I have been favoured with an abstract of the quantity of land at this time draining through the Vernatt's drain, chiefly by mills, from which it appears that about 27,326 acres are thus circumstanced.

In this place it will be but justice to say, that the present state of the drainage is highly improved, compared to what it must have been previously to the cutting of the North and South Drove drains, and the erection of the six district mills upon them. It is a matter of importance to know that the above new drains may be readily adapted to constitute part of the natural drainage, whenever the proprietors of the lands shall think proper to resort to that final and complete measure.

All the waters of Deeping inclosed fen, and Thurlby and Bourne fens, drain through an important sluice called Podehole sluice, which has been lately rebuilt in the most creditable and substantial manner. From this sluice the waters pass through Vernatt's drain and sluice, at present somewhat too high and contracted. From Vernatt's sluice the waters of the above fens, with those of the river Glen, enter into the river Welland, at a point originally a broad wash and tideway, and but for the new bank lately made to confine the channel to one point, would have been by this time considerably silted up by the tides, so as to have much impeded the drainage of the whole fen.

In Cowbit Wash the tides have deposited a shoal which pens up the waters in the Welland, which shoal will gradually increase if they are suffered to flow through the Spalding locks as at present. From Spalding locks to the Vernatt's sluice, the channel has been much improved by the flux and reflux of the tides into Cowbit Wash; and from testimony the most indisputable, it appears to have been lowered upwards of three and a half feet; and that at similar periods of the tides when in the former condition of the Welland there would have been barely eighteen inches of water, there are, in the present state of that river, about six feet.

There are, however, a few shallows, particularly in the town of Spalding, which should be removed; and towards the lower end of the river, in consequence of a considerable widening of the channel, a depth equal to that of the upper part cannot be maintained.

The transverse sections which I have procured, by the assistance of Mr. Pear, will prove that the widening of the river is the cause of the present shoal about one mile above the reservoir. The average section of the upper half of the channel is equal to about 630 square feet; while that of the lower half is about 1,215 square feet, or nearly double the former; but as the same quantity of water passes through both parts of the channel in the same time, it is very evident that the velocity of the current must be only half in the lower part of what it

had been above, and therefore will naturally deposit the silt and finer particles of sand which before had been suspended, and thereby gradually form the shoal which we there find.

A similar effect is produced by the same cause, at the beginning of the wide part of the Wash, below Fosdike Inn, where, for a considerable distance, the bottom of the channel in the open Wash is from three to four feet higher than that between the new banks above the inn. From Fosdike to deep water, the channel is variable from time to time, both as to position and depth; and at this time takes a circuitous course of seven miles and a half, where the direct distance is not more than five miles and a half. At this point of deep water, the Welland joins the Witham, and this we may consider the general outfall of the South Lincolnshire fens.

Between this general outfall and the lower part of the embanked Welland, the distance in a direct line is about five and a half miles, and the difference of level nine feet. This is a most important fact, and proves the certain practicability of effecting a complete drainage of the whole fen.

It is well known that the high tides flowing up the Welland, in times of inland floods, considerably impede the drainage through the sluices of Vernatt's and Glen rivers, and that if the tides were excluded, the present sluices would run at such times nearly eight hours per day longer than at present; or, which amounts to nearly the same thing, the height to which the water required raising by mills would thereby be reduced nearly one-third. Instead therefore of raising the water about three feet by the mills, it would require to be raised but two feet; and of course the quantity raised would be one-third more with the same machinery and power. But if, in addition to excluding the tides, the channel below and through Vernatt's sluice were lowered about three feet, it follows that as much water would flow through the sluice at Podehole, without being raised by mills, as flows at this time in consequence of being so raised; and this is upon the supposition of the mills being constantly used.

The improvements then, which would be equal to the constant work of the mills, must be productive of great advantages over the present system.

From the surveys which have been made, it is evident that the nature of the soil and the difference of level are such as to render it practicable both to exclude the tide and deepen the channel, which would produce the greatest advantages, as far as relates to the drainage of the lands.

The navigation of the Welland has heretofore been noticed with regard to its condition, and requisite improvements, between Stamford

and Deeping; to preserve and improve the lower part, it will be necessary to remove the shoal deposited by the tides in the Welland towards the lower end of Cowbit Wash, and for the purpose of keeping up a navigable head in dry seasons, a small lock or pen sluice should be made near the outlet of the Wash, which would not obstruct the outflow of the upland waters.

The present channel of the Welland, between Spalding locks and the Vernatt's sluice, should be lowered about two feet, and a new channel, below Fosdike Inn, excavated through the marshes, corresponding with the upper part, and communicating with the deep water by a sea sluice nearly opposite Hobhole sluice.

The result of the proposed new cut, and the deepening of the present channel of the Welland, will be that of enabling vessels to navigate at all periods, and to have free access at all tides to the town of Spalding; the beneficial consequences of such a measure not only to that town, but to all the country connected with the present navigation, would be more than can now be calculated.

In the present state of the survey, a general estimate only can be made of the probable expense of accomplishing all or any part of the above improvements. At this time also it would be difficult, without having more particulars, to say what part of the above expenses should be provided for by the proprietors of the land to be improved, by submitting to a moderate rate or tax, and what part the merchants should furnish by agreeing to pay a tonnage upon the goods navigated.

The best estimate I have been at present able to make of the sum necessary to complete the whole of the objects suggested in the above report does not exceed 150,000*l.*; the accomplishment of which would in a short time cause the warping up of the greatest part of the present open Wash, and produce from three to four thousand acres of dry land.

A considerably less sum would be sufficient to provide a constant navigation without regard to the present improvement of the drainage, and which would ultimately produce the same effect under a course of scouring of the newly-made channel, by the help of the upland floods and occasional tides. The gradual deepening of this channel may be made to correspond with the condition of the mills now used for the drainage of Deeping fen, that upon their decay no new ones might be required.

To obtain a sufficient fund for accomplishing the above improvements, it appears to me that a new company might be composed of all the persons locally interested in the drainage and present navigation, and that transferable shares might be created upon the contingent advantage of the produce of the navigation above the common five per

cent. interest, to be provided for by the joint produce of the tonnage, and the rate upon the improved land.

This rate upon the land, as well as the tonnage upon the merchandize, would be more conducive to the ultimate security of the works without being in any degree more burthensome in the present instance, if formed upon the principle of a corn rent, so as to guard against the evil of depreciation in the value of money, to which most of the modern works are liable.

In the consideration of the proposed improvements in the drainage and navigation, due regard has been observed to the maintenance and improvement of the mode of procuring a supply of fresh water for all the required purposes of the district.

I am, Gentlemen,

Your most obedient humble Servant,

B. BEVAN.

Leighton, 1st September, 1812.

The Report of Mr. Thomas Pear, on the Improvement of the Outfall of the River Welland, in the County of Lincoln.

To the Proprietors of Estates and other Persons interested in the Drainage and Navigation by the River Welland.

GENTLEMEN,

Having been desired to report upon the present state of the lower part of the river Welland, and its outfall to sea, and the means of improving the drainage and navigation thereby, I beg to state that I have for several years past paid particular attention to the drainage of the fens dependent upon that outfall; and that having been employed on several occasions to take sections of nearly all the present drains and levels of the low lands in Deeping and adjoining fens, I trust I may be enabled to point out the causes of the present imperfect drainage and impediments to navigation, and suggest the least expensive and most effectual remedies for both.

From the sections above mentioned, it appears that there is no part of the fens but what is susceptible of the most complete natural drainage, without the aid of mills or any other artificial means of

raising the downfall waters; inasmuch as the surface of the lowest land in Deeping fen is found to be about fifteen feet above the ordinary low water in the south channel (which is within eighteen miles thereof, in the direction of the drains); the average surface of the fen is upwards of seventeen feet, and the general surface of Crowland Wash is about twenty feet above the said low water.

The great defect of the present drainage is the want of a better outfall at sea. It is universally admitted that the drainage and navigation have been considerably improved by the new cut or embanked channel, made under the direction of the Welland Commissioners, from the reservoir to near the new bridge over Fosdike Wash; and as so limited a work has been attended with considerable benefit, it is fair to presume that an extension of it to a lower and more certain outfall would completely effect the desired object.

It is observable that when the fen waters enter the Wash below Fosdike bridge, they have to pass through a wide tract of loose shifting sands, over which they spread themselves without being confined to any determinate channel, and the consequence is, that their current is so weakened as to be unable to carry back to sea the silt brought up by the tides. The accumulation of silt thus formed, chokes up the channel, so much so that at some times it does not in particular places exceed the depth of four inches. The outfall being thus impaired, the channel of the upper part of the river must of necessity silt up in the same proportion as the sands rise below; and to such a height are they now risen, that the neap tides, which at the upper end of the south channel flow about fifteen feet, seldom reach to Spalding, and there are frequently five or six feet of water on the sill of Vernatt's sluice, which alone must offer a serious impediment to drainage.

Having so far detailed the present state of the channel of the Welland, from the reservoir to the junction of its waters with those of the river Witham, which takes place at the south channel, I proceed to demonstrate the existence of the obstructions alluded to, from the observations I have made upon the influx of the tides.

On September 23rd, 1812, when the ordinary spring tide at the junction of the Welland and Witham waters had flowed two hours and forty minutes, it had risen fourteen feet, and had arrived at Fosdike bridge, a distance of about five miles. In an hour and twenty minutes more (being in the whole four hours), it had risen to the height of twenty-three feet two inches. On the same occasion the elevation of the water at Fosdike bridge in one hour and thirty-five minutes was nine feet two inches, and in about ten minutes more the ebb or

reflux commenced. It follows, therefore, that there is an absolute acclivity of fourteen feet between the low water in the south channel and that at Fosdike bridge.

I will next state the result of my observations upon the passage of the upland floods through Deeping fen and Spalding, to the sea.

The river Welland, with its subsidiary streams, rises in a country which, compared with the fens between Deeping and Spalding, may be called high lands. In times of heavy rains, the flood waters are brought rapidly from these high lands, and accumulate in the unembanked parts of the fens, or the washways of the river, until the channel below has had time to carry them off.

I have known the water in Cowbit Wash, in the largest floods, to rise to the height of twenty-five feet;* that in the Welland, at the Reservoir (where the Glen and Vernatt's sluices are situate), twenty feet, and at Fosdike bridge eighteen feet above the low water mark in the south channel. And even admitting that the water be raised four feet at that place by the united flood waters from the Witham and Welland (though this could very seldom occur during the absence of the tides), there would still be a fall of twenty-one feet from Cowbit Wash (a distance of about sixteen miles), sixteen feet from the Reservoir, and fourteen feet from Fosdike bridge, to the then low water surface in the south channel, and five feet from thence to Boston Deeps.

There are about 30,000 acres of land drained by the Vernatts; and the present drainage (imperfect as it is) is chiefly effected by fifty wind engines, which raise the water within the banks of that channel. The drain itself is not of sufficient capacity to receive the water, and its outlet into the Welland is in an unfavourable situation. It is not low enough down the channel to possess the required fall, and is, moreover, fixed in the point of an acute angle, formed by the junction of the Welland and Glen rivers. The consequence is, that when those rivers are bringing down the upland floods, they override the water in the Vernatts drain, and wholly prevent its discharge; and that is at a season when relief is most called for. A very serious evil results from this circumstance; for while there is no sufficient discharge of the Vernatts water, the operation of the wind engines serves to fill all the main drains in the fen to the top of the banks, which, being formed of a spongy or loose earth, are unable to retain the water, which consequently leaks or oozes through them, and again oppresses the level. And this evil is of long continuance, owing to the very languid cur-

* When Deeping bank broke, in 1799, the height of the water in the Wash was twenty-five feet nine inches.

rent through the Vernatts drain, and the imperfect outfall for the united waters of that drain, and of the Welland and Glen below Fosdike.

Having thus detailed the inconveniences and inadequacy of the present system of drainage, I shall now proceed to propose a plan to improve the outfall of the river Welland, and thereby effect a natural drainage of the country, and an important improvement in the navigation. To effect the object in question, I propose that a new outfall be made at or near the present sluice, called Holbeach middle sluice, fixing the low water mark at about five feet above the ordinary low water surface in the south channel, which will give a fall (the distance being but about a mile and a half) amply sufficient for the water to force its way through the sands below to the sea.

From this intended outfall I propose a new channel, about two miles in length, partly through the embanked, and partly through the open salt marsh upon Mr. Garland's estate, to the outlet of Holbeach and Whaplode sluice, this channel to be made fifty feet wide at the bottom, and to be sunk three feet below the low water at the intended outfall, and to rise one foot in the mile from thence to the upper end; the slope of the sides, as three horizontal to one perpendicular, with a substantial bank; and a cess, or foreshore, of not less than fifty feet in width on the south side, and a low bank on the north side thereof; the sides of the new cut to be hardened, and secured with rubble stones, brushwood, sedge, clay, or any suitable materials which can be procured at a moderate expense. Allowing the ordinary low water to run at about three feet deep in that new channel, the rise at the upper end will be two feet above the intended outfall, and three feet below the lowest water in the present channel, at the outlet of Holbeach and Whaplode sluice, and six feet lower than at Fosdike bridge. The waters discharged from the present outfall at Fosdike bridge will force their own way through the sands into the intended new cut, and scour out a deep channel in their course. Proper attention must be given, and necessary works done to confine that channel to a straight line, and corresponding dimensions with that above and below; and the sides must be progressively raised and secured, until they are brought into a proper state for embankment. This will be a work of time.

Reckoning this confined channel to have a similar acclivity to that below, will lower the surface of the water in the present channel at Fosdike bridge at least four feet, or bring it down from thirteen to nine feet.

The present channel or new cut executed by the Welland Drainage Commissioners, extends from Fosdike bridge to the Reservoir, or

Vernatts sluice, a distance of three miles. This work is of sufficient width, but of inadequate depth. This imperfection, however, will be cured with little artificial assistance, by the ordinary current of water, increased in velocity by its straitened course and improved fall below. Allowing the same fall, viz. one foot in the mile, as before, there will be a rise of the water surface at the Reservoir of twelve feet above that in the south channel, or seven feet above the intended outfall, being two feet below the lowest water at the Vernatt's sluice, and six feet below the ordinary freshes in the Welland.

The very important benefits which have hitherto resulted to the navigation of the port of Spalding and the drainage of the fens, from the contraction of the Welland waters below the Reservoir to Fosdike bridge, by the new cut, justify a conclusion that, by an extension of the confined channel through the now open washway, the drainage and navigation will be further and most essentially improved. To effect this contraction, I propose, when a determinate channel through the sands is once acquired by the means before mentioned, to form the sides by fascines, &c. which, it is intended, the tides shall overflow, and thus arrest the silt and sediment brought up and suspended in the tide waters. This work, carefully attended to, and assisted when necessary, will, in a few years, form a foundation of such strength as to resist the utmost efforts that can be reasonably anticipated of the winds and tides; and, after the first quarter's ebb, the returning waters will be confined to this prescribed channel, and not wander over the washway, as they do at present.

The deposition of silt or alluvium from each overflowing tide, will gradually raise the sands on each side of the channel to the height of the present marshes, whilst the bed of the channel will be worked upon by the current of water passing to the sea, and thus gradually acquire greater depth, until it will be brought to the level of the low water in the outfall.

When the sands have become high marsh, it will be a work of but little difficulty permanently to embank the proposed channel from Fosdike bridge to its outfall.

To preserve and improve the navigation of the Welland above the Reservoir, to Spalding, it will be necessary to erect a lock or pen sluice, &c. a little above the Reservoir, for the purpose of keeping up a navigable head of water in dry seasons; to be so contrived as to admit the free influx of the tides, and at the same time leave a free passage for the outflowing upland waters. Some shoals deposited by the tides in that part of the river should be removed. A pen sluice should also be erected in the Glen, to preserve the navigation by that river, and secure fresh water for the fens in times of drought.

The expense of first executing the proposed works will certainly be considerable, and there will also be a progressive expenditure required for the formation (as circumstances admit) of the channel, through the sands to Holbeach and Whaplode sluice. It is hardly feasible to form an estimate of the whole expense that will attend the completion of the works; but from the best consideration I can give to the subject, I can with confidence state, that 50,000*l.* will do all that will be required, including the purchase of land, &c.; and of this a very considerable part will be annual and progressive. The proposed redemption of the Welland Drainage Tax will, I understand, raise about 15,000*l.*; and the value of the tolls and tonnage duties (which it has been estimated will produce about 2,000*l.* per annum) will greatly aid the fund, so that the immediate pressure upon the landed interest will not be heavy.

THOS. PEAR.

Spalding, 31*st October*, 1815.

To the Trustees of the Outfall of the River Welland.

GENTLEMEN,

THE resolution of your meeting on the 25th of May last instructs me to report upon,—

1st. The expense of continuing and embanking the river Welland below Fosdyke bridge, to the extent that I may deem necessary and expedient for rendering the outfall thereof permanent and effectual.

2d. The extent of the necessary embankment, and the acquisition of marsh land and sands now overflowed.

3d. The improvements necessary to be made in the river between Fosdyke bridge and the Staunch above Spalding.

4th. The effect which any proposed improvements may have on the lands which entirely depend on the Welland for draining. And

5th. Their effect on the shipping interest.

SURVEYS. The first thing required to enable me to comply with the above resolutions was, to have a survey made, and levels taken, of the unembanked space or estuary between Fosdyke bridge and Clayhole, and of the river from Fosdyke bridge to Spalding. This was done by Mr. Comrie, and plans and sections prepared from the survey are now submitted, together with a reduced plan for depositing with the clerk of the peace, preparatory to an application to Parliament, if thought advisable. I may add that I also took the opportunity the dry season

afforded of surveying the washes between Spalding and St. James Deeping.

Improvements below Fosdyke bridge. The first point in the resolutions refers to the improvements below Fosdyke bridge.

The area of the unenclosed space or estuary below Fosdyke bridge, supposing the northern boundary to be determined by a straight line drawn from Western point, at the mouth of the Witham, to Holbeach middle sluice, is nearly 5,000 acres. This includes the channel of the river; but I think that ultimately about 4,000 acres of available land may be gained by extending the banks in something like the direction shown by the dotted lines marked B B B on the plan, though enclosing to this extent at present would be imprudently expensive, from the great height of bank that would be required. The effect of a partial inclosure, by reducing the action of the sea and tide upon the space left open, will cause a gradual deposit or warping up of the unembanked part, after which a further inclosure may be made, which will be attended with much less cost and less risk than if done at present. By this postponement also the direction and proper form of the bank may be more correctly ascertained.

I have shown by a strong black line A A A on the plan, what appears the extent to which the channel of the river may be inclosed, and the lands reclaimed in the first instance. The site of the northern bank will be almost entirely on ground now so far warped up as to bear herbage; the return or cross banks at right angles with the direction of the river will be on lower ground, and their formation consequently more expensive;—so also will the banks for the proposed straight direction of the river from Fosdyke bridge outwards if immediately raised; but if the *outer* embankment for the marshes from Western point to the cross or end embankments, and part of such cross embankments be made first, leaving a sufficient opening between the latter for the free admission of the tide, the warping up of all the interior space will be very rapid, and then the banks parallel with the proposed straight channel of the river, and the channel itself, will be made and supported at much less cost.

Estimates, &c., of such Improvements. By the works I have described the quantity of land inclosed or embanked on the north side of the channel will be about - - - - - 1800 acres

And on the south side - - - - - 700

Making together - - - - - - 2500 acres

The embankment on the north side will be five miles long, and the expense, including sluices, £28,000.

The south embankment, being limited to the proposed extent of the new channel of the river, will be about two miles and a half long, and the expense £13,000.

These works will confine within banks two miles and a quarter of the river below Fosdyke bridge, being nearly half of the length from the bridge to the outfall of the river Witham. In estimating the expense of the forming a permanent straight channel in these shifting sands, it is extremely difficult to approach correctness; if the work were done wholly by excavation, the amount would be heavy, but I think this would be useless labour, and that if the proper direction be given, the requisite size of channel will be formed by the current itself, so that the principal expense will be in supporting the sides by long thorn faggots or fascines, successively and progressively applied, as the depth of the new channel may require.

The formation of this new channel should be concurrent with the making of the side embankments, because the excavated material, where near, will go to form the embankments, and because the warping up will add to the solidity of the soil through which the new channel will be formed. I have estimated that this new cut and the fagotting of the sides will cost about £13,000.

I have not calculated the expense of doing any works in the first instance lower than above mentioned; but the direction of the Welland waters through the sands further outwards may be regulated by fagotting, as may be found necessary.

Effects of Improvements on river.

Supposing the works below Fosdyke bridge to be done to the extent I have proposed, their immediate effects, or the capability of improvement afforded for the lands drained by the Welland, will be best judged of by reference to the present state of the channel and the rise in its bed, caused by interruptions and want of scour, of which the following statement will give an idea.

On 24th September last, being a good spring tide, the lift or rise of tide was found to be as under:

	Ft.	In.
At Clayhole - - - - - -	25	3
At the junction of the Witham and Welland -	20	1
At Fosdyke bridge - - - - -	8	6
At the Reservoir - - - - -	5	5
At Spalding - - - - - -	3	6

There was therefore a fall of five feet two inches in the two miles and a quarter of open channel between the point of confluence of the Welland and Witham, and Clayhole, which is equal to two feet per mile. This great fall is owing to the nature of the soil forming the

bed of the channel, which is of clay too tenacious to be moved by the current.

If advantage were taken of low tides, increased depth of water might be obtained in the passage to Clayhole, by casting down the small hills or *hummacks* of clay that stand above the regular bottom of the channel. I think at least a foot might be gained in this way at little expense, and the passage to Clayhole and the scour of both rivers would be improved.

It is, however, with the Welland that I have chiefly to do; and it appears by the statement I have given that, in the five miles and a quarter from its junction with the Witham to Fosdyke bridge, there is, at low water, a fall of eleven feet seven inches in the surface of the river, supposing (which is nearly correct) high water at the two places to be horizontal. Now I think that the embankments I have proposed, and the straightening of the channel, and guiding it below the cross embankments in a direction towards Clayhole, will have the effect of deepening the passage up to Fosdyke bridge at least five feet, thus still having a foot of fall per mile in the river from the bridge downwards. This fall will not be confined to the part below the bridge: I think the same addition may be calculated on up to the Reservoir, still leaving the present inclination of three feet in three miles, or a foot per mile. Until stability is secured, some extra pains and expense must be incurred both above and below the bridge, in keeping the fagotting, as it sinks, up to the proper level. The additional expense attending this work may be taken at £500 per mile for two years, or £3,000.

There are shoals and pools in various places below the Reservoir, caused by inequalities of the section or area. Such inequalities should therefore be removed. The greatest irregularity in section or in depth is, as might be expected, near the Reservoir, at the point where the Vernatt's drain and the river Glen are discharged into the Welland. The velocity of their shoot into the river deepens the part immediately under, where an eddy is formed, and the sand is deposited at the extremities of the pool, thus forming a bar at the lower end of the length that goes up to Spalding, and at the upper end of that going down to Fosdyke bridge. This effect is to some extent unavoidable, while the cause exists; but the directions of the outfalls, and the widths under them, may be so regulated as to lessen the evil, and certainly to reduce the awkward turn of the Welland at this place, and at the same time improve the outfall of Vernatt's drain.

Between the Reservoir and Spalding, a distance of four miles and a half, the fall in the surface at low water was one foot eleven inches, or six inches per mile. Supposing an increase of five feet in the depth of

water at the Reservoir to be the effect of the proposed works, I think that three feet additional may be expected at Spalding; but some guiding and regulating will be necessary to produce this result, of which I estimate cost at £2,500.

The whole of the works thus estimated amount to £60,000, and if £15 per cent. be added for contingencies, superintendence, &c., the gross amount will be about £70,000.

Effects of Improvemnets on land and drainage.

Having arrived at what may be taken as the end of the improvements at present recommended below Spalding, I proceed to state their probable effect.

The reclaiming of 2,500 acres of land, the greater part of which is at present sand, and the residue of but little use, but the whole of which, when embanked and secured from the tidal waters, will be extremely valuable, has been named.

The Bourn and Thurlby pastures, containing 1,000 acres, and Bourn South fen common, of equal extent, drain by a culvert under the river Glen into the counter drain, whereby their waters are discharged into Vernatt's drain, at Podehole. This drainage is much at the mercy of the powerful engines at the latter place; and I am told that although their surface is at a much higher level than Deeping fen, the lands are almost always flooded in winter, from the water raised by the engines standing as a wall between them and their outlet. Now as the deepening of the Welland outfall will accelerate the passage of the flood water to sea, the head of water raised by the engine will be less, and will go off more quickly, and consequently the Bourn and Thurlby fens, and also the Glen washes, containing 400 acres, which now form a reservoir to receive their drainage, will be benefited. The same beneficial result will be found in the drainage of the Cowbit and Crowland washes, and in short it may be said, that all the lands and washes, however distant, that depend upon the Welland for their drainage, and are at present subject to injury from floods, or want of depth in the river, will be essentially benefited and improved. From their situation and liability to be flooded, which, I believe, they almost always are during winter, the Cowbit and Crowland washes will derive the most important and immediate benefit: but it would require great local knowledge to state positively the absolute or comparative value of the improvement upon different lands; this must depend upon the degree in which they at present suffer, and their situation, because generally those near the river will profit more than those at a distance, and I apprehend there will be no other means of determining the proportion of benefit than by a survey of their present state, and a comparison of it with their condition after the contemplated improvements have been made, and their effect felt.

The banks of the Glen appear in many places bad, and I am informed that breaches are not unfrequent: the expense of supporting them must be great, from the country which drains into this river being high, and sending down the floods rapidly. The proposed improvements in the Welland, below the point where the Glen joins it, will take off the waters as they come down more quickly than at present, and by thus affording direct relief to the banks, add to the security of the lands liable to be injured by breaches.

Effects on shipping interests.

I now come to the effects upon the shipping interests. On 24th September, the day before referred to, the tide flowed

At Clayhole - - - - - - -	5 hours.
At the meeting of the Witham and Welland -	3½
At Fosdyke bridge - - - - -	1½
At the Reservoir - - - - - -	1¼

I have already stated that the above was a high spring tide—neap tides are much lower: during several days that my surveyors were near Fosdyke bridge, there was no rise of tide there, and therefore none any where above it, and this is a common occurrence. While I was last at Spalding, a gang of lighters, drawing only eighteen inches, lay below the Reservoir, unable to get up to the town, although the spring tides were then on.

At low water in dry seasons, such as the last, there are but a few inches of water in the bottom of the channel below Fosdyke bridge, and the channel is so narrow, and so extremely tortuous and shifting, that the navigation may be said to depend entirely upon the tide, and when *no tide, no navigation.* Vessels drawing only three feet to three feet six inches are frequently not afloat, except during the high water of a few days at the top of the springs, and if the opportunity be not watched for them to get away, they are stuck fast for a fortnight. Vessels drawing more than six feet, cannot depend upon being afloat at all, even during the springs, and if these tides are not good, they may be detained for a month: there are, indeed, cases of detention for several months. Vessels of this draught, therefore, remain at the bridge, and have their cargoes taken up and brought down by small craft, few vessels drawing more than three feet venturing up to Spalding, from the liability to long delay here.

The sudden twists and bends through the sands below the bridge above alluded to, are, if possible, a greater evil than the want of depth. The plan will give an idea of them as they now are, but after a flood the course may be very different, so that it is almost in vain to attempt to mark out a channel.

Such is the navigable river Welland in its present state; it cannot, I think, always have been so, or Spalding would not have been built as a shipping town, with its warehouses and other accommodations, although I do not see sufficient cause for a very great diminution of water. The Vernatt's drain certainly takes the water from 27,000 acres that used to pass into the Welland, at a higher point than it now does, and there are various draughts from the river by tunnels into the North Level and South Holland, which are also injurious. If parties have a right thus to supply themselves with fresh water, the number and size of the tunnels, or rather the quantity of water to be issued, should at least be defined, and the sooner this is done the better, for the security of all.

If the effect of the measures I have proposed be to deepen the water to the extent I have stated, or even approaching to it, the benefit to shipping must be immense. It will probably enable a vessel drawing ten feet water to get to Fosdyke bridge, and one drawing six feet to Spalding, with a tolerable prospect of getting away early on the return of the springs.

At present the width of the river between Spalding and the Reservoir is 60 to 70 feet at the surface of low water; between the Reservoir and the bridge the width is about 120. The former is probably too narrow for the quantity of water, and the latter too great for a regular channel; both may be altered beneficially, but I would advise that attention and money should be in the first place bestowed upon the works below the bridge, and that the effect of these on the part above should be seen before any great expense is incurred with the upper part, which, if done without experience of the works below, might be in a great measure useless, from the channel being too large or too small for permanency.

Trade of Spalding. How far the trade of Spalding may be extended after the Welland has been improved to its greatest capability I cannot say; but there must be something of peculiar advantage in the situation that attaches trade to it, while the river is in its present deplorable state, and there is therefore every encouragement to improve it; not only with a view to the prosperity of the town and surrounding country, but in reference to the increase of trade, and, consequently, of the river dues, which will amply compensate for any judicious outlay.

Future Works. Such are the works as they appear to me expedient at present; if the results prove beneficial, still further improvements may be contemplated. Of these the extension of the sea embankment in the lines B B B on the plan, will be a first and principal one, as it will increase all the effects described as arising from the first embankment, besides tending to the improvement of the outlet of the Witham, of which the embankment next the sea may be considered as forming one side.

Between Spalding and Deeping the Welland is circuitous and shallow, the South Drove drain comparatively straight and deep. If the outfall of the river be deepened to near Spalding, it will be well to consider the effect of making the South Drove the main drain, connecting it with the river by a cut behind Spalding at the lower end, and another cut to Deeping at the upper; a lock, with gates to lock both ways, and a sluice being placed at each end of the drain when so extended. If this were done, the present course of the Welland through Spalding deepened and widened, and having gates at its extremities communicating with the South Drove drain and with the river, might form a convenient dock; the South Drove drain would be a good navigation to Deeping, the gates at each end regulating the height of the water in it; the upland floods might wholly or in part be taken through this channel, to the great relief of all the district between Deeping and Spalding, which is now often flooded by the Welland; and probably Deeping fens now drained by steam would have a good natural drainage. But the proprietors of these fens, like the owners of Tyd and Newton, in the North Level, would not be likely to trust to this drainage alone, without full experience; nor need they, for the lock gates I have named would prevent any annoyance to them, and to say the least, the expense of pumping would be reduced. These views are, however, given as distant ones, to be corrected by a nearer approach, which the works I have before recommended will, when executed, afford.

I am, Gentlemen,

Your obedient Servant,

JAMES WALKER.

Spalding, 7th November, 1835.