

served, all the lock-walls have been torn down to their foundations for the sake of the stone of which they were built.

The outlay of \$372,520 was therefore lost, as none of the work done was of any benefit to the Licking River.

March 9, 1868, commissioners were appointed by the State of Kentucky to ascertain the cost of removing the mill-dams and other obstructions from the mouth of the river to Mason's Branch, in Magoffin County. The removal of the mill-dams soon followed.

Your obedient servant,

C. SCHENK,
Assistant Engineer.

Col. W. E. MERRILL,
Major, Corps of Engineers, U. S. A.

APPENDIX A.

REPORT OF MR. SYLVESTER WELCH, CHIEF STATE ENGINEER, TO HON. WILLIAM OWNSLEY, PRESIDENT OF THE BOARD OF INTERNAL IMPROVEMENT OF KENTUCKY.

ENGINEER OFFICE,
Frankfort, September 15, 1836.

SIR: In obedience to an order of the board of internal improvement, dated June 11, 1836, directing surveys and examinations to be made of the Licking River, and a report to be made as soon as the survey should be completed from the mouth of the river to Falmouth, I have the honor to submit the following statement, together with an estimate in detail, by N. B. Buford, esq., resident engineer, of the locks and dams necessary to make a slackwater navigation to Falmouth.

The Licking River, from the mouth up to the Lower Blue Licks, a distance of 98 miles, has a deep bed of nearly uniform width. There is generally on one side a bluff of limestone rock, which rises abruptly from the water; and on the opposite side an alluvial bottom, the surface of which is from 30 to 60 feet above the low-water plane. The bottom of the river is generally rock. The banks are regular, and the pools will average, when the dams shall be completed, about 400 feet in width below Falmouth and about 350 above. Between the Lower Blue Licks and the mouth of Slate Creek, the banks, so far as the river has been examined, appear to be more broken, and the bottoms or flats are not so high. Between the mouths of Slate and Beaver Creeks the bottoms are lower and wider than on the other parts of the river. From the mouth of Beaver Creek to the town of West Liberty the valley is narrow, and there is but little bottom land that would be injured by the erection of dams of any desirable height.

From the mouth of the river to Falmouth, 51 miles, the ascent is 80 feet, or about 19 inches in a mile; from Falmouth to the Lower Blue Licks, 47 miles, the ascent, as determined by the survey of Lieutenant Turnbull, in 1829, is 64 feet, or 16 1/4 inches in a mile; from the last-named point to the mouth of Slate Creek, 47 miles, the ascent is 56 feet, or 14 1/4 inches in a mile; from Slate Creek to West Liberty the river has not been surveyed. The distance is estimated at about 60 miles, and the ascent at 80 feet, or 16 inches in a mile.

The lower part of the river is susceptible of improvement for a navigation as large as that adopted for the Kentucky River. The pools will be wide enough to be navigated by common steamboats as far up as the Lower Blue Licks, and probably to the Sherburn Mills, if it should be deemed advisable to carry a large navigation to that point. Above this the river becomes too narrow and crooked for large boats.

There has been no time, during the present season, when the river has been down to what is called low-water, and no measures could be made to determine the minimum quantity it would furnish during a dry season. The smallest quantity which has been observed at Falmouth, above the entrance of the South Fork, was about 27,000 cubic feet per minute, or about five times the quantity which would be necessary for the purposes of navigation. It appears from the information obtained with regard to the water, that the supply will be abundant for the purposes of navigation during the driest seasons, as far up as the mouth of Slate Creek, and that there will at all times be a surplus on the lower part of the river. From Slate Creek to the North Fork, in Morgan County, the supply will probably be sufficient for a small navigation. Above the North Fork it may fail in the driest seasons, but there will be enough for navigation during the greater part of the year.

In forming a slackwater navigation, where the channel is as free from obstructions as the lower part of the Licking, the locks and dams constitute the principal items of expense. The cost of the dams will be nearly the same, whether a large or a small navigation is adopted. The expense of the locks will be greater for the large than for the small navigation. The whole cost of the improvement on any portion of the river will be nearly in proportion to the lockage. As the upper part of the river becomes smaller, the dams will be reduced in length, and the expense of constructing them

will be proportionally reduced; but the cost of the locks will remain the same where building materials are equally convenient.

Estimates are made for three kinds of navigation. The first with locks of the same dimensions as those adopted for the Kentucky River, viz, 175 feet long and 38 feet wide in the chamber; the second to have locks of half this width and 120 feet long in the chamber; the third to have locks 130 feet long and 25 feet wide in the chamber. The first estimate contemplates a large navigation from the mouth of the river to the Lower Blue Licks, and a navigation adapted to boats of half that size from that point to West Liberty. The second estimate provides for a navigation, with locks 130 feet long and 25 feet wide at the chamber, to be uniform throughout the whole extent of the improvement. The depth of water in all cases is supposed to be 6 feet.

In the plan proposed for the navigation below Falmouth there are five locks and dams below the South Fork and one at the town. This last dam will back the water up so as to give the required depth about 14 miles, making in all a navigation of 65 miles.

The sites for the dams and locks, as far as they are located, are represented upon the accompanying maps. The first dam is placed about 3 miles above the mouth of the river. Below this, some improvements are required in the channel. The Ohio River was too high during the time the examinations on the lower part of the Licking were in progress to permit a correct measurement of the work required to be taken; but the estimate made is believed to approximate near to what will be found the actual cost. Above the first dam, the only work required between the locks, below the Blue Licks, will be the removing of some of the timber from the shores.

A dwelling-house, with the necessary outhouses, will be required at each lock for a lock-keeper. The expense of each will be about \$1,200.

The amount of damages which will accrue to private property will be small. The supposed cost of land at the locks and dams, and the amounts which will be required to pay damages for mill property, &c., are included in the estimates.

ESTIMATED COST OF THE LOCKS, DAMS, AND OTHER WORK NECESSARY FOR A SLACK-WATER NAVIGATION ALONG THE LICKING RIVER, FROM THE MOUTH TO THE TOWN OF WEST LIBERTY, IN MORGAN COUNTY.

The locks below the Lower Blue Licks to be 175 feet long and 38 feet wide in the chamber; and the locks above that point to be 120 feet long and 19 feet wide in the chamber; the depth of water to be 6 feet.

Lock No. 1, 17 1/2 feet lift; dam, 450 feet long.....	\$120,771 00
Lock No. 2, 18 feet lift; dam, 450 feet long.....	117,451 00
Lock No. 3, 16 feet lift; dam, 350 feet long.....	100,200 00
Lock No. 4, 17 feet lift; dam, 425 feet long.....	102,176 00
Lock No. 5, 16 feet lift; dam, 400 feet long.....	102,865 00
Lock No. 6, 16 feet lift; dam, 350 feet long.....	97,156 00
104,250 bushels of hydraulic lime for locks and dam abutments, at 40 cents.....	41,700 00
Lock-houses and fixtures about them.....	7,200 00
Removing timber from the banks of the river, along a distance of 65 miles, at \$100 per mile.....	6,500 00
Damages to private property, including land for lock-houses.....	6,000 00
Improvements in the channel below No. 1, including the bar at the mouth of the river.....	15,000 00

Add for contingencies 3 per cent.....

	716,999 00
	21,510 00

Estimated cost of 65 miles of large navigation, including all expenses, \$11,361.67 per mile or \$7,343.35 per foot of lockage.....	738,509 00
Estimated cost of 33 miles of large navigation, extending from the head of the pool of dam No. 6 to the Lower Blue Licks, including all expenses; lockage, 40 feet, at \$7,000 per foot, \$280,000.....	280,000 00

Estimated cost of the large navigation from the mouth of the river to the Lower Blue Licks; distance 98 miles, lockage 140 feet.....	1,018,509 00
Estimated cost of 107 miles of small navigation, extending from the Lower Blue Licks to West Liberty, including all expenses; lockage 136 feet, at \$5,408.71 per foot lift, or \$6,874.57 per mile, \$735,580.....	735,580 00

Estimated cost of navigation from the mouth of the river to West Liberty, 205 miles, with 286 feet lockage.....

	1,754,089 00
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NOTE.—The cost of the five locks and dams, and other work necessary for the navigation (with locks 175 by 38 feet in the chamber) from the mouth of the river to Falmouth, will be \$628,138.

ESTIMATED COST OF A SLACKWATER NAVIGATION FROM THE MOUTH OF LICKING RIVER TO WEST LIBERTY, WITH LOCKS 130 FEET LONG AND 25 FEET IN THE CHAMBER, INCLUDING ALL EXPENSES, AS STATED ABOVE.

Lock No. 1, 17½ feet lift; dam, 450 feet long	\$95,385 00
Lock No. 2, 18 feet lift; dam, 450 feet long	94,046 00
Lock No. 3, 16 feet lift; dam, 350 feet long	78,474 00
Lock No. 4, 17 feet lift; dam, 425 feet long	81,150 00
Lock No. 5, 16 feet lift; dam, 400 feet long	83,167 00
Lock No. 6, 16 feet lift; dam, 350 feet long	77,771 00
74,800 bushels of hydraulic lime, for locks, dams, and abutments, at 40 cents	29,920 00
Lock-houses and fixtures about them	7,200 00
Removing timber from the banks of the river along a distance of 65 miles	6,500 00
Damage to private property, including purchase of land for lock-houses. Improvements in the channel below lock No. 1, including the rock-bar at the mouth of the river	6,000 00
Add for contingencies	15,000 00
	21,510 00
Estimated cost of 65 miles of navigation with locks 130 by 25 feet, \$9,171.12 per mile, or \$5,931.58 per foot lockage	595,123 00
Estimated cost of 140 miles of navigation (locks as above, 130 by 25 feet), extending from the head of the pool of dam No. 6 to West Liberty, including all expenses; lockage 175½ feet, at \$5,444.25 per foot lift	944,468 00
Estimated cost of slackwater navigation from the mouth of the river to West Liberty (with locks 130 by 25 feet in the chamber), 205 miles, with 286 feet lockage	1,539,591 00

NOTE.—The cost of the five locks and dams necessary for the navigation, with locks 130 by 25 feet in the chamber, from the mouth of the river to Falmouth, will be \$513,580.

From the information obtained relative to the quantity of water, it appears that there will be at each dam, on the lower part of the river, a surplus of at least 10,000 cubic feet per minute during the dryest part of the season, and at all other periods of the year a much larger quantity. As we proceed up the river, the quantity of surplus water will diminish; and above the mouth of Slate Creek there will be none in summer which can be depended upon for constant work.

All of which is respectfully submitted.

SYLVESTER WELCH,
Chief Engineer of Kentucky.

The Hon. WM. OWSLEY,
President of the Board of Internal Improvement of Kentucky.

APPENDIX B.

REPORT OF MR. N. B. BUFORD TO MR. SYLVESTER WELCH, CHIEF ENGINEER OF THE STATE OF KENTUCKY.

OFFICE OF RESIDENT ENGINEER
OF THE LICKING RIVER NAVIGATION,
November 1, 1837.

SIR: I have the honor to submit the following report upon the survey of the Licking River, from the Blue Licks to West Liberty, together with a table exhibiting an estimate of the probable cost of twelve locks and dams which have been located above the Blue Licks, and a table exhibiting the locality, lift, and guard of each lock; length and height of each dam; the length of the pools; distances from the mouth of the river, and probable cost of the 21 locks and dams, which are to extend the navigation to West Liberty. To this table have been added all the other items which should be embraced, so as to exhibit the estimate of the entire cost.

As soon as the test-level had been run from the mouth of the river to the Blue Licks, which was completed on the 6th of June, I progressed with the survey to West Liberty.

At the Blue Licks the river is 250 feet wide, which is its least width, and from that

point to Atchison's Ripple, which was selected for the site of lock No. 13, the width varies from 250 to 400. The banks of the river between these points are high, being seldom less than 40 feet above low-water. The valley of the river is contained between hills that are gradually sloped from their summits to the river, and a very small portion of the bottoms is composed of alluvium. The lands adjoining the river in Bath and Fleming Counties are very fertile. The only rocks which compose the hills are stratified secondary limestone as high as the mouth of Slate Creek, which is 145½ miles above the mouth of the river, and 6 miles below Atchison's Ripple. In all this distance the river has a solid rock bottom at depth varying from 1 to 10 feet, is free from accumulation of sand, and affords numerous excellent sites for locks and dams. From lock No. 9 to Atchison's Ripple the distance is 60½ miles, and the ascent is 63 feet. The locks between these points are proposed to have lifts of from 15 to 16 feet. Building materials are abundant on this section of the river. Strata of good limestone are found a short distance above lock No. 9, of about 2 feet in thickness, but are not so thick near the other sites. It is not doubted but that suitable stone exists in the hills. No quarries have been opened. White-oak timber of the best quality is very abundant.

From Atchison's Ripple to Wilson's Ripple the river and its banks exhibit very different characteristics from those above described. Above the mouth of Slate Creek, which is the largest tributary above the North Fork, the river is reduced to widths varying from 180 to 250 feet. Sandstone begins to appear in the tops of the hills near Slate Creek, and about 2 miles above Atchison's Ripple forms the bed of the river. Above this latter point sandstone and slate are the principal rocks that occur. Near the top of the hills, at a considerable distance higher up the river, one stratum of compact secondary limestone of about 15 feet in thickness makes its appearance, dipping to the south. The river in the vicinity of Ile's and Gill's mills flows in an alluvial valley of from ½ to 3 miles in width, bounded by high hills. The bottoms are sandy, and in some places less than 20 feet above low-water. The river in this valley is very crooked. Sand bars are formed below every point where the river changes direction, and the alluvial banks are seen in some places yielding to the action of the current. Strata of slate frequently occur crossing the bed of the river, and afford good foundations for locks and dams. Bluffs of slate 50 feet high, sometimes form the banks of the river. From Atchison's Ripple to Wilson's Ripple, which is 1 mile below Beaver Creek, the distance is 39½ miles, and the ascent is 63 feet. The locks in this portion of the river are proposed to have lifts of from 9 to 12 feet. Building-materials of superior quality are found near the lock-sites. Good sandstone, in strata of from 1 to 6 feet thick, occurs in the hills.

From Wilson's Ripple to McClure's mill, which is about 6 miles below West Liberty, the river and its banks again change their characters. The valley of the river becomes gradually reduced from about 1 mile to 500 feet in width, and becomes inclosed between perpendicular cliffs of rock. The bottom lands again become to be from 30 to 40 feet above low-water. The hills are composed of strata of slate, sandstone, and limestone. The stratum of limestone is single, and is about 15 feet thick. It occurs near the summits of the hills, which are about 500 feet high near Gill's mill and Beaver Creek, and dips so much to the south as to pass under the bed of the river, about the mouth of Blackwater, which is 212 miles above the mouth of the river. The river in this section is called the "Narrows." For about 18 miles it is without habitations, and is very difficult of access by roads. It affords good sites for locks and dams, and the lifts are proposed to be from 15 to 18 feet.

From McClure's mill to West Liberty the river presents the same characteristics as between Ile's and Gill's mills. The alluvial bottoms again become wide, and the banks become very low.

From Wilson's Ripple to West Liberty the distance is 39½ miles, and the ascent is 60½ feet. This section of the river is very crooked. In the "Narrows" the bed of the river is frequently obstructed with large masses of sandstone, sometimes measuring 500 cubic yards above low-water. This section receives six considerable tributaries.

The whole distance from the mouth of the river to West Liberty is 231 miles, and the whole ascent is 310 feet. The number of locks and dams required for the navigation is 21, with lifts varying from 9 to 18 feet.

The quantity of water which the river furnishes was carefully measured above the site of lock No. 21, on the 1st of August, when the water was believed to be at its lowest stage, and the quantity was found to be 2,520 cubic feet per minute. Three considerable tributaries enter the river within 10 miles below the point where the measurement was made, which are estimated to furnish about 1,200 cubic feet of water per minute.

All of which is respectfully submitted.

N. B. BUFORD,
Resident Engineer, Licking River Navigation.

To SYLVESTER WELCH, Esq.,
Chief Engineer of Kentucky.

APPENDIX C.

AN ACT to incorporate the Licking River Lumber and Mining Company.

Be it enacted by the general assembly of the commonwealth of Kentucky—

1. That John A. Stacy, Jonas Butterfield, William H. Baldwin, their associates and successors, be, and hereby are, constituted a body politic and corporate, with power of perpetual succession, under the name and style of the "Licking River Lumber and Mining Company," and by that name shall have succession, sue and be sued, have and use a common seal. * * *

2. That said company may, without let or hindrance, float and drive down the Licking River and its tributaries, logs, wood, and other lumber, and remove all rocks, trees, and other obstructions which may stop or hinder the same from floating down said streams, not interfering with the vested rights of others; may erect, maintain, and control such booms and piers on the Licking and its tributaries as may be deemed necessary for the purpose of stopping and securing the logs, wood, and other lumber; and shall enjoy the unobstructed and exclusive use of booms and piers for said purpose, and when necessary for the purpose of driving, dislodging, fastening, and securing boats, rafts, logs, and lumber; or for reclaiming and putting back into the stream any of the same that by flood or overflow may be floated upon land without the banks of the river; or for building, repairing, and operating booms and piers, may enter upon and occupy the land of others, subject, however, to pay such damages as may be sustained by such entry and occupation; and may do and perform all acts and things necessary for successfully driving and safely securing logs, wood, and other lumber: *Always provided*, That said booms and piers shall be so constructed as not to prevent the safe and convenient passage of rafts and boats on said Licking River.

3. That said company may build and maintain roads and bridges, also tramways or railroads, from its lumber and mineral lands, to accessible points on the Licking River and its tributaries, for the more convenient transportation of lumber and minerals; and if for this purpose it shall be necessary to pass over or use the land of others, they may condemn the same for the purpose in the same manner as is provided by the Revised Statutes for turnpikes, and by paying the assessed damages.

4. That said company may construct and navigate boats and rafts for the transportation of lumber, minerals, and merchandise, and to this end may build and keep in repair such dams as may be deemed expedient, not to exceed five feet in height above low-water mark, on the Licking River and its tributaries, for the purpose of floating and navigating boats, rafts, and logs over riffles and shoals: *Provided*, No dam shall be erected by said company on said river below the mouth of Triplet Creek. It being now considered by the legislature of this State whether it will order all the dams to be taken out of Licking River, it is distinctly understood and provided that if any dams are erected in said river under this act, the State reserves power to order the removal of the same, and said company shall not be entitled to any damages for the removal of said dams if ordered to be removed by the State, and the said company shall remove said dams at their own expense.

5. * * *

6. That if any person shall willfully or maliciously destroy or injure any of such booms, piers, dams, locks, or other works, or shall knowingly and wilfully unfasten, turn adrift, destroy, or injure any raft, boat, logs, or lumber, or shall knowingly and wilfully saw, take away, stop, or in any way interfere with logs or other lumber, the property of said company, which may be floating in said river or its tributaries, or lodged on the shores thereof, or shall deface, cut, or otherwise remove the mark from any such logs or other lumber, put marks or brands on the same for the purpose of depriving the owners thereof of their property therein, or do any other act to prevent said logs or lumber from being identified or known as the property of said company, he or they shall pay double the amount of the damage so done to said company, to be recovered by action of trespass, and shall also be liable to the same penalties and punishments imposed by the general laws of this commonwealth for such offenses.

7. * * *

8. * * *

9. This act may be altered and amended at the discretion of the legislature.

10. This act shall take effect from and after its passage.

Approved January 25, 1868.

AN ACT to amend an act to incorporate the Licking River and Mining Company.

Be it enacted by the general assembly of the commonwealth of Kentucky—

1. That Moses D. Kirk, M. D. Martin, William Mynhier, Joseph Gardner, and F. D. Young be, and they are hereby, appointed to notify the Licking River Lumber and Mining Company to remove any and all obstructions they may have placed in said river under the provisions of an act to which this is an amendment.

2. That said Licking River Lumber and Mining Company shall, and are hereby, required and ordered, within sixty days from the service of notice on the president of said company, to remove all dams and obstructions erected by said company on said river, at their own expense. * * *

3. This act shall take effect and be in force from its passage.

Approved March 10, 1869.