GEOLOGICAL SURVEY OF KENTUCKY.

N. S. SHALER, DIRECTOR.

A REPORT OF A RECONNOISSANCE

OF A PART OF THE

BRECKINRIDGE CANNEL COAL DISTRICT,

BY CHARLES J. NORWOOD.

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INTRODUCTORY LETTER.

Professor N. S. SHALER, *Director Kentucky Geological Survey:*

DEAR SIR: In accordance with your instructions, I herewith present a report of a reconnoissance, made in 1875, on that part of the "Breckinridge Cannel Coal" district (lying partly in Breckinridge county and partly in Hancock county) which is known as the property of the "Cloverport Coal and Oil Company."

This report is largely a rearrangement of one made, by your direction, to Col. J. C. Johnston, of Louisville, Kentucky. As that report was partly written in the field, however, and within a limited time, some of the facts were not so carefully weighed as otherwise would have been done. A more careful study of my notes has shown the necessity of modifying some parts of that report, and some new matter has been added, so that, although largely a rearrangement of the one furnished Col. Johnston for his immediate information, this report may be regarded as more accurate and complete. The changes made, however, are comparatively few, and, under the circumstances, do not materially alter the value of the former estimates. Some new computations (based on a more recent determination of the specific gravity of the coal) have been made for the estimated amount in tons of the coal underlying the lands. This, to a certain degree, affects the estimate for the possible total income which may be derived from the property; but the effect would be apparent only in the future.

The work of computing the probable income which may be derived from mineral lands is always subject to revision, and, as in the present instance, serves rather for illustration than as a strict mathematical fact.

The yearly income is necessarily dependent on the price that the coal will fetch in the various markets. These prices fluctuate, and, as a consequence, an estimate made now for the probable income, using the present market value of the coal as a basis for computation, would be subject to revision at any time.

This, however, does not alter the value of the estimates for the use of those having experience in such matters.

The estimate for the cost of mining, etc., is subject to little change on account of fluctuations, and remains as given when the report was originally prepared.

Respectfully,

C. J. NORWOOD.

REPORT OF A RECONNOISSANCE OF A PART OF THE BRECKINRIDGE CANNEL COAL DISTRICT.

I.

DESCRIPTION OF THE PROPERTY, ETC.

According to the data furnished me, it appears that the various boundaries of the property of the Cloverport Coal and Oil Company inclose about 7,224 acres, lying southwardly from Cloverport, as represented in the following statement:*

In fee-simple	4,744	acres.
Mineral rights in perpetuity	1,970	"
Cloverport town and river property, on which stand the old factories and accessory buildings, the Superintendent's cottage, and "Cairn's Castle,"	60	"
The "Crawford" farm	436	"
A lot on the railroad	2	"
Railroad rights of way	12	"
Total	7,224	"

"The 'Crawford' farm is detached, lying about one mile and a half east of the principal body of the estate, which includes about 6,500 acres."

The especial value of the section examined lies in the deposit of cannel coal which is found on it. Several "entries" were driven by the "Breckinridge Cannel Coal Company," a number of years ago, for working the coal.† If the report is correct, these mines were at one time operated by their former owners solely for the manufacture of illuminating oil from the coal.

*Cloverport is on the Ohio river, 260 miles below Cincinnati. It is 110 miles below Louisville, 190 miles above Cairo (which is at the junction of the Mississippi and Ohio rivers), and 1,182 miles above New Orleans.

†The amount of coal removed by that company was, so far as can be learned, comparatively little. A report has been circulated somewhat to the effect that the deposit has been practically exhausted; but I have been unable to verify it in any way. There is in Col. J. C. Johnston's possession a map, said to be authentic, exhibiting the area of coal removed up to the time that the mining was suspended. Their condition was such that the old entries could not be surveyed when I visited them.

From a report of the directors, issued in pamphlet form, it is learned that the erection of the oil works was commenced by the Breckinridge Coal and Oil Company in the autumn of 1855, and that in April, of the following year, twelve retorts were in operation, producing from 600 to 700 gallons of crude oil daily. In June, 1856, that company and the "Breckinridge Cannel Coal Company" consolidated; following which, an extension of the works was undertaken, and, in the succeeding year, eighteen additional retorts were put in place.

All of the apparatus about the works was the best of its kind; and, had not the discovery of natural oils been made, there is little reason to doubt that a prosperous business would have followed.

Disastrous fires, the discovery of petroleum, and the commencement of the war between the States, all happening near together, however, caused the abandonment of the works till now, when, if the matter is correctly understood, it is desired to establish a colliery at the old mines, and mine the coal for general exportation.

Some knowledge of the extent of the cannel coal bed, incidentally taking into consideration the general worth of the property, and the estimated cost of placing the mines in working order once more, was accordingly desired.

Having a pressure of work in another direction, the time that could be given to this matter was limited, and was not sufficient for me to enter into such detailed explorations as would be desired for the preparation of a complete statement. So far as they were extended, however, the observations were such as would impress the observer with a high sense of the worth of the lands.

The surface of the region is naturally varied, according to the character of the underlying beds. Towards the Ohio river a sandstone is usually the first bed below the surface, and, as a consequence, there is a considerable proportion of comparatively flat or undulating surface in that direction; the same conditions are also found along some of the streams in the interior. The larger part of the property, however, is

hilly, the hills frequently rising rather sharply from the lowlands.

The tops of the hills are frequently "rolling," and furnish a few admirable localities for farms. A large proportion of the land, however—especially where, in the immediate vicinity of streams, the shale beds of the Sub-carboniferous Group are the first ones below the surface—is too broken to be desirable for farming purposes.

The most prominent feature in the geography of the region is a long, irregularly trending ridge, which passes southwardly through the property. It is said to vary from one quarter of a mile to two miles in width.

This ridge forms the water-shed for the region near it, and has a distinct value, not only topographically but geologically, as within its structure the bed of cannel coal is contained. Accordingly, to know the true form of the ridge becomes very necessary in order to determine with accuracy the extent of any of the beds contained within it. Until this shall be done, all work in that direction is, of necessity, estimative.

II.

AGRICULTURE.

The agricultural aspects of the property are fair, certain portions of the land being fairly well adapted for the growth of small grain, while some parts serve admirably for the production of tobacco. It may be said that, as a whole, this region will compare favorably with the general class of lands, with like geological conditions, in the southwestern portion of the State, for the growth of corn and tobacco—the staple products of Western Kentucky.

There are two sorts of soil to be distinguished within the limits of this property: that on the hills has, usually, a sandy composition, while that in the lowlands is, in a large measure, calcareous.

Although it is somewhat in advance of the regular order of the report, it seems proper at this place to call attention to the green and reddish marly shales, which are found on certain

parts of the estate or in the vicinity, overlying the great sandstone which occurs first above the massive limestone of the Sub-carboniferous series. These shales or marls are valuable, and are worthy of much consideration, as they bid fair to prove most admirable fertilizers for some of our impoverished tobacco lands. Their geological position is in the Chester Group, and they are found, wherever it is well developed, over a large portion of the western part of the State. They are undoubtedly destined to become quite valuable to Kentucky farmers, especially to tobacco-growers; and it is possible that they may form the basis for a large manufacturing interest.

The marls are wonderfully rich in *potash* and *soda*, and for that reason they possess properties which, when their proper treatment shall be determined upon, should render them unexcelled for fertilizing worn-out tobacco lands. Tobacco extracts proportionately more potash than any other material from the soil; so that, in order to restore its former vigor to the soil, it becomes necessary to supply it with the substance in one of two ways: either with the potash in an uncombined condition, or with some mixture holding a large proportion of that material.

These marls may be used with benefit by simply spreading them thinly over the surface in the form that they are found in the bank, allowing the coating to remain on the ground throughout a winter, and then turning it in with the soil in the spring. It has also been suggested that they may be roasted in a kiln with lime. The advantage to be derived from such treatment would lie in the increased amount of potash, etc., that might then be taken from the mixture, within a certain time, by the simple atmospheric agencies, and mingled with the earth.*

Especial attention has been directed to these marls by Prof. Shaler and the chemists of the Survey. Should the experiments undertaken by Mr. Talbutt, for the purpose of testing

* For further discussion of the question, see the biennial report of the Director of the Survey.

the practicability of making the marl an article of commerce, prove successful, this point would be a desirable one from which to make shipments, being, as it is, within easy reach of water transportation. The marl beds are not distant more than two miles from the Ohio river, and may be found even nearer. At "Buffalo Lick," which, however, is not on this property, the marls are especially thick.

These marls are wonderfully alike in their composition, so far as yet known, wherever they are found in Western Kentucky. Unfortunately a sample of the marl in this region, although collected, was lost; but the following analysis, made by the chemists of the Survey, of a sample collected from Haycraft's Lick, Grayson county, will serve to show what may be expected from the marl in this region:*

COMPOSITION, DRIED AT 212° FAHRENHEIT.†

Alumina, iron, etc., oxides	27.811
Lime carbonate	.880
Magnesia	.824
Phosphoric acid	.109
Potash	5.554
Soda	.657
Water and loss	4.245
Silica and insoluble silicates	59.920
Total	100.000

According to the statement made by Captain William H. Pitts, there are already fifteen or twenty farms on the property of the company, each farm being provided with dwelling-houses and the necessary farm-yard buildings. The number of acres under cultivation was not learned.

TIMBER.

The larger portion of the property (that not under cultivation), is covered with a healthy growth of timber, including white oak, black oak, red oak, pin oak, and chestnut oak, poplar, ash, elm, sugar-tree, maple, linn, cherry, sweet gum, etc.

*Samples of the marl were placed on exhibition in the Kentucky Department of the International Exhibition at Philadelphia.

†The partial results of Mr. Talbutt's investigations have been made public through the columns of the *Kentucky Yeoman*, Frankfort, Kentucky.

This forest supply is an item of much importance, and should be duly regarded, as our forests of oaks (especially of the white and chestnut varieties) are yearly becoming more valuable. Considering the demand there is for timber at Evansville, Indiana, and at other points on the Ohio river, it seems remarkable that so little has been removed from this section.

III.

THE COAL, ETC.

As previously stated, the chief value of the property is derived from the bed of cannel coal which underlies certain parts of it. The cannel bed is not the only coal found on it, however; on the contrary, there is certainly one distinct bed of bituminous coal above the cannel bed—possibly more. There seem to be possibilities, also, that an iron ore of good quality is to be obtained on the land, or within a short distance of its limits. In examining a collection made by Major Atkinson, said to have been collected entirely on this property, samples of very admirable limonite, similar to the Subcarboniferous limonite worked in Trigg county, this State, were observed. No evidence, however, more trustworthy than this was obtained indicating the existence of any valuable ore deposits on the estate. It is not at all improbable that the specimen in Major Atkinson's collection was obtained in the ore region bordering the Cumberland river, and was present in the collection by a mistake.*

As originally written, an attempt was made in this report to give an approximate section of the more important beds in

*Since this report was written, this region has been examined by Mr. P. N. Moore—having come within the limits of his survey of the section along the eastern face of the coal field. It has accordingly been more thoroughly studied by him than by me; and the questions concerning the existence of ores in the region; of the form, height, and extent of the ridge, which has been mentioned on a preceding page, and the details of the structure of the ridge, are properly ones to be treated of in his report. It is to be hoped, also, that Mr. Moore's examinations, being more final in their nature than were mine, may have served to determine with accuracy the general character of the cannel bed; whether it preserves its condition as a cannel throughout its extent in this region, or merges into bituminous coal at some point beyond that reached by those openings that have been made in it at the mines; it may also have been possible for him to determine more definitely the extent of the bed, and hence the acreage of the coal. (April, 1877.)

the ridge which forms the central point of interest in the region. Subsequent considerations, however, have rendered it inexpedient to make the attempt a matter of record; accordingly, the following statement is an approximate section of only those beds underlying, and including, the cannel coal:

1. Cannel Coal . . . . . 22 inches to 3 feet 2 inches.
2. Sandstone and Shale, about . . . . . 40 "
3. Limestone and Shales ("Chester" beds), about . . . . . 110 "
4. Massive Sandstone (base of Chester Group), about . . . . . 60 "
5. Massive Limestone (St. Louis Group).

For want of an accurate map, it is impossible to locate the various coal outcrops.* Bituminous coal has been found at several localities on the estate. At present, however, the bituminous coal has little commercial value; but seems to serve more especially to indicate the probable presence of the cannel bed.

It is probable that no cannel, the "Boghead" of Scotland (which, in fact, is not a true cannel) excepted, has received more general attention than that which has been bestowed on the bed found in this region; its remarkable general character and its quality as a gas enricher have already been discussed in some detail in former geological reports on Kentucky, and in kindred works.

The coal is remarkably dense in structure and tenacious; vigorously resisting cross-fracture, although cleaving with tolerable facility in the direction of the laminæ. Its character is such, in fact, that the coal stands handling and weathering more than ordinarily well, sustaining thereby little loss in bulk either in mining or transportation.

In Gesner's work on coal oils† attention is drawn to the curious fact that, although analysis proves the Boghead cannel to have the largest per centage of volatile matters, the

*A map, prepared by a gentleman who had formerly examined these lands, was furnished me when in the region, and an attempt was made to use it when this report was originally prepared. Its imperfections are so apparent, however, that it has proved to be of little service. A correct map of the region has been made by Mr. Wm. Byrd Page, Topographical Assistant to the State Survey, in the course of the later investigations in the section, and may be issued at an early date. (April, 1877.)

†New York: Bailliere Brothers, 1865.

coal actually produces *less oil* than does the Breckinridge article.

The following is a comparison made by Gesner of the two coals: The Boghead cannel yields 120 gallons of crude oil to the ton, from which are obtained 65 gallons of illuminating oil, 7 gallons of paraffin oil, 12 pounds of paraffin—equal to about 84 gallons of marketable oils.

The Breckinridge coal yields 130 gallons of crude oil to the ton, from which are obtained 80 gallons of illuminating oil and 12 gallons of paraffin oil—making 92 gallons of marketable oils. Other products, such as aniline, benzole, etc., not uncommon to coals, are to be obtained from the cannel.

The extraordinary value of the coal for the manufacture of illuminating oil may be appreciated, when the fact is remembered that a coal which will yield 60 gallons of crude oil, or 40 gallons of refined oil to the ton, is regarded as an excellent article.

In fact, excepting the natural reservoirs of petroleum, the Breckinridge cannel undoubtedly offers one of the most productive sources yet known for the distillation of illuminating oils, and should it be necessary in the future to again manufacture our oil from coal, this article will be of very great value.

For the present, however, the especial and decided value of the coal depends upon its quality as a steam fuel and gas producer. This value is fairly indicated by the following analyses:*

* The differences between the analyses are probably, in a large degree, due to a difference in the samplings. The quality of any coal bed is variable according to the conditions existing in its various parts; to equalize this, by making an average of its quality as found at different parts of the bed, should be the aim of the one who takes the samples; this is very difficult to do in the case of cannel coal. Everything considered, the analyses do not compare unfavorably with each other.

Composition.	No. 1.	No. 2.	No. 3.
Moisture	1.30	1.44	.64
Volatile combustible matter	54.40	62.40	61.30
Fixed carbon	32.00	28.20	30.00
Ash	12.30	7.96	8.05
Total	100.00	100.00	99.99
Specific gravity	1.318	1.339	.....
Analyst	Peter.	Owen.	Gesner.

The amount of sulphur in Nos. 1 and 2 was undetermined; in No. 3 there was a trace.

These analyses (at least Nos. 1 and 2) were made quite a number of years ago; and the probabilities are, that in no case was an attempt made to procure fairly *averaged* samples of the coal—as was the case with the larger part of the tests made in those days to ascertain the quality of coals. The analyses were probably made from specimens which were collected without due regard being had for possible changes in the character of the bed at different places.

It is probable that, of the three analyses, No. 2 may be considered as the best fitted for general application. It is an average of *four* analyses made by Dr. D. D. Owen, and published in one of the volumes of his geological reports on Kentucky. Dr. Robert Peter mentions, in the report from which analysis No. 1 is taken, that the per centage of sulphur obtained in one air-dried sample of the coal was 2.433. This, however, is undoubtedly too high a per centage for the average amount of sulphur in the coal.

When this report was first written, the only available analyses of this coal (within my knowledge) were those which have been presented. Since then, however, an analysis, made by the chemists of the Survey, of a sample collected by myself, has been obtained. It is here presented, with the belief that it will be found to be a fairer indication of the *general* quality of the coal than any of those analyses previously given:*

* For the purpose of comparison, a set of analyses of other cannels is appended to this report.

Specific gravity	1.213	
Moisture	1.30	
Volatile combustible matter	59.60	
Fixed carbon	27.00	Coke 39.10.
Ash	12.10	
Total	100.00	
Sulphur, two determinations	1.890 and 1.903	

The quality of the coal as a gas *producer* is fully indicated by the above analysis, although the value of the gas, measured by its candle power, is yet to be determined. The fact of its great value as a producer of gas has also been proved by a practical test—considerable quantities of the coal having been at one time shipped to New York, and sold there at the rate of $15 and upwards the ton for enriching gas. It is in view to have photometric tests made of the gas produced from the coal, which, it is believed, will prove satisfactory.

IV.

THE EXTENT AND TONNAGE OF THE COAL.

An essentially important point to be determined in the inquiry concerning this coal is its acreage. The importance of a good map, showing the details of the topographical features of the lands, was very apparent when the reconnoissance was made. With the assistance of such a one as should be prepared, it would have been comparatively easy, it is believed, to lay down the area of the bed with some accuracy; but without it, especially since the examinations were not so thorough as would be desirable, all computations as to the acreage of the coal are necessarily *estimative*, and are to be regarded only as such.

From the testimony of others and from personal observations, it is believed that about 4,000 acres may be roughly assumed as the number which are, in all probability, underlaid by the coal; which would include an area of about six square miles.* In making this estimate the "Crawford" farm and

*It is very important for it to be understood that this estimate is based on the condition that the deposit is a true bed, and but little more subject to abrupt changes than is usually the case with coal beds. That this is true for the bed, *as a bed*, there is little doubt, at least so far as concerns this area; but the question concerning its constancy as a bed of cannel, whether at some places it may or may not merge into bituminous coal, is not considered. It must be borne in mind that the work was preliminary, and that the results are to be considered as preliminary to other work, hence on this point (especially), and kindred ones, the writer does not feel prepared to give his opinion unqualifiedly.

the "town property" (a total of 496 acres) are excluded; no coal will be found on the latter land, and very little is known concerning the former.

Whether this coal is to be found beyond the limits of this property is a question of much interest in the neighborhood. At present, any views in that connection must necessarily be based entirely on conjecture.* It may be well to quote, however, from the impressions recorded when this report was originally outlined: "Although unprepared with any absolute data concerning the question, the opinion that it may be found towards the southwest and west for a limited distance, provided the geographical conditions are favorable, may not be altogether improbable. There is undoubtedly a considerable gap in the extent of the bed beyond the boundaries of this property, and the quality of the coal may deteriorate—the bed may merge into bituminous coal. It is not probable that its quality will improve. The cannel does not seem to extend very far in any direction beyond the boundaries of the particular section under consideration, as the coal found elsewhere, which is thought to occupy the same relative position as the cannel bed in this district, is of the 'bituminous' kind."†

The thickness of the coal varies from twenty-two inches to thirty-eight inches, and the bed is reported to have occasionally measured forty-four inches in thickness. It is, therefore, a difficult matter to accurately determine the number of tons of coal to the acre. It is stated by trustworthy men, that the thickness of the bed is oftener three feet than two feet; it seems more prudent, however, to underrate than to overestimate the tonnage; accordingly, the average of the measurements (two and a half feet) is used as the basis for calculation.

* The truth of this was particularly impressed upon me by a journey made from Cloverport to Hawesville in the spring of 1876. At this time it seems extremely improbable that the bed, as a cannel coal, extends much beyond the west limits of the Cloverport Coal and Oil Company's property. (April, 1877.)

† For more specific information on this point, the reader is referred to Mr. Moore's forthcoming report on this region. The more accurate results obtained by him in his study of the district may have been sufficient to determine the full extent of the bed, and to solve the questions concerning its general character. (April, 1877.)

With a specific gravity of 1.213, which is the specific gravity indicated by the analysis of the samples analyzed by the chemists of the present Survey (see page 14), a thickness of 2½ feet would produce 3,685.7 tons to the acre, or 14,742,800 tons for the 4,000 acres (using the ton of 2,240 pounds), should that area prove to be underlaid by the cannel. Assuming a smaller acreage for the coal, however—for instance 3,250 acres—the result would be 14,374,230 tons, measuring the thickness of the bed at 3 feet; which, under the circumstances, would seem allowable. According to this computation, the coal would last for 287 years, with an annual output of 50,000 tons.*

V.

THE COST OF PRODUCTION.

The present price paid for mining is one ($1) dollar the ton *to the miner*. To this may be added seventy-five cents the ton to cover all additional expense incurred in removing the coal from the mine and placing it on barges on the Ohio river at Cloverport.

The towage to New Orleans, so I am informed by coal-shippers, may be placed with safety at not more than seventy-five cents the ton. Should the mine-owners have their own barges and tugs, however, the freightage would be less.

The total cost per ton of the coal, when arrived at New Orleans, may then be represented thus:

Amount paid for mining	$1 00
Amount paid for removing from mine and placing on barges	75
Towage to New Orleans	75
Assumed amount to cover all incidental expenses—insurance, etc.	50
Total cost, delivered at New Orleans	$3 00

* Without the aid of a large number of determinations of the specific gravity, there is always a certain degree of approximation which enters into the calculations for the tonnage of coal—even when a certain thickness of the bed is assured. When this report was first prepared, the only analyses to be obtained of this coal were those presented on page 13, and 1.339 was taken as the specific gravity—that being the result of four determinations by Dr. D. D. Owen. It is deemed proper, therefore, to present the calculations based on that determination, as they were embodied in the original report. With a specific gravity of 1.339, a thickness of 2½ feet of coal would produce a fraction more than 4,023 tons to the acre, or 16,095,658 tons for 4,000 acres. Assuming 3 feet as the thickness of the bed, 3,250 acres would produce 15,833,250 tons of coal; and, according to this calculation, the coal would last 316 years, with a yearly yield of 50,000 tons.

The cost of handling and selling the coal at New Orleans was not learned. It may be confidently estimated, however, that $3.25 the ton will fully cover all manner of expenses which may be incurred in mining and vending the coal. It is not improbable, indeed, that it is an overestimate.

The cost of carriage from New Orleans to Liverpool was not definitely learned. It is believed, however, judging from information received from Mr. Wm. Creevy, of New Orleans, that, at certain seasons of the year, the coal may be landed at Liverpool, direct from the mines, at a total cost of from $5.25 to $6.25 the ton—possibly less.

It does not seem at all necessary, however, to look to England for the disposition of the coal. There is no reason why all that may be mined in a year may not be sold in this country—in the towns lying along the Mississippi river, in New Orleans, and in New York. In fact, its quality as a gas producer is such that, were it placed in the market, New York alone should consume a large proportion of the output.

ESTIMATES FOR THE INCOME.*

The coal may be carried to New York *via* New Orleans at a cost of about $5.00 the ton from New Orleans, or $8.25 the ton direct from the mines (including the cost of mining, etc.), and sold there for from $10.00 to $15.00 the ton—an average of $12.50.†

Were all the coal sold at the rate of $12.50 the ton, which is believed to be rather under than above an average price, there would be a net profit of $4.25 per ton. Multiplying this by 50,000, the assumed number of tons vended in a year, we obtain $212,500 as the annual income from the coal alone.

This simplified reads:

Gross returns from 50,000 tons, at $12.50 the ton	$625,000
Less cost, at $8.25 the ton	412,500
Total annual profit	$212,500

*This is a matter which is entirely estimative, and is of more value as a graphic illustration of the possibilities of the estate than as a strict mathematical fact. The estimate was made at the request of Col. Johnston.

†These prices fluctuate, of course; but a careful comparison of many "prices current" reports justifies this estimate.

To this may be added rental from some fifteen or twenty farms; not knowing the amount of income from them, however, it is not taken into consideration. Appended to this report is a letter from Mr. Creevy, of New Orleans, giving further information concerning the market price of cannel coal in Liverpool, New Orleans, and New York.*

Just at what sum the property is valued I am not informed. Supposing, however, that a capital of $500,000 be raised for its purchase, with the expectation of the purchaser recovering the amount in twenty-five years, the following would exhibit about the amount on which a yearly dividend might be declared:

Annual income from 50,000 tons of coal	$212,500
Less amount to be set aside annually (bearing interest at 6 per cent.) to reinstate the capital—about	18,875
Net income	$193,625

This would be about 38.7 per cent. on the original capital.†

VI.

THE MINES.

The mines from which the coal used by the Breckinridge Coal and Oil Company was taken are located near the centre of the property, at Bennettsville—the name given to the mining village about eight miles southwardly from Cloverport.

There are at this place eleven dwellings worthy of restoration; to do which would cost, on an average, $200 to each house—making a total of $2,200 as the cost for repairing the eleven.‡ In addition to these dwellings, there are (at the mines) an engine-house, in good order, with stalls for two engines; an office, a scales-house, a large building used for a school-house and "lodge-room," and a barn and stables for the bank mules.‡

At the factories, on the river, there is a cottage used by the superintendent, valued at $2,500; a tenement row, valued at

*See Appendix "A."

†The actual amount of coal mined in a year may, and very probably would, fall very short of 50,000 tons. It will be understood that such a basis for calculation is used altogether for convenience, the actual yield being determined entirely by circumstances.

‡See Appendix "B."

$5,000; and "Cairn's Castle" (a dwelling which cost in its unfinished condition $11,000), valued at $5,000. The remaining buildings and materials are, under the circumstances, valued at no more than $2,000.

The mines were connected with the river by a broad-gauge railway, seven and a half miles in length. The line is now in a very poor condition, the trestling and cross-ties having rotted away. The road-bed, however, is in comparatively good order, requiring but little work to make it ready for a narrow-gauge track. The track as originally constructed was a poor affair, consisting merely of wooden stringers, banded with iron, laid across the cross-ties. It will be seen that the estimate for rebuilding the road calls for no articles but those of the best quality.*

The mines consisted of sixteen (16) adits driven in the hill high above water level; only one is now working, and that chiefly for the purpose of supplying steamboats with coal for torches, etc. Taking into consideration the length of time they have lain without attention (nearly fifteen years), the entries are in a fair condition; many of them, so far as may be seen, needing but little work to reopen them. Some, however, are choked up with débris which conceals their interior condition. As the roof is a sand rock, however, it is believed that most of the material has come from near the entrance, and that further back the entries are comparatively clear. Water was standing in nearly all of the drifts (except the one now working), kept there by the banked up débris at their mouths. From all that could be gathered concerning it, it would seem that the question of drainage is of small moment, as the entries are so located that they may be kept clear of water with comparative ease.

THE COST OF REOPENING THE ENTRIES, ETC.

The cost of reopening the mines and arranging everything in working order once more would be about as follows:†

*See Appendix "C."

†See Appendix "C" in part.

Reopening fourteen entries, at $100 each	$1,400
One hundred bank cars restored	1,500
One pair track scales	1,000
Repairing incline and drum-house	1,500
Repairing ten houses at the mines	2,000
Hoisting engine and rigging for drum-house	4,500
Re-establishing the railroad	83,617
Incidentals	1,000
Total	$96,517

Reference is made to the careful estimate prepared by Captain William H. Pitts, which is appended to this report, for the details required in rebuilding the railroad.

In conclusion, it may be stated that, although this statement may seem crude in some of its parts—due in a large measure to the limited time that was allowed wherein to collect data—it has been the endeavor to give no more than simple facts concerning the property. I was not so fortunate in obtaining estimates as was desired and expected; accordingly, those given may not be so complete as possibly may be generally desired.

APPENDICES.

APPENDIX A.

LETTER FROM WILLIAM CREEVY, ESQ.

"NEW ORLEANS, October 19th, 1875.

"DEAR SIR: * * * * With regard to the selling price of coal in England, would say that it varies very much, as there are such a variety of qualities. The article known as 'English Cannel,' which assimilates very much in character to the 'Breckinridge,' sells at 16 sh. and 20 sh. per ton; and freight from Liverpool ranges from 12 sh. to 15 sh. per ton. The article is not in general use in this market on account of the price; it usually commands $12 to $15 per ton. With regard to the cost of transportation of coal to England, would remark, that I have never known a shipment from this country, although freight could doubtless be had at some seasons of the year, for the purpose of ballast, at $2 and $3 per ton.

"While agent for the 'Breckinridge Coal Company,' in 1853–'6, I shipped several cargoes of the coal to New York, at freight of $5 per ton; and the coal sold in that market for fuel purposes and as enricher of gas for $15 per ton and upwards.

"Since 1857, no Breckinridge coal was received at this point, and, in fact, no shipments were made from the mines. The company considered the coal too valuable for fuel purposes, and their attention was given to the manufacture of oil, etc. The coal in this market commands about the same price as English cannel, and I sold large quantities at $10, and in some instances, when the stock of coal was low, at $12 and $15 per ton.

"This market is now almost exclusively supplied with Pittsburgh coal, and the consumption of last year was put at 375,317 tons. The price depends very much on the supply, which is governed by the stage of water in the Ohio river. The average price for the past two years, at wholesale, about $4 per ton; at retail, about $6.50 and $7 per ton.

"Having lost all the books and memoranda connected with my agency of the 'Breckinridge Coal Company,' I am unable to furnish you with particulars. * * * * *

"Yours truly,

[Signed] "WM. CREEVY."

APPENDIX B.

LETTER FROM CAPTAIN WM. H. PITTS.

"CLOVERPORT, KY., September 24th, 1875.

"*Mr. C. J. Norwood:*

"DEAR SIR: I am in receipt of your favor of the 20th inst., and respond just as soon as I have been able to obtain answers to some of your questions; and regret that I can offer but meagre information.

"As regards your first question,* I can give you no figures. Major Atkinson and myself both endeavored last year to get data upon which to base an estimate of the amount taken from the mines, but such information as we did get was obtained by leading questions put to parties whose answers I considered only guess-work, although Major Atkinson made therefrom a map, which should be with those you have, and will give you as accurate an idea as anything I can give you.† You saw the condition the entries were in, and will readily see that at present a survey cannot be made.

"A list of articles at the oil works would require the work of two men a number of days to make, and avail little after it is made. The value of such old material as now remains is simply the amount it would bring if sold as such. All the carpenters here are, at present, engaged in the construction of a large tobacco warehouse, and I have not been able to get one of them to go to Bennettsville to make the estimate you desire; besides, I do not think any one of them is capable of giving an accurate opinion about the repairs necessary.

*This concerned the amount of coal that had been removed from the mines.—C. J. N.

†This map I found to be not of very practical value.—C. J. N.

"There remain at the mines, at present, some eleven dwelling-houses worthy of restoration. Three of these are occupied, and I believe, as an average, less than $200 each will place them in good repair. Besides these there is an engine-house, with stalls for two engines, which is in good order; also an office, scales-house, a large building used as a school-house and lodge-room, and a barn and stables for the bank mules.

"The Superintendent's cottage is valued at $2,500; the tenement row was only partially finished originally; now some seven of them are worth say $500 each, and as many more $300 a-piece. The other buildings at the works are not adapted to other use than the one they were intended for, and I therefore think, in view of their present condition, they are most valuable as old material, and as such are probably worth $2,000. The building known as the 'Castle' was not entirely finished when the work upon it was suspended; up to that time it had cost $11,000, I am told. Although it might not sell for so much, I believe it is worth $5,000 to any one who could spend $2,000 in repairs to it.

"In addition to the coal lands, of which you have maps and areas, the company owns the right of way for a railroad from Bennettsville to Cloverport, some seven miles in length, and fifty feet on each side of the centre line of the road.

"At the river there are some twenty-seven acres of land, to which must be added the castle lot, containing eight more. There are some fifteen or twenty farms in the outlying lands, the buildings upon which are log-houses, with necessary barns and outbuildings, the value of which we cannot estimate.

"There has never been a survey made of the cultivated lands, and I can't tell the number of acres they contain, nor have I had time to go and make an approximation.

"Since receiving your letter, I have talked with several miners, and they all agree in saying that, on the eight hour system, one ton per day to the man is about as much as can be relied upon for each miner to average.

"The price I am now paying is $1.60 per ton, the miner delivering the coal outside. I send you inclosed a copy of the railroad estimate; you will find therein some answers to your questions.

"The gauge of the old road was four feet eleven inches, and of course any one under this can be adopted, and will not change materially the aggregate amount.

"The prices affixed for iron, spikes, cars, engine, etc., are quotations from reliable firms, and are of late date; and the other prices are rather over than under, and everything to be first-class of its kind. There are one or two items omitted, for the reason that we can supply them from what we have on hand.

"Regretting my inability to give you more accurate answers, * * * * * * *

"Respectfully yours,

[Signed] "WM. H. PITTS."

APPENDIX C.

ESTIMATE OF COST OF RE-ESTABLISHING THE CLOVERPORT COAL AND OIL COMPANY'S RAILROAD, ETC.

8 miles grading, ditching, and surfacing, at $500 per mile	$4,000
19,000 cross ties, at 20 cents each	3,800
17,000 cubic yards of stone ballast	8,500
3,700 lineal feet of trestling, at $3 per lineal foot	11,100
43 culverts restored, at $50 each	2,150
380 tons T rails, 30 lbs. per yard, at $56 per ton	21,280
3,168 fish-bar joints, at 60 cents each	1,908
297 kegs of rail spikes, at $7 per keg	2,079
35 coal cars, at $200 each	7,000
2 flat cars repaired, at $200 each	400
1 locomotive engine, delivered	7,500
100 bank cars restored, at $15	1,500
2 turn-tables	1,500
Laying track	1,500
Water-tanks	1,900
Track scales	1,000
Repairing incline and drum-house	1,500
Reopening entries to mines, at $100 each	1,400
Repairing 10 houses at mines, at $200 each	2,000
Engineering expenses	3,000
Engineering instruments, stationery, etc.	1,000
Contingencies, freights, etc.	5,000
Total	$91,017

[Signed] WILLIAM H. PITTS, C. E.

APPENDIX D.

TABLE OF SPECIFIC GRAVITIES OF COAL, WITH COMPUTATIONS FOR THE CORRESPONDING NUMBER OF TONS IN ONE ACRE AND ONE HUNDRED ACRES.* PREPARED BY C. J. NORWOOD.

Specific gravity.	1 acre.	100 acres.	Specific gravity.	1 acre.	100 acres.
1.01	1,227.55	122,755	1.21	1,470.63	147,063
1.02	1,239.70	123,970	1.22	1,482.78	148,278
1.03	1,251.86	125,186	1.23	1,494.94	149,494
1.04	1,264.01	126,401	1.24	1,507.09	150,709
1.05	1,276.17	127,617	1.25	1,519.25	151,925
1.06	1,288.32	128,832	1.26	1,531.40	153,140
1.07	1,300.47	130,047	1.27	1,543.55	154,355
1.08	1,312.63	131,263	1.28	1,555.71	155,571
1.09	1,324.78	132,478	1.29	1,567.86	156,786
1.10	1,336.94	133,694	1.30	1,580.02	158,002
1.11	1,349.09	134,909	1.31	1,592.17	159,217
1.12	1,361.24	136,124	1.32	1,604.32	160,432
1.13	1,373.40	137,340	1.33	1,616.48	161,648
1.14	1,385.55	138,555	1.34	1,628.63	162,863
1.15	1,397.71	139,771	1.35	1,640.79	164,079
1.16	1,409.86	140,986	1.36	1,652.94	165,294
1.17	1,422.01	142,201	1.37	1,665.09	166,509
1.18	1,434.17	143,417	1.38	1,677.25	167,725
1.19	1,446.32	144,632	1.39	1,689.40	168,940
1.20	1,458.48	145,848	1.40	1,701.56	170,156

APPENDIX E.

ANALYSES OF VARIOUS CANNEL COALS.

Following are analyses of several cannel coals, some of them being well-known ones, for comparison with those made of the Breckinridge coal:

Number of analysis	1	2	3	4
Moisture	1.50	1.20	3.53	0.94
Volatile combustible matter	52.20	58.80	48.30	52.38
Fixed carbon	40.60	35.30	42.39	35.54
Ash	5.70	4.70	5.78	11.14
Total	100.00	100.00	100.00	100.00
Coke	46.30	40.00	48.17	46.68
Sulphur	0.780	not est.	not est.	1.423
Specific gravity	1.306	1.180	not est.	1.280
Analyst	P. and T.	P. and T.	C. and B.	P. and T.

*The thickness of the coal is reckoned at one foot, and the ton used is the one of 2,240 pounds. The table will also serve for other materials than coal.

Number of analysis	5	6	7	8
Volatile matter*	43.37	49.6	70.10	58.52
Fixed carbon	46.50	41.3	10.30	25.28
Ash	10.13	9.1	19.60	14.25
Total	100.00	100.0	100.00	98.45
Specific gravity	1.27	1.228	not est.	1.1831
Analyst	Johnson.	. . . . .	Gesner.	. . . . .

* Includes "moisture." Sulphur not determined.

Analysis No. 1 is of the "Hunnewell" cannel, Kentucky; No. 2, Frozen Creek cannel, Breathitt county, Kentucky; No. 3, Saline county, Missouri, cannel (used at the St. Louis gas works), analyzed by Chauvenet and Blair; No. 4, George's Branch cannel, Breathitt county, Kentucky; No. 5, Kanawha cannel, Virginia; No. 6, Lesmahago cannel, Scotland; No. 7, Boghead cannel; No. 8, Weym's cannel.

All analyses indicated as made by "P. and T." were made by Dr. Robert Peter and Mr. John H. Talbutt, Chemists for the Geological Survey.

For proper comparison with the last four analyses, it should be remembered that the total volatile matter indicated in the analysis of the Breckinridge coal amounts to 60.90 per cent., or 9.20 per cent. less than in the Boghead cannel coal.