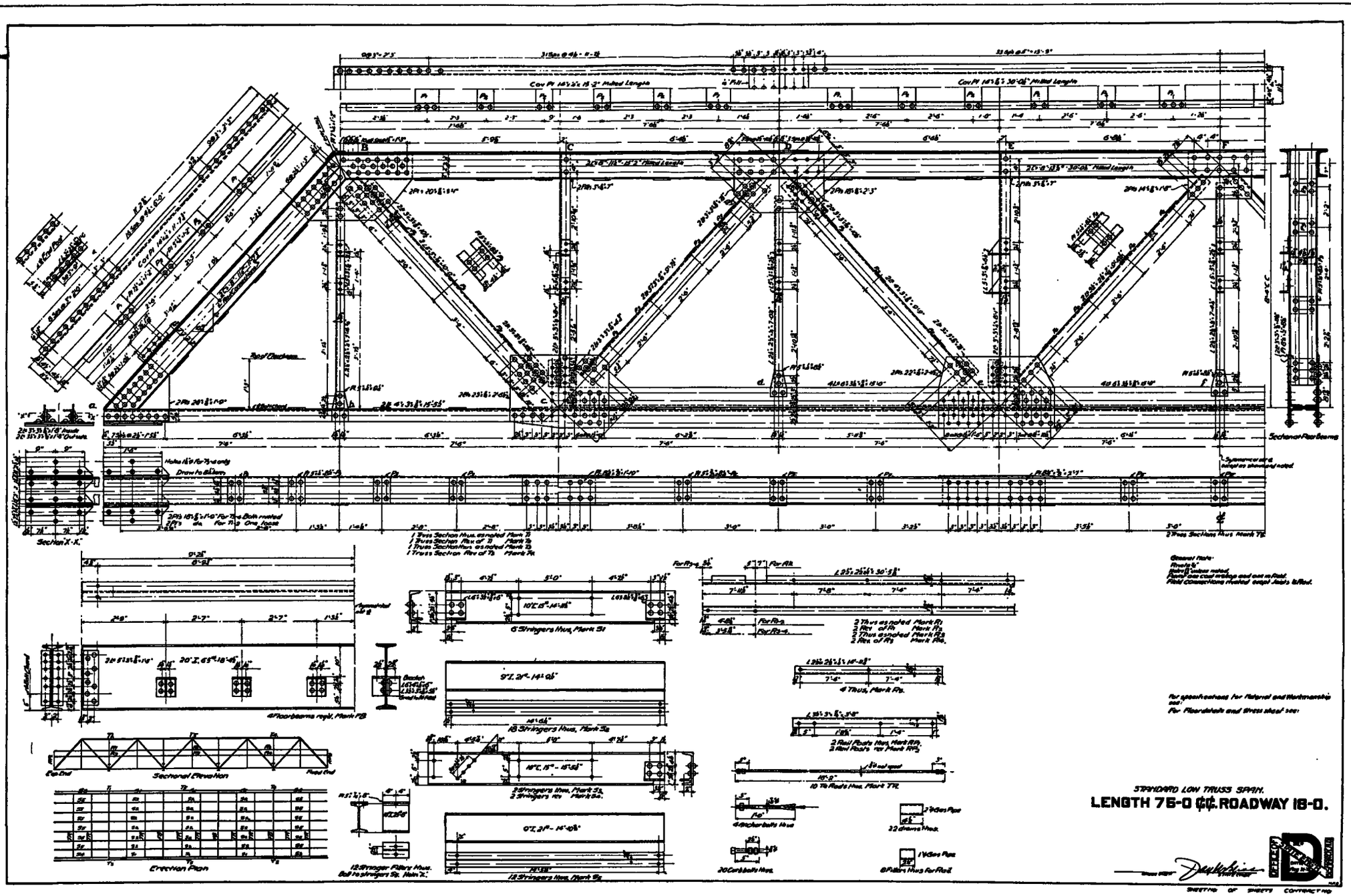
_____ COUNTY.

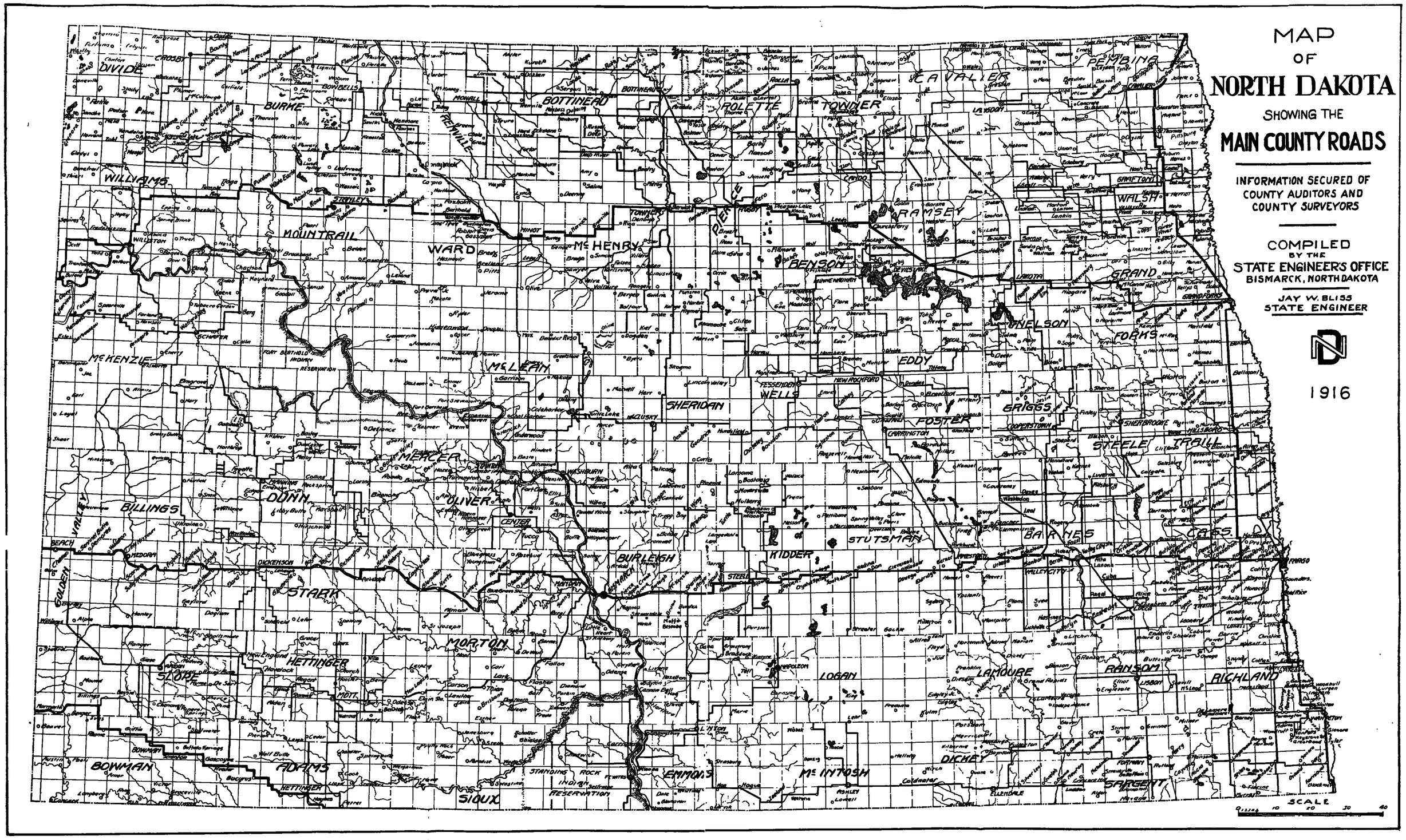
APPROVED:

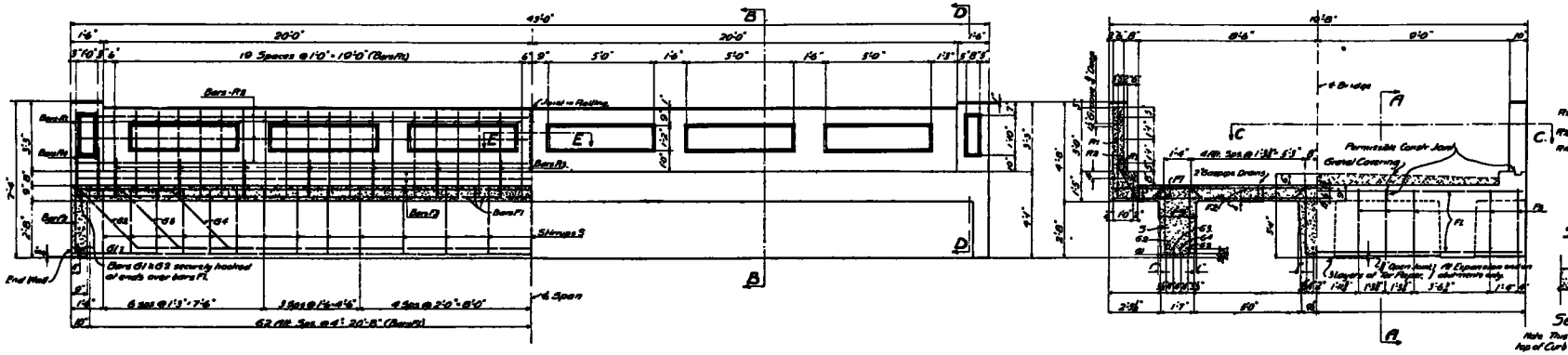
STATE ENG'R.

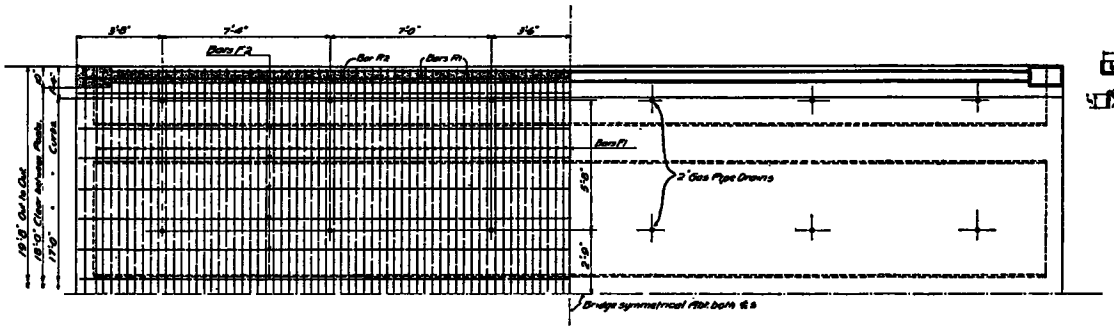
STATE HIGHWAY COMMISSION

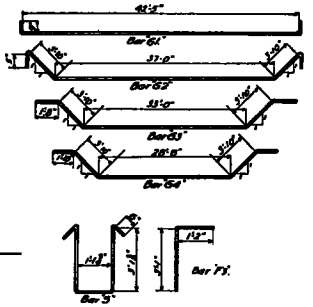
H.R.S.


Section X-X
Section Floor Beams
Sectional Elevation
Erection Plan
Roof Clearance
6 Stringers Hus, Mark S1
18 Stringers Hus, Mark S2
18 Stringers Hus, Mark S3
18 Stringers Hus, Mark S4
4 Floorbeams repl, Mark FB
4 Thus, Mark F2
10 Tie Rods Hus, Mark TR
4 Anchor Bolts Hus
20 Cap Bolts Hus
STANDARD LOW TRUSS SPAN.
LENGTH 75-0 ¢¢. ROADWAY 18-0.


MAP
OF
NORTH DAKOTA
SHOWING THE
MAIN COUNTY ROADS
INFORMATION SECURED OF
COUNTY AUDITORS AND
COUNTY SURVEYORS
COMPILED
BY THE
STATE ENGINEER'S OFFICE
BISMARCK, NORTH DAKOTA
JAY W. BLISS
STATE ENGINEER
1916
CROSBY
DIVIDE
BURKE
WILLIAMS
BOTTINEAU
ROLETTE
TOWNER
CAVALIER
PEMBINA
RENVILLE
WARD
MOUNTRAIL
MCHENRY
BENSON
PIERCE
RAMSEY
WALSH
GRAND FORKS
NELSON
GRAFTON
MCKENZIE
MCLEAN
SHERIDAN
WELLS
EDDY
FOSTER
GRIGGS
STEELE
TRAILL
MERCER
DUNN
OLIVER
BILLINGS
BURLEIGH
KIDDER
STUTSMAN
BARNES
CASS
STARK
MORTON
HETTINGER
SLOPE
LOGAN
LAMOURE
RANSOM
RICHLAND
BOWMAN
ADAMS
SIOUX
EMMONS
MCINTOSH
DICKEY
SARGENT
SCALE



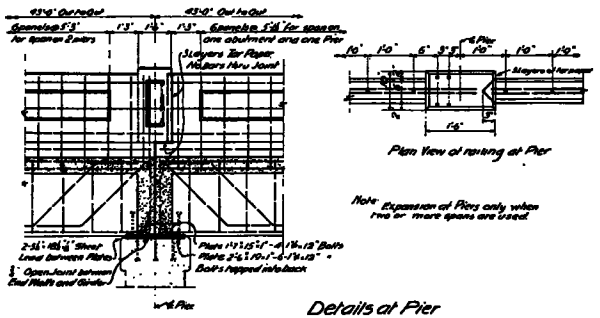




BILL OF BARS FOR ONE SPAN.

Bar	No.	Size	Length	Kind	Shape	Location
G1	12	1 1/8"	44'-0"		Bent	Girders - Bottom
G2	6	1 1/8"	45'-6"		-	- -
G3	3	7/8"	46'-9"		-	- -
G4	3	7/8"	48'-0"		-	- -
S	81	5/8"	8'-4"		-	- - Stirrups
F1	129	1/2"	19'-6"	Straight		Floor - Transverse
F2	20	1/2"	42'-9"		-	Floor and Curb Long
F3	20	1/2"	4'-3		Bent	Floor to End Wall
F4	96	1/2"	19'-3"		Straight	Rails and Post - Vert.
F3	17	1/2"	3'-10"		-	- - Horiz.
F3	28	1/2"	2'-11"		-	Floor to Rail - Diag.
F4	8	1/2"	3'-0"		-	- - Post -

Total Steel ___ #
Drains: 24 pieces 2"x9" Gasp.
Concrete: 1:2:4 Mix. Girders, Slab & Curbs — Cu. yds.
1:2:3 Mix. Railings & Posts — Cu. yds.



General Notes:-

Cement to be a standard brand and to be sampled by the engineer and tested before being used.

Sand to be clean and coarse, entirely free from vegetable matter and not to contain more than 1% percent of clay.

Gravel and broken stone to be clean, hard and durable.

Pit run gravel not to be used under any circumstances.

Mix 1:2:4. Concrete to consist of one part cement, two parts sand and not to exceed four parts of broken stone or screened gravel rejected by a quarter inch screen and passing a one inch screen.

Mix 1:2:3. Concrete to consist of one part cement, two parts sand and not to exceed three parts of broken stone or screened gravel, rejected by a quarter inch screen and passing a three quarter inch screen.

All proportions to be measured by volume.

A neat mixture to be used, well spaded so the forms to give a smooth surface and to insure close contact with the reinforcing bars.

The reinforcing bars to be spaces as formed, at the size indicated on the plans. Special care is to be taken to place bars exactly in the position indicated on the plan, and securely wired or tied intersections. All bars to be wired in place before concrete is placed.

Forms to be built tight and substantial, dressed lumber to be used on all exposed faces and use tack corner strips to be used at all exposed corners.

Construction Joint permissible only where shown on the plan.

Forms shall not be removed until permission is given by the engineer. Generally the forms shall not be removed within thirty days of the time the concrete is placed.

Bridge not to be subject to loading until forms are removed.

For complete specifications for material and workmanship see:

STANDARD REINFORCED CONCRETE GIRDER SPAN

CLEAR SPAN 40 FT. ROADWAY 18 FT.

SEC. ____ T. ____ N.-R. ____ W.

COUNTY

Approved:

Bridge Engr. — State Engr.

SHEET ___ OF ___ SHEETS