River Welland Navigation.

J. S. Brickwood, Esq., Secretary to the Commissioners for the Loan of Exchequer Bills.

Sir,

In compliance with the directions of your letter, dated 12th October, I proceeded, on the 23rd of the same month, to survey the works in progress for the improvement of the river Welland, below Fosdyke bridge. On the 24th Mr. Bonner, Clerk to the Trustees, and Mr. Beasley, under whose superintence the works have been done, accompanied me upon the survey.

I have since received from Mr. Bonner some accounts and other details of information, which on consideration of the subject I had applied for.

Your instructions to me, state that the Trustees had transmitted to you a copy of my Report to them, dated November, 1835. The Commissioners would see from that Report, and the plan which accompanied it, the nature of the works then recommended for the improvement of the river below Fosdyke bridge; and as the recommendations have been followed in the part which has been done, it may be sufficient to refer to that Plan and Report without troubling you with a repetition, and to state that the new course for the river has been formed for about a mile and a half below the bridge, and that this is the only thing of a public nature which has been done.

You would observe by the estimate in the Report, that the cost of the proposed new course for the river was calculated separately from the embanking of the river, for the purpose of reclaiming the saltings and other land which is covered by the sea at every high water.

Now to your first question: "If the proposed works are of a public character and likely to produce beneficial results of importance?"

I reply, that although the work of embanking and reclaiming is important, by the conversion into excellent land of several thousand acres, which are now almost entirely useless, I consider this as of a private nature; but that in so far as the embankments, by being raised above the highest tide, would define and confine effectually the course for navigation, the work is public; that the embanking is therefore of a mixed nature.

The formation of the straight channel for the river through the bay, which is what has in part been done, and to which the loan now applied for is, as I understand, to be exclusively applied, I consider as decidedly of a public character, and likely to produce beneficial results of importance.

That the river Welland is not better known as a public navigation may be supposed to arise from its very defective state, particularly before the present works were begun. I stated in my Report already referred to, that there was no lift of tide perceptible even at Fosdyke bridge excepting at spring tides; that I had seen a gang of lighters drawing only eighteen inches unable to get to Spalding even at spring tides; that at low water in dry seasons there were but a few inches in the channel of the river below the bridge, and that the channel was so extremely tortuous and shifting that the navigation might be said to depend entirely upon the rise of tide; that vessels drawing three feet to three feet six inches, were frequently not afloat at Spalding except during a few days at the top of the springs; and if of greater draught not at all, unless the springs were high: also that the sudden bends and twists through the sands below the bridge were, if possible, a greater evil than the want of depth. In my last visit I was informed that six weeks were sometimes taken in getting up through the two and a quarter miles below Fosdyke bridge.

Notwithstanding the above difficulties the Welland has been navigable after a fashion for twenty-seven miles above the bridge. Spalding, Deeping, Stamford, Crowland, Peakirk, and Bourn, are the principal towns in the line of it, or of the river Glen, which joins the Welland about three miles above Fosdyke bridge, and the district of Coventry, including Holbeach, Moulton, &c., round the above towns, of which the Welland is the natural navigation for the supply of coals, and the shipping of produce, is at once extensive and fertile. I have said the *natural* navigation, because such are the effects of the improvements of the Nene, and such the bad state of the Welland, that although the latter river runs through Stamford, that town is or was supplied through the Nene at Wansford, from which the coals had to be carted six miles. The effect of this has been a reduction of the trade between James Deeping and Stamford, to one-half since 1832, and a proportionate reduction of tolls in the upper district.

The improvement of the Welland will also be important, in substituting natural drainage for the present very expensive artificial mode of drainage by means of steam-engines, extending over 30,000 acres in Deeping fen above, and 6,000 to 8,000 acres in other levels, which, particularly those upon the Glen and the washes, are very

imperfectly drained, very subject to floods, and of comparatively little value.

The small portion of the work that has already been done has been practically useful, almost beyond my expectation, and is an earnest of what may be looked for.

Already vessels drawing eight feet can, after reaching the new channel, get through it, and up to the bridge, with as much ease and far greater certainty than those of three feet could do in 1835. The course is now straight and fixed, and the depth regular for a width of 125 feet at the bridge, and 150 feet at the end of the length done; so that there is now no uncertainty as to getting up or down at every spring tide.

In my Report of 1835, I stated, that "if the formation of the new channel were to be done wholly by excavating, the expense would be heavy; but that I thought this would be useless labour, and that if the proper directions were given, the requisite size of channel would be formed by the current itself; so that the principal expense would be in supporting the sides by long thorn faggots or fascines, successively and progressively applied, as the depth of the new channel might require."

This course has been followed most successfully, even without any of the previous embanking or partial excavation referred to in my Report. The sides being formed, the excavation of the channel has been done without any expense, and is as perfect as if it had been made by hand; indeed more so, as the depth and form are exactly conformed to the quantity and velocity of the current. The work appears to stand well, and is very creditable to Mr. Beasley; for in a work of this kind, where tides and currents are to be watched and taken advantage of, more depends on the execution than the design.

In answer to your second question, viz., "the cost of the part done," I beg to report that, by a statement signed by Mr. Beasley, and transmitted to me by Mr. Bonner, the whole expense of the one and a half* mile that is done, including about 900*l.* of debt for materials, a portion of which is not yet used, is 7,026*l.* 2*s.* 8*d.* My estimate for two and a half miles was 13,000*l.*; so that I do not see reason for saying that the cost has exceeded the estimate.

Your third question is, "Whether the loan of 10,000*l.* applied for, if granted, would, with any other funds under the control of the Trustees for such purpose, be sufficient to complete, with proper expedition

* The length of north bank is one and a half mile 100 yards; the length of south bank is one and a quarter mile 100 yards.

and efficiency, the contemplated improvement to the navigation and drainage?"

My reply to this is decidedly negative. 10,000*l.* will be sufficient to form the new channel for three miles from the bridge, which will no doubt effect a benefit of much greater value than the cost, as respects either navigation or drainage; but it will leave the improvement incomplete, which will be to be lamented. An addition of 6,000*l.* to the 10,000*l.*, making 16,000*l.*, exclusive of the present expenditure, but inclusive of the 900*l.* due, would take the river out to C upon the plan, making four miles from the bridge, which is what my design extended to. I must not, however, withhold my opinion, that even this should not be the ultimate limit of the work; and that where nature is at hand ready to do so much, the direction given by art should be extended quite to the Witham, say a mile beyond my idea of 1835, which would probably cost about 7,000*l.* additional. A very small sum for effects, of which the importance would be almost beyond calculation, upon the value of the property and the improvement of navigation. Ships of the largest class would be seen at Fosdyke; and by corresponding improvements up to and at Spalding, vessels of heavy burthen would unload their cargoes there.

The experiment that has been made has been so very successful that there is every encouragement to proceed; and when the magnitude of the interests, public and private, and the influential individuals, owners of the valuable estates, that will be improved without being taxed for the improvements, are considered, the idea of stopping half way seems very unreasonable. Whether the loan of 10,000*l.*, if to be granted, is to be applied *immediately*, or after the expenditure from other sources of the 6,000*l.* referred to, or even reserved to complete the junction with the Witham, is of course entirely out of my department.

The last question is as to the permanency of the work, "Whether it will require expensive repair, so as to leave a net income applicable to the liquidation of any loan the Board may see fit to advance and the interest thereon?"

The work has the appearance of permanency. The deepening of the river, as it is extended outwards, may cause repairs to be wanted in the sides; but as the good effects of this deepening by increasing the trade, will, even in point of revenue, be likely always to exceed the repairs wanted, I do not think they affect injuriously the question of disposable income. By Mr. Bonner's accounts, the tonnage duties from July 18, 1837, to July 30, 1838, were 2,298*l.* 8*s.* He states the rate of charge to have been tripled by an Act which came into operation 18th July, 1837: but as the amount at which the duties

were let for the year 1836 was only 452*l.* 13*s.* 4*d.*, it appears that the trade has much increased since that time; although from the duties having been leased for several antecedent years, the exact sums received by the lessees are not known.

My opinion is that the trade is likely to increase as the improvements do. Therefore, if the Commissioners are to have the first claim upon the funds of the Trustees for the repayment of a loan of 10,000*l.*, with interest, or even a greater sum, I should conceive the security good.

You are, I think, aware that, independently of the tonnage duties, about 25,000 acres of land pay yearly taxes to the Welland; but I am informed that this revenue is not mortgageable.

I am, Sir,

Your very obedient Servant,

JAMES WALKER.

23, *Great George Street, Nov.* 21, 1838.

Navigation of the River Welland.

Mr. Bevan's Report.

In consequence of the resolutions made at the meeting held at the Town Hall, in Spalding, on the 18th of July, I have made a number of observations upon, and inquiries respecting the impediments to the navigation of the river Welland; and find, that although there are several shallows and fords in the navigation between Deeping and Stamford, and the locks in that length are not in such repair as is desirable, or to the advantage of the persons interested in the river, either for the use of mills or for the navigation; yet these works might be repaired and suited to an extensive trade, by removing the shallows, by erecting bridges over the fords, and by raising the banks in some places, which, in general, would be sufficiently effected by the earth necessarily removed from the bottom of the channel in deepening the river.

The present locks would, with small alteration, admit the passage of the regular trading boats, which are at this time used in preference to others on most of the inland canals; at the same time the lighters,

which are now used upon the rivers Welland and Nene, and through the whole of the fen country, might still be used, with more facility than heretofore, on account of the greater depth of water which would be thereby provided.

The middle part of the navigation, or that from Deeping to Spalding, has, in a few places, been neglected, and shoals have been suffered to remain, to the great disadvantage of the traders; but these shoals might, at a moderate expense, be removed. The principal shoal, I observe, is near the lower end of the wash, and has been occasioned by suffering the tides to flow without regulation into the wash. The strong tide waters containing a large proportion of fine sand, which is deposited when the water becomes stationary (and as this effect will continue so long as the cause remains), it will be necessary, for the preservation of the navigation, *to prevent, generally, the tides from flowing into the wash.*

By clearing out the channel of the present course of the river, *and raising a small bank on the south side of the stream,* and by repairing and restoring the use of the lock at the lower end of the wash, a sufficient depth of water may, at all times, be preserved for navigation, at the same time the drainage of the wash will not, in any degree, be impeded.

As the navigation will, by the above means, be rendered regular and certain, and capable of carrying double the present burdens, a moderate tonnage will be readily and advantageously paid by the traders.

As all works are maintained and kept in repair much better by those who have an interest in so doing, the whole of the navigation would be best attended to by a regular company of persons under an Act of Parliament; and might (to the mutual advantage of the traders and subscribers to the undertaking) be incorporated into the intended Act for making a navigation from Harborough to Stamford, and from Deeping to Peterborough.

The lower part of the Welland, from Spalding to the sea, has of late years been much improved; and vessels which are able to coast from the Thames to the Humber, can now unload at Spalding goods shipped at London or Hull.

This branch of the navigation is, however, still capable of improvements.

The present new cut, below the Reservoir, has materially benefited both the navigation and drainage of this district, and would, by a farther extension, and by erecting a sea sluice at the lower end of the channel to keep out the tides, still greatly improve both.

But as the advantages to be derived by the drainage are of a different nature from the profits expected by the subscribers to a public navigation, it appears to me that the value of this lower district would be more properly appreciated, and the drainage conducted by persons whose local interest and knowledge have better qualified them for this purpose, than by those who have confined their attention chiefly to the mercantile interests of the country.

For these reasons, I think it most advisable that this lower part should be considered as a distinct undertaking.

I beg leave to express my acknowledgments for the great assistance received from the gentlemen who were appointed, at the last meeting, to assist me in my inquiries on this subject.

The necessary plans of the river and country between Spalding, Peterborough, and Stamford, are in a state of forwardness, and will be finished in due time to conform to the rules of the House of Commons, that an application may be made to Parliament in the ensuing Session.

B. BEVAN.

Spalding, 28th August, 1810.

To the Gentlemen meeting at Spalding, for taking into consideration the Improvement of the Navigation of the River Welland.

Newboro' Fen and River Welland.

To the Drainage Commissioners of Newboro' in the County of Northampton.

My Lords and Gentlemen,

I have the honour to address to you this Report on the subjects of supplying the fens with fresh water in time of drought; improving the navigation of the river Welland, between Deeping and Spalding; effecting a better drainage of the wash, and a more ready exit for the land waters in times of flood; together with a means of improving the port of Spalding, and assisting the effects of any works for improving the outfall between that place and the sea.

Having been called upon in the early part of the present year, by Mr. Lawrance, your solicitor, to go down to Newboro' fen, and examine into the merits and effects of certain tunnels connected with the river Welland, the Folly river, and the Newboro' fen, with a view to giving evidence thereon in a cause which then stood for trial at the ensuing summer assizes, I took the earliest opportunity my engagements would permit of attending thereto, and in the middle of May went down to Peterborough, taking with me assistants competent to the making of any surveys that might be required for the purpose of the inquiry, with the precise nature and merits of which I was at that time totally unacquainted.

On taking a general view of the "*locus in quo*," it appeared to me that the question of the alleged abstraction of water by the Folly tunnel (let its real merits be what they may) formed but a very small portion of the question at large, or what in my judgment is the real question, or, more properly speaking, the real questions which the said tunnel was stated to affect: viz. "injury to the Deeping fens and the Welland navigation by the undue abstraction of water;" as it appeared to me on a first view, that there would be at all times ample water for these purposes, were it but to be properly used and applied, and that the very means to be adopted for so using and applying the water for the purposes of irrigation and navigation might also be made to effect other and more important objects, none of which (either the former or the latter) would be effected by any modification or even annihilation of the Folly tunnel. But in order to ascertain these facts, it was necessary to make certain surveys, and to take the levels of the river, &c., from Deeping lower lock to Spalding bridge, and as these operations and the requisite investigation of the subject would of necessity occupy more time than the interval till the summer assizes, it became necessary to put off the trial for a time, if my report and plans were to be previously considered; and this being represented to Mr. Bonner, (the solicitor to the Welland Navigation), the cause was postponed accordingly, on my making affidavit before the judge as to the impossibility of being ready in time with the necessary plans, &c.; and I deem it due to Mr. Bonner to state that on its becoming known to that gentleman, that I was taking a more extended view of the case than the effects of the tunnel merely, and that local maps or surveys of the washes and the neighbourhood of Spalding would facilitate my inquiries, I was supplied by him with the loan of some very useful documents and information relative to the subject, for which I beg to make my best acknowledgments.

By a reference to the plan and section which accompany this report, it will be seen that the river Welland, after passing the lock

and weir at Deeping, forms a junction with the Folly river at Peakirk, and the united streams then enter the tract of land termed The Washes, or open waterway, left between the Deeping fen embankment on the north, and the Newborough fen and Bedford Level embankments on the south, thus forming a kind of reservoir for the land flood waters, varying in width from six chains to sixty, comprising an area between the banks of about 2,000 acres, and extending in length from Peakirk to near Spalding (a distance of twelve miles).

At Spalding the whole of this extensive reservoir is contracted to the narrow channel of the river which passes through the town, which being insufficient to take off the flood waters during a succession of high tides as fast as they enter the washes from above, the consequence is, an accumulation of water, occasionally to a very dangerous extent, against the main embankments of the very extensive levels both north and south of the washes, and which, as I have been informed, have more than once given way to its pressure and occasioned immense losses; and to such a contingency must they at all times be subject whilst the outlet at Spalding continues in its present contracted and unimproved state.

Again, in times of short water during the summer and autumn, when but little water comes down from the upper country, the contrary effects ensue. The river drains off so low, that boats drawing two feet can neither pass the shoals just above the Folly junction and enter the Deeping lock without penning up the water by means of a stanch (a vile water-wasting contrivance) situated two and a half miles below the lock, nor pass the shoals just above Spalding during the neap tides, at which period the tidal water does not flow above Spalding, and boats are obliged to wait till the spring tides come on, to pass up and down the navigation, and the lands on each side remain destitute of fresh water, although at the same time there may be sufficient fresh water passing down the river from Deeping to Spalding to lock up or down about seventy boats per day, as far as navigation is concerned, or to cover very nearly 2,000 acres of land one inch deep with water daily, as far as irrigation is concerned, all which at present is wasted or misapplied, as will appear from the following facts.

During the time I was on the spot (the middle of May last) and subsequently whilst my assistants were taking levels, &c., of the river, the average quantity of water passing down the river was about 80 cubic feet per second, and yet the stanch had to be set to get boats into the Deeping lock, and barges were aground in the channel above Spalding waiting for the commencement of the springs to get them up.

At the time I was there 100 cubic feet per second passed through the stanch, which was not then set, and on the same day, I saw boats aground on the shoals above Spalding.

Now if we take 80 feet per second and turn it into lockfulls of water for 24 hours, it will fill 691 locks per day, allowing each lock to use and waste 10,000 cubic feet of water, which would admit the lock to be 100 feet long and 15 wide in the chamber with a fall of 6 feet, allowing one-ninth of the quantity for waste every time it is used, which shows that as far as navigation is concerned one-tenth of the quantity of water which is at present insufficient to keep the channel navigable, would, if properly applied, be capable of navigating 70 vessels per day in plenty of water.

As regards the use of the water for irrigation or watering the lowlands on either side the washes, the above quantity of 80 cubic feet per second is sufficient in 24 hours to cover nearly 2,000 acres of land about one inch deep, from which its capability with greater or less quantity of water or land may be easily estimated; but the fact is that, as regards the above important purposes, the whole quantity may at present be said to run waste.

Having thus described the situation of things as at present existing, my next object shall be to point out by what means those defects may be remedied; how in times of flood the waters may be prevented from accumulating to their present dangerous extent in the washes, and the navigation and outfall at and below Spalding improved; and how in times of short waters and drought there may always be abundance of water for a free and uninterrupted navigation from Spalding to Deeping, and the whole surplus of the land waters, over and above that required for navigation, be made applicable to watering and irrigating the fen lands on either side the washes requiring such treatment, and the marshes also which constitute the wash itself.

The method by which I propose to effect the above objects is as follows:—

First, To make a side cut to the southward of Spalding, as shown by the plan, for the purpose of taking the superfluous land and flood waters off from the washes, at the upper end of which cut should be a very long weir or overfall to prevent the accession of common tides, and a sluice for the purpose of effectually draining the washes, or stopping in the fresh waters for irrigation when required.

Secondly, To erect a navigation lock for the passage of seaborne vessels just below Spalding, and above the point where the new cut would enter the main channel of the river, which lock would convert the river at Spalding into a floating dock, with from 8 to 10 feet water at all times, and pen up at a dead level from 2½ to 3 feet of

water upon the lower sill of Deeping lock, or any greater depth required, by lowering the lock sill and the shoals in the channel. Should it be thought more desirable not to pen up the water in and through Spalding, and convert the town into a floating harbour, the same object, as regards the navigation above Spalding, may be obtained (although less perfect as part of a whole plan) by making a boat lock just above Spalding, with draw-gates to scour out the channel through the town occasionally, which would in that case be subject to the tides as at present.

Thirdly, To raise the inner banks of the present navigable channel to a height of one foot above the level before mentioned for the navigation, so that when the water from any accession of land-floods rose to the extent of a foot above the depth necessary for navigation, the surplus would pass over the bank into the washes, and from thence by the weir and sluice at the lower end thereof into the new cut, and through the present outfall to the sea.

Fourthly, To arrange a set of tunnels or sluices along the north or Deeping bank of the navigable channel, for the purpose of watering or irrigating the low lands in times of drought, and a sufficient number of turn-down weirs or overfalls in the dwarf or navigation bank for the purpose of watering the washes when requisite. The sills of all the tunnels, and the weirs to be so constructed that the water could not be drawn off below a certain level as regards the navigation; but this convenience might be increased to a considerable extent by lowering the lower sill of Deeping lock, and taking off a few shoals in the channel, by which means a range or variation of from two to three feet might be allowed in the depth of the navigable channel, as the wants of the low lands for watering might require.

The above arrangements of the navigable channel contemplate of course the entire removal of the present stanch.

By carrying into effect a plan on the above principles, the following consequences would ensue:—

First, The outfall of the washes would be improved, and the great embankments and low lands on the north and south thereof put into a greater state of security against heavy land-floods than at present.

Secondly, A perfect canal navigation would exist at all times on one level from Spalding to Deeping, unimpeded by either flood or drought, and with a range of level amounting to two feet or more in addition to the depth necessary for boats, if required, upon its whole surface, as a reservoir for lockage and watering land in very dry seasons.

Thirdly, The river in the town of Spalding might be converted into a floating dock with a constant supply of fresh water, by having

the lock below the town; or into a tidal harbour, with an excellent mode of scouring and cleansing the same, by having the lock and a sluice above the town; or a combination of both, by having locks both below and above the town, which latter would be the most perfect plan of all.

Fourthly, The whole of the water coming down the river would be applicable to the purposes of navigation and irrigation, and all the surplus would pass off quicker than at present, in consequence of having a larger outlet by Spalding, and consequently with a better effect upon the outfall channels below that town.

Fifthly, The washes would be more rapidly cleared of water in times of flood, and with little expense be made subject to the most perfect system of irrigation possible, and their value in consequence very much improved.

The drawings sent herewith will explain themselves. There is one general map or plan of the river and washes from Deeping lock to Spalding bridge, with the proposed improvements coloured in red; a longitudinal section along the navigable channel showing the height of the Deeping bank, &c., the surface of the water as at the time the levels were taken, and as it is proposed to be raised, the bottom line of the navigable channel, and the top of the wash bank, both as at present, and as proposed to be raised, the latter (the additional wash-bank) coloured red; and a sheet of cross sections of the river channel, taken at the places referred to by corresponding letters on the plan and section; in all which the heights and depths are referred to a datum line level with the top of the stone weir at Deeping lock.

I have the honour to be,
My Lords and Gentlemen,
Your most obedient Servant,
W. CUBITT.

London, October 13*th*, 1837.