

COUNTY BOROUGH OF DERBY



OFFICIAL OPENING

of the

WATER TREATMENT WORKS

and **PUMPING STATION**

at **LITTLE EATON**

and the

SPONDON No. 2 SERVICE RESERVOIR

by

Councillor G. H. PERRY

(Chairman of the Water Committee)

Wednesday, 30th September, 1959

COUNTY BOROUGH OF DERBY

THE WATER COMMITTEE AT 30th. SEPTEMBER 1959

The Mayor - Councillor G. A. COLLIER
Chairman - Councillor G. H. PERRY
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I. G. EDWARDS, B.Sc., M.Inst.C.E.
Water Engineer and Manager

G. H. EMLYN JONES,
Town Clerk

OFFICIAL OPENING OF WATER TREATMENT WORKS AND PUMPING STATION AT LITTLE EATON AND THE SPONDON No. 2 SERVICE RESERVOIR

The Scheme of Reconstruction

It had become apparent, even before the second World War, that major new works would be required to treat and distribute satisfactorily the resources of water available to the Corporation to meet the ever-growing requirements of their consumers. Total consumption at 54 million gallons per day in 1937 had increased by more than a third in ten year.

Ten years later, in 1947, consumption was nearly 8 million gallons per day, and it is now approaching 11 million gallons per day.

A scheme of reconstruction was approved in principle by the Council in 1946 so as to ensure that the Undertaking could furnish adequate supplies of water to consumers in the coming years, the scheme, in addition to this prime requirement, being designed to provide alternative works which would much reduce the danger of failure of supplies to large areas (at that time the water needs of more than 100,000 people and many large industrial works depended on a single water main) and to provide for the supply of mixed water to most parts of the supply area from the Undertaking's two sources, namely, the works of the Derwent Valley Water Board and the Corporation's own works at Little Eaton.

The scheme is, for it is not yet complete, arranged to be carried out in phases, with the object of providing only such works as are necessary to meet increasing estimated demand, and of replacing those no longer fit for use, and so of keeping the repayment of loans and the interest thereon to a minimum.

The present occasion, commemorated by the official opening ceremonies, marks the completion of the first phase of the scheme, the principal works of which are now briefly described.

The Radbourne Lane Water Tower

The Radbourne Lane Water Tower and the associated 12 in. diameter water main, completed in 1948, were constructed to relieve critical supply conditions in the higher parts of the west and south

west of the area of supply. The water tower, which is a prominent feature of the landscape in the area, is a reinforced concrete structure some 119 ft. high and has a capacity of 90,000 gallons. The cost of these works was £17,000.¹

The High Pressure Main System

This system comprising some 5 ½ miles of 30 in. and 27 in. diameter steel, and 18 in. diameter spun iron main with 12 in. and 9 in. diameter connecting links, was completed in 1953 at a cost of £180 000.



Pipe Bridge over the River Derwent. The bridge carries a 27in. diameter high pressure main

The pipe line provides an alternative to the existing 30 in. diameter high level main, and has a capacity which will allow of considerable further expansion in demand. It is connected, at the upstream end, to the aqueduct of the Derwent Valley Water Board at Breadsall, and the water conveyed is subject to the pressure due to that Board's Ambergate Service Reservoir.

¹ Costs throughout this brochure are given to nearest £1,000

The Radbourne Lane service reservoir and the Pumping Station at the Low Level Works, Little Eaton, are two Works which are associated with the high pressure mains system.

The reservoir, which is sited at the terminal of the main, was built on the same site as the Radbourne Lane water tower, and is of 3 million gallons capacity, completed in 1955 at a cost of £79,000. It is constructed of reinforced concrete, and is provided with a valve house which contains electrically-operated repumping plant for emergency use. The reservoir proper is covered by an earthen embankment.



Service reservoir in Radbourne Lane, under construction. The water tower is seen on the left

Rising demand in the lower, industrial, part of the supply area made it imperative to increase supplies to this area and the most economical course available was to instal the Pumping Station at the Low Level Works to repump water from these works as an alternative to laying a trunk main through the heart of the town, this course not only deferring for a considerable time the necessity to lay the trunk main, but providing a refined control of supply conditions in the area concerned. Moreover, due to the fact that some of the water to be used in the area would be taken from the High Pressure Main, power could be obtained by passing this water through a Pelton Wheel (a form of Water Turbine), and so contribute



Valve House-Radbourne Lane Service Reservoir



Pumping Station at Low Level Works, Little Eaton. (Before reconstruction of service reservoir)

very usefully to the power requirements of the Station. This principle was used in the design of the works, and since the completion of the Station in 1952 some £3,740 in cost of electricity has been saved.

The Pumping Station, a brick building founded on a reinforced concrete basement, contains four pumping units and the total cost, including plant and associated connecting mains, was £24,000.

Other Mains and Works

The scheme of reconstruction provided for six pressure zones in the area of supply, in place of four previously, with the object of reducing, in some areas, pressures which were excessive and giving rise to greater waste of water, and of increasing pressures in others where they were too low to give satisfactory service to consumers.



18in. and 24in. diameter pipe lines (spun iron pipes) being laid in the same trench

This plan required the laying of pipe lines to reinforce and extend the trunk main system. The mains laid fall into the following groups: ²

- Zone 1. 18 in./15 in. diameter main, Osmaston Road.
12 in. diameter main, Nottingham Road, Derby
- Zone 2. 24 in. 21 in. diameter main, Radbourne Lane Reservoir to Ford Street, and the 24 in. /21 in./18 in. diameter main, Byron Street, Newdigate Street, and associated mains.
12 in. diameter main at Spondon.
- Zone 3. 15 in./12 in. diameter main, Warwick Avenue, 12 in. diameter main, Broadway, and 9 in. diameter main Old Hall Road area, Littleover.
- Zone 6. 15 in./12 in. diameter main, Locko Road, Spondon

All the foregoing mains were completed by 1957 at a cost of £185,000.

By reason of the necessity to provide increased supplies in the Industrial part of the area to the south and east of the centre of the Borough, a further group of works was commenced in 1957, comprising a 12 in. diameter main 3 1/2 miles in length, conveying water treated by the Little Eaton Works to a new service reservoir -----



Valve house of Spondon No. 2 Service Reservoir nearing completion, 1959.

² See also diagrammatic plan at the end of this brochure

Spondon No. 2 at Longley Lane, Spondon, together with other mains connecting the reservoir with the pipe line conveying Derwent Valley water, in Locko Road. The principal outlet main from the reservoir is of 21 in. diameter, having a length of 22 miles, linking the reservoir with the existing distribution system at Alvaston.

The reservoir itself is of reinforced concrete construction having a present capacity of 1,700,000 gallons, and is so designed that a second part may be added if necessary in the future, so as to increase the capacity to some 3 million gallons. The reservoir is provided with a valve house, containing pumping plant operated by water power in a similar manner to that described in the foregoing for the Low Level Works Pumping Station, namely, by the utilisation of the high pressure of Derwent Valley water. The pumping plant repumps water from the reservoir to the higher parts of the Spondon area.

The cost of what may be described as the "eastern development scheme" amounted to £148,000 and its completion is marked by the official opening of the Spondon No. 2 Reservoir.

The Treatment Works and Pumping Station, Little Eaton

These Works were originally laid down by the Derby Waterworks Company as a pumping station only, in 1850, and included steam driven pumps arranged to deliver water which gravitated into a large collecting tank from infiltration galleries laid alongside the River Derwent, to the Low Level Works on the hillside to the east of the Pumping Station. Additional pumping plant was added in 1875 to deliver water to the newly constructed High Level Works, of similar general design to the Lower Works, and from that date, with the exception of the provision of some temporary pumps about the turn of the century, which were later removed, no further additions were made to the plant until 1935, when two electrically-driven centrifugal pumps were installed to take over the duties of the steam plant.

Water from the pumping station was treated at the Low and High Level Works by slow sand filtration, by works, the greater part of which were from 70 to 100 years old at the end of the last War. The works were separate, and for this reason more difficult and expensive to operate, and did not, by modern standards, provide an entirely satisfactory treatment of the raw water. Further, the water obtained from the Filter tunnels is relatively hard, while that received from the Derwent Valley Water Board is a soft water, so that in supplying a mixture of these two waters to the area, and at the same time increasing the proportion of filter tunnel water without producing an undue increase in total hardness of the water supplied, it was necessary to include plant capable of softening the raw water



View of the Pumping Station as it was in 1930. The boiler house, now containing part of the lime handling plant, is to the upper left of the picture, and the 150 ft. diameter collecting tank, in which the filters are built, is in the right foreground.

See over for an aerial view of the Treatment Works as reconstructed.



before admixture with Derwent Valley water. It was decided to instal, in 1947, plant which would partially soften the filter tunnel water before filtration by the addition of lime, and otherwise improve water quality while providing much data for future use.

This pilot plant, completed in 1950 at a cost of £25,000, was so designed as to be incorporated into a later development, and proved very successful in increasing the length of the periods for which the slow sand filters and the open service reservoirs at the Works could be operated without cleaning. In 1952 it was decided to go ahead with the completion of the scheme namely, the centralisation of all water treatment at the Pumping Station.

It was necessary that the design of the works should be such as to ensure that throughout the period of construction the output of the existing plant should be unimpaired. This was achieved, the new works being commenced in March 1954, and substantially completed by February 1958. They have been in full use since that time, with the exception of the lime slaking and handling plant, which is now, however, also in full operation.

A brief description of the Works can be followed by referring to the isometric projection at the end of this brochure. Raw water



Interior of North Pump House, containing two of 'the raw water pumps .

from the filter tunnels enters the north sump (1), from which it is pumped by means of remotely controlled raw water pumps (2) in the North Pump House into six reaction tanks comprising the central circular tank (No. 1), part of the pre-treatment plant previously mentioned. No. 2 group of three hopper-bottomed upflow tanks and No. 3 group (of two similar upflow tanks).

During its passage through these reaction tanks the water is treated with chlorine, a coagulant, aluminoferric, and lime. The first two of these chemicals are delivered at the unloading bay (3) of the Administration and Chemical Block, and after storage are fed to the water in measured quantities through instruments and plant installed in the building for the purpose.

The lime, however, of which over 1,200 tons per annum are required when the plant is in full operation, is delivered to the Works in the lump form as calcium oxide, at the lime unloading bin, (4) from which it passes into a crusher, housed below, and thence, by means of a pneumatic conveyor (5) to the storage bins (6). From these bins the crushed lime is supplied to slakers (7) by means of screw feeders working in conjunction with batch weighers (8). After slaking, the lime cream is pumped into mixing tanks (9) where water is added to bring the cream to the requisite strength. The resulting lime mix is supplied to the reaction tanks by means of metering pumps (10). Part of the lime handling plant is installed in the Boiler House of the Steam Pumping Plant laid down in 1875.

The chemical reaction which takes place in the reaction tanks produces considerable quantities of lime sludge (mainly chalk which is disposed of directly into lagoons by desludging pumps and gear. Sludge dewatering plant (installed with the pilot plant in 1949) is also available if required, which enables partially dried lime sludge to be loaded into vehicles for transport away from the Works.

The supernatant water which is drawn off from the top of the reaction tanks passes through rapid gravity filters (11) of which there are eight into the filtered water reservoirs (12) beneath. These reservoirs, of which there are two, each of 300,000 gallons capacity, as indeed, the filters themselves, the framework for the Administration block, and the reaction tanks, are constructed of reinforced concrete.

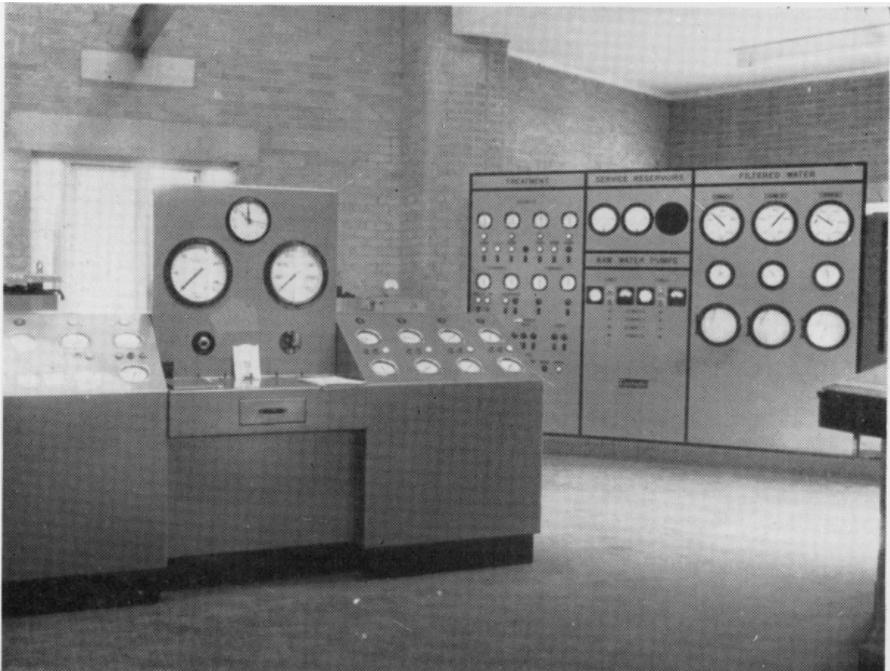
The control gear provided for the filters is such that the output is automatically adjusted to the quantity of water delivered by the raw water pumps, and the principal valves of the filters themselves are hydraulically and remotely operated. A central control point for virtually the whole plant is established in the Filter House, where is also sited the instrumentation giving details of flows, levels, pump operation, and chemical treatment, and of the washing and operation of the eight filters, together with a comprehensive alarm system, providing warning of low and high water levels in the various tanks.

and reservoirs, the and when the content of chlorine in the water after treatment is too low.

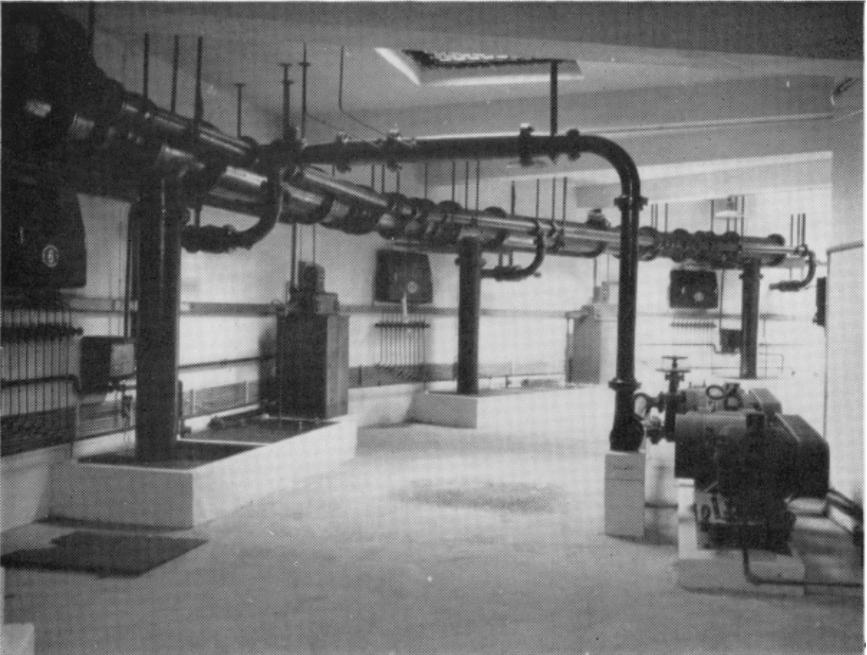
The removal of suspended matter from the filters is accomplished by a combination of air scour and back washing with filtered water, stored, in this case, in a tank of 100,000 gallons capacity on the hillside to the east of the Works.

The upwash water from the filters passes into a reception area from which it is pumped by automatically controlled pumps installed in the central pump house, to the wash water recovery tanks. These latter enable solid material to settle out and be drawn off to a lagoon, and the bulk of the water to be returned to the north sump for re-use.

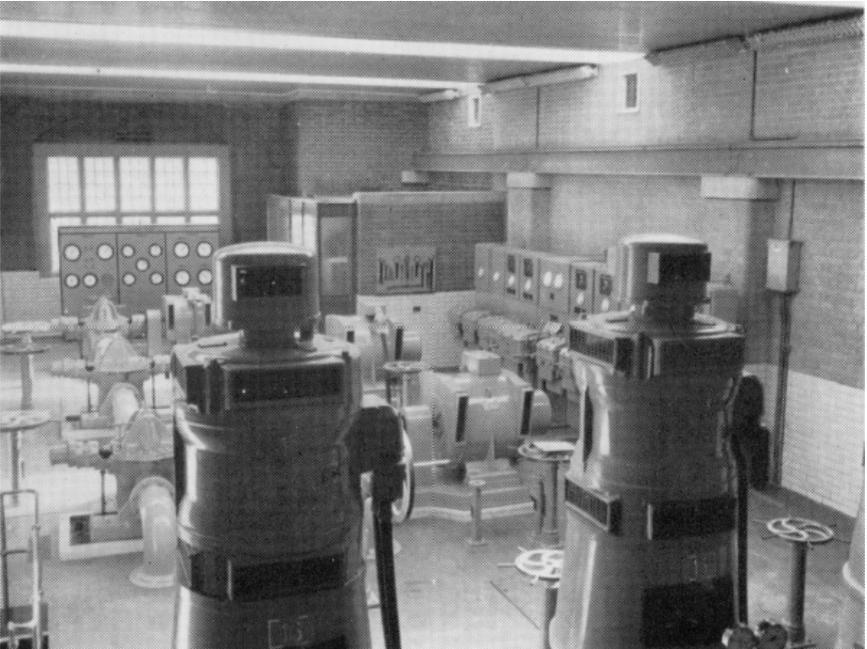
After entering the filtered water tank the water passes through a system of baffles and is dechlorinated, by the addition of sulphur dioxide to a predetermined level controlled by plant in the Filter



Part of the control room of plant



Part of a filter gallery



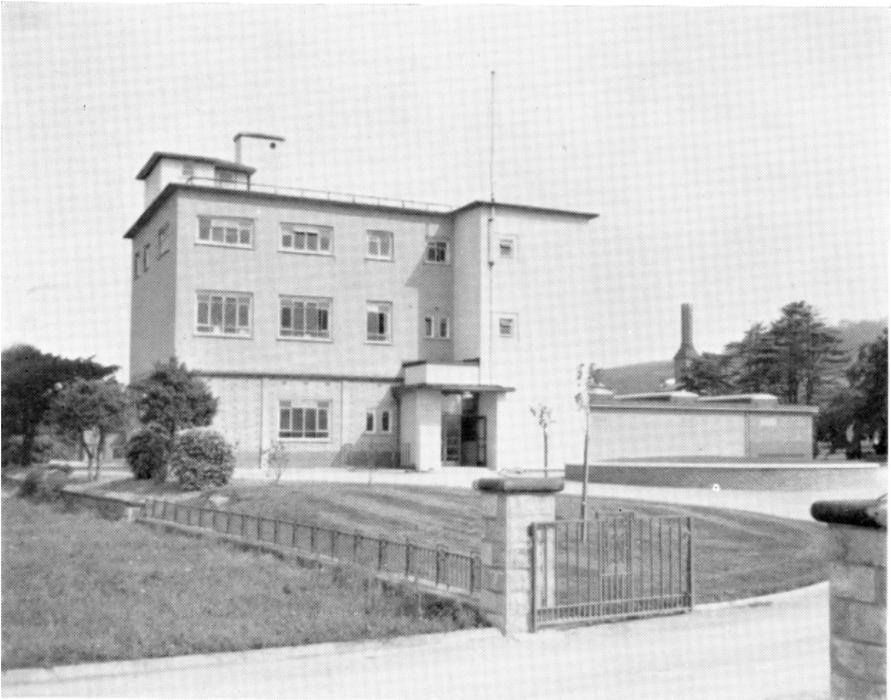
Interior of ` South Pump House

House. The finally treated water is drawn from the filtered water tank by pumping plant in the South Pump House, in which six pumping units, driven by electric motors having an aggregate horse-power of 1,470, are installed, and these enable the water to be delivered into three different zones of supply.

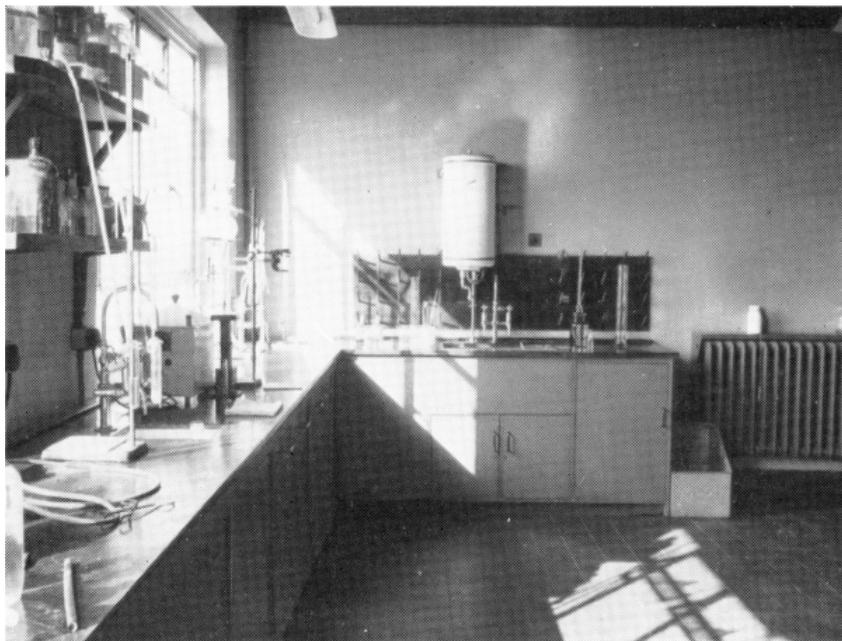
Close chemical control of the treatment of the water at all stages is essential and a laboratory has been provided in the Administration Building, in the charge of the Work's Chemist. There is also a machine shop adjacent to the unloading bay, which enable repairs to be carried out expeditiously.

The capacity of the whole works is 7 million gallons a day.

The incorporation in the new works of parts of earlier mains and works installed on this site enabled considerable economies to be made in costs of construction. The final cost of the works was £287,000.



Exterior of Administration and Chemical Block and South Pump House



Interior of Laboratory - Treatment Works and Pumping Station, Little Eaton

Responsibility for Works

The total cost of the First Phase of the Reconstruction Scheme amounted to £945,000, and of this £500,000 was the value of the works carried out by contract and £445,000 the value of the work done by the Water Department direct. Almost the whole of this latter sum was devoted to the laying of water mains and included in it is the value of pipes, valves and other materials and plant purchased directly by the Undertaking.

The design and supervision of construction of the whole of the Works were the responsibility of the Corporation's Water Engineer and his staff, with, in respect of the design and construction of the reinforced concrete structures the collaboration of the F. C. Construction Co. Ltd. of Derby, and in the case of the buildings of the Administration Block and South Pump House at the Little Eaton Pumping Station and Treatment Works, and of the Re-pumping Station at the Low Level Works the collaboration of the Borough Architect, who also supervised the construction of these two buildings.

Contractors

The principal Contractors were as follows:

Radbourne Lane Water Tower	Christiani & Nielsen Ltd., London	£ 9,000
Little Eaton Pumping Station (Pilot Treatment Plant)		
Treatment Plant	Paterson Engineering Co. Ltd., London	10,000
Pumps	W. H. Allen Sons & Co. Ltd., Bedford	4,000
Reinforced Concrete Work	Head, Riggott & Miller, Castle Donington	3,000
Low Level Works Pumping Station	Kirkland (Derby) Ltd., Derby	4,000
High Pressure Mains System		
<i>Contract 'A'</i> (Steel Pipes)	Horseley Bridge & Thomas Piggott Ltd., Tipton	56,000
<i>Contract 'B'</i> (Pipe-laying)	Edward Thompson Ltd., Derby	55,000
Radbourne Lane Service Reservoir	M. J. Gleeson (Contractors) Ltd., Sheffield	64,000
Little Eaton Pumping Station		
<i>Contract 'A'</i> (Treatment Plant)	The Candy Filter Co. Ltd., London	90,000
<i>Contract 'B'</i> (Reinforced Concrete Works)	M. J. Gleeson (Contractors) Ltd., Sheffield	54,000
<i>Contract 'C'</i> (South Pump House Building)	J. H. Whitehead & Son Ltd., Derby	6,000
<i>Contract 'D'</i> (Administration Block)	M. J. Gleeson (Contractors) Ltd., Sheffield	38,000
<i>Contract 'E'</i> (Chlorinating Plant)	Wallace & Tiernan Ltd., London	10,000
<i>Contract 'F'</i> (Pumping Plant)	Harland Engineering Co. Ltd., Alloa	17,000
Electrical Work	The East Midlands Electricity Board, Derby	10,000
Screening Plant	F. W. Brackett & Co. Ltd., Colchester	3,000
Spondon No. 2 Service Reservoir	Bowmer & Kirkland, Heage	45,000

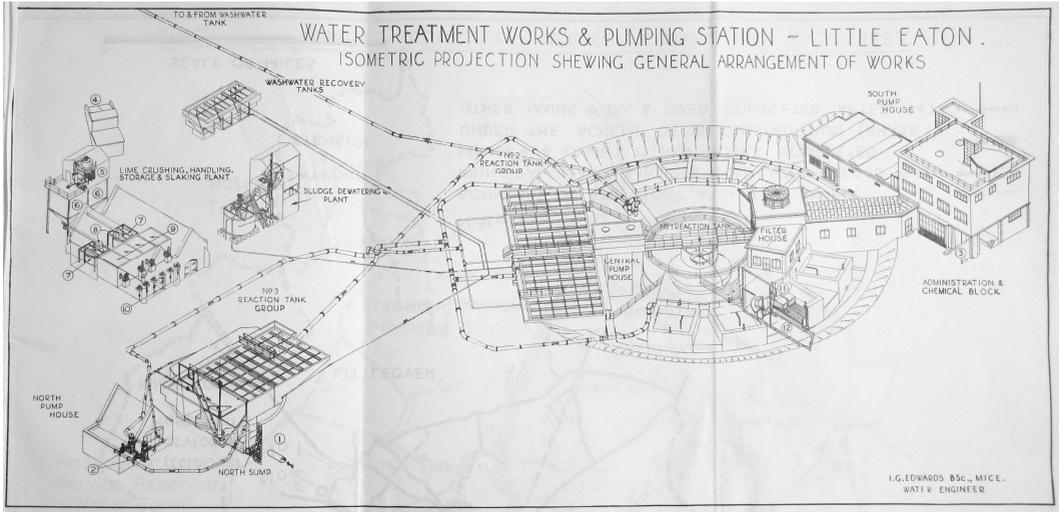
The works carried out by the Department included:	£
Water mains of diameters from 30 in. to 4 in. laid in various parts of the area	352,000
Installation of mains, plant and machinery at the following:	
Radbourne Lane Water Tower and Service Reservoir,	
Low Level Pumping Station at Little Eaton	
Little Eaton Pumping Station and Treatment Works .	
Spondon No. 2 Service Reservoir	93,000

The principal suppliers suppliers of materials, plant and equipment installed by the Department direct were as follows:

Pipes	The Stanton Ironworks Co. Ltd. and The Staveley Iron & Chemical 1 Co. Ltd,
Valves	Glenfield & Kennedy Ltd, and Ham Baker & Co. Ltd,
Pumps	The Harland Engineering Co. Ltd.
Instruments and Metering Equipment	Electroflo Meters Co. Ltd.
Reinforced Steel	The Whitehead Thomas Bar and Strip Co. Ltd. Steel, Peach & Tozer



30 in. diameter steel pipes laid in trench and jointed before backfilling



Water Treatment Works – Isometric Projection Shewing General Arrangement of Works

