

The biggest problem in our own district was now to deal with the flood that had occurred in the Bourne Fen area. The situation was such, that no gravity discharge of any form was practicable, with the possible exception that some of the Thurlby water was at a slightly higher level and could under certain circumstances be discharged through Heathcotes Tunnel by gravity, but these conditions only obtained for a relatively short time. Various units of pumping equipment were assembled from different places, some of them through contact with the Ministry of Agriculture & Fisheries. There were a number of different types of pump in use, some diesel driven, some with electric generators, others petrol driven, and the largest set which was finally erected being operated by means of a high tension electric mains supply. The Boards two portable pumps were operated on the site for a total of 1,808 hours virtually non-stop, and a 12" pump erected near the site of Heathcotes Tunnel also ran for approximately the same time. Two electric generator operated pumps, which were supplied from Portsmouth and erected at Tongue End Bridge, had very good outputs when they were in operation, but considerable difficulty was being experienced with regard to the electric motors after they had run for some while continuously, and although it has been impossible to confirm the theory, it is believed that these motors, under continuous running, set up a certain amount of distortion owing to heat with a resultant failure, and after some while, when temperatures had dropped, they were capable of restarting. In total these two pumps ran for about 370 hours. A petrol driven pump on the site of the Tongue End Bridge, pumping water into the Glen, ran for a total of 456 hours.

The last set of pumps to be erected at Tongue End Bridge to evacuate water from the flooded Fen into the River (Glen, was a set of three electrically operated pumps having 21" delivery lines, and the erection of this unit with all its ancillary equipment was very definitely a major undertaking. The first outstanding difficulty to be met and overcome, was the provision of a continuous supply of electricity. It was necessary to construct an 11,000 volt line from Bourne, and for this purpose some 6,000 yards of cable were obtained through the Ministry of Agriculture & Fisheries; the Mid-Lines Electric Supply Company did a very fine piece of work in laying the cable and making the supply available for the pumps in a matter of three days, once they were assured that the cable itself would be forthcoming.

The first consignment of material from the Metropolitan Water Board, from whom the equipment was obtained, in connection with these pumps, arrived at Podo Hole at eleven minutes past nine on the morning of Friday April 11th., and this consisted of a miscellaneous collection of pipes, which incidentally would be the last thing required on the site, and from that time onwards loads of various sorts were continuously arriving and being transported through the flooded Fen and handled into position.

The site itself presented some very serious difficulties as the whole of the Fen, including a considerable length of the road which had to be used, was completely under water and all transport had to be reversed along this road for a distance of rather more than half a mile as a minimum, the hard surface below the water being marked by means of poles.

During the course of four days three vertical pumps

were erected on a metal stage, and these were driven by three electric motors mounted and coupled directly to the top of the pumps. The motors were coupled to three separate control panels which in turn were connected to a mercury bulb rectifier, transformer and high tension switch gear at the final point of the H.T. line constructed by the Mid-Lince Company.

The discharge lines presented some difficulty as the quantity of water being evacuated would be considerable, and the velocity of discharge would be extremely high with the possibility that the Glen banks would fail under scour unless some adequate work of protection was installed. To overcome this a large barge was brought up from below Fosdyke Bridge, where it was in use on the Wolland Outfall Improvement Scheme, and sunk in the Glen so that the discharge lines from the pumps in effect filled the barge, which in turn overflowed, the gunwales acting as a long crested weir.

The first water to be discharged by this unit was from one at 7.37 p.m. on Tuesday April 15th. and within another few minutes a second pump was in operation, and on the following day all three pumps were running to capacity.

As the water level was drawn down in the flooded Fen the stage on which the pumps had been mounted had to be progressively lowered, and for this reason a considerable amount of work was continuously necessary; at the present time these pumps are being retained on the site, but have still to be lowered further to provide a really adequate water table level. By the 3rd and 4th of May some of the farmers were beginning to plough in Bourne South Fen, and by the end of the following week a high proportion of the

area that had been previously flooded had been ploughed, and it seemed reasonable to assume that this operation would enable a satisfactory crop to be taken from the flooded district; it is also interesting to note that the Counter Drain Washes were also capable of being ploughed in many cases a day or two before the lands of the Bourne South Fen. The total capacity of the pumping units employed in evacuating waters from the Bourne South Fen and Thurlby Fen area aggregated something in the order of 108 cu.secs.

There were, of course, numerous things that were done in the area in an effort to expedite the clearance of flood water and to return the district to something like its normal conditions which are far too numerous to mention, and I will content myself with one further reference to work that was done, not in an effort to improve the situation in the areas under my control, but in what, at that time, was considered to be National necessity, and to afford some considerable relief to the Postland area.

On Tuesday the 1st. May an emergency meeting was held of the South Holland Board, and it was there decided that a new culvert should be installed and a new drain cut from the Postland area to the South Holland Main Drain with a view to evacuating a considerable quantity of the Postland flood water. This meeting had not been held until it was quite obvious that the water levels in the South Holland, within the course of the next day or so, would be capable of dealing with any waters introduced from an outside source, and machines were brought in from various places in the area to make a new waterway and to construct a new culvert under Queens Bank. By 10 o'clock on Easter Saturday morning something in the order of 50 cu.secs. was being discharged

from the Postland area. This discharge was under complete control and varied as circumstances dictated, the maximum quantity at any time being something in the order of 90 cu.secs., and it is felt that this relief was undoubtedly of great benefit to the Postland District in particular and the North Level in general.

REINSTATEMENT TO PERMANENT WORKS AS A RESULT OF THE FLOOD.

As can be well imagined a flood of the magnitude we have just experienced is bound to leave a trail of damage in its wake. Not only does flood water damage the land from a point of view of crop productivity, or even making it impossible to get a crop off for a particular season, but it damaged high level flood banks, culverts, sluices and other structures and "landed up" a number of dykes and water courses, with the consequent detrimental effect upon drainage as a whole.

As soon as the flood waters were subsiding, arrangements were put in hand to dispose of the temporary works, such as cradging, that had been erected during the crisis, and up to the present time a considerable amount of this salvage has been done although the area has by no means assumed its normal aspect yet. Consideration was also given to the condition of various dykes, and in a number of instances work is already in hand in clearing obstructions of various sorts created by the flood.

The biggest problem however, presenting the greatest potential danger to the area, was the protection works between the high level carriers and the Fen and Marsh areas, there being no doubt whatsoever that these works are not

now in a fit condition to withstand a reasonably heavy flood next winter should such a condition obtain. With this knowledge an immediate approach was made to the Ministry of Agriculture & Fisheries as to the position with regard to reinstatement and rehabilitation works, and, as an outcome, a meeting of selected contractors was convened for the 30th April when some indication was given as to the quantity of work involved and the types of plant required to make the Fens relatively safe in a reasonably short period of time.

There is, of course, a major scheme of improvement about to be commenced for the whole of the lower reaches of the River Welland which will have far reaching results upon the safety of the Fens, and this scheme also provided for relief to the ombanked section of the River Glen, the job, however, is of such magnitude that it must be treated as "long term" and it was quite obvious that, for a reasonable degree of safety to be enjoyed in the interim, a "short term" job must immediately be put in hand, and a second meeting of contractors was held on the 8th May when they had had an opportunity of examining their plant potential and going into other factors which would influence their working capacity through the summer months. As an outcome of this second meeting prices were received for various schedules of work and by the 13th. May the contractors were allocated certain sections of bank upon which to start, and by the 15th. May the first contractor's machine was on site and working. In addition to contract work, rehabilitation is now in progress by direct labour at the upper end of the Washes and in the Deepings district, and it is hoped that by this prompt action the ravages of the flood will, to a very large degree, be overcome, and resultant upon this, a

flood during the next winter should be faced with a reasonable degree of confidence.

There are of course a number of other works to be put in hand as soon as time permits, but there is no doubt that the high level banks must take absolute priority over everything else in view of damage that can be done as a result of a failure.

#### CONCLUSION

There are a number of outstanding features connected with the flood which I think might be suitably mentioned.

Both the main rivers had two separate peaks approximately three days apart - an unusual feature.

At Spalding the water level during this flood reached 18.10 O.D. (Liverpool), the 1880 figure being 17.38 and the 1939 figure 16.32. The gauge at Crowland Bridge was slightly in excess of 19.75 O.D. (Liverpool) and the 1939 flood was in the order of 18.00.

The maximum computed input into the Crowland and Cowbit Washes was in the order of 5,500 cu.secs. The maximum gauged discharge through the River Welland channel at Spalding (downstream of the Washes) was approximately 2,400 cu.secs.

It should be fully appreciated that the closing of the breach in the River Glen was of paramount importance, particularly so as no failure subsequently occurred in the Deeping High Bank. The closure was effected under very adverse conditions and against an appreciable head of water, in a period of approximately 51 hours; with the resultant complete cessation of flow of extraneous water into the

Fen at this point.

The highest water level recorded at Podo Hole Pumping Station was 5'8" (3.80 O.D. Newlyn). Record of non-stop runs of the engines - Henry Bain 792 hours. Dennis 475 hours. Welby  $480\frac{1}{2}$  hours. Elloo  $367\frac{1}{2}$  hours. The longest previous recorded run was by the Dennis of 396 hours in January 1939.

The Fourth District ran 550 hours continuously, the longest previously recorded being 408 hours in 1927.

The Pinchbeck Marsh Pumping Station exceeded the previous longest recorded run of 1912 by two days.

One of the main contributory causes to the rapid evacuation of flood waters from Deeping Fen was the Vornatts Drain, which was the subject of a major improvement scheme carried out during the war, and I hesitate to assess the dividends attributable to this expenditure.

The South Holland system has also been very greatly assisted by the improvement scheme that is now in hand and although this improvement at the present time is not completed, even as far as the main drain is concerned, it was very evident that the area would have been flooded to a very great extent and for a longer period if this work had not progressed to the stage which it has now reached.

In the area of the different Marsh Boards the extensive schemes of improvement which have been carried out during the last six years have proved of untold benefit, it being evident that once the ice formation began to thaw out the districts very rapidly evacuated their waters. When all the programmes of improvement in these districts have been completed satisfactory drainage should be enjoyed under all normal flood conditions.

When it was eventually decided to relieve a portion of the Postland area by taking some of the waters into the South

Holland system the speed with which the necessary machines, etc. were transported to the site and the rapidity of the job was very gratifying.

Certainly one of the outstanding achievements, from an engineering point of view connected with the erection of emergency pumping equipment in the country, was the way in which plant was assembled and erected for the purpose of evacuating the flood water from Bourne South Fen & Thurlby Fen, enabling a crop to be obtainable this season. In this respect the Ministry of Agriculture & Fisheries, the Mid-Lincs Electric Supply Company and the London Metropolitan Water Board (who supplied the pumps) are to be congratulated on their ready co-operation.

It is interesting to note that, as near as can be computed, an area of about 53,000 acres of land in the Marsh and Fen was at one time or another under varying depths of water and a considerable number of houses were adversely affected.

As is usual in an emergency in the Fens of this type, the majority of the farmers and their employees gave yeoman service in defence of their lands against the floods.

The local N.F.S., the Commandants of the Prisoner of War Camps and the W.V.S. (in serving hot drinks to the workers) - all of them are to be thanked.

The Police carried out all my requests with promptitude and dispatch and are much to be commended for their services.

Transport operators and local tradesmen also played a very important part, co-operating both with this department and their own colleagues during the emergency.

Thanks are also due, in no small measure, to numerous volunteers who undertook, to the best of their ability, any