CHAPTER 12

Operations and maintenance and contracting out

Operations and maintenance

SWA: operations

12.1. The operational responsibility for water supply in SWA rests with the divisions. Within each of the divisions water operations and maintenance are the responsibility of the Water Manager reporting to the Operations Manager, who in turn is responsible to the Divisional Manager. Building maintenance is the responsibility of the Common Services Section under the overall control of the Operations Manager.

12.2. The physical nature of the water supply system reflects the different sources of supply and the different patterns of distribution of consumers in each division. Traditionally an underground source served a number of service reservoirs sited on higher ground to provide customers with water at the required pressure. In many areas there are now trunk mains to transport water in bulk from surface sources to augment the borehole supply and to transfer water from one service reservoir to another to meet a sudden increase in demand or a failure of a source or of part of a distribution system. The complexity of water supply and of its control is likely to increase over the years to make better use of water without the need to build large storage reservoirs. The advent of telemetry has also made it possible for 126 of SWA's 132 extraction locations to operate unmanned, while providing much more information on the movement of water within the system.

SWA: water sources and treatment

12.3. Raw water is pumped from its source, be it a borehole or a river, to some form of treatment works, sometimes via a holding reservoir. Treatment may be either simple disinfection by chlorine or a more complex process to remove a number of contaminants such as iron and manganese. Within SWA borehole sources predominate: these generally produce good quality water at a lower unit cost than surface sources where water quality is more variable. Borehole pumps are usually bolted to the bottom of a rigid 'string' or column of vertically-rising pipes, each 12 feet long, which may be several hundred feet in height. For the deeper boreholes the cost of bringing a pump to the surface and then returning it to use may be greater than the value of the pump. Fortunately, these pumps usually require little attention for long periods. As shown in paragraph 12.27, new flexible materials have been developed for borehole pipes. It is not, however, usually economic to use them to replace existing metal pipes before they are due for normal renewal.

12.4. Other pumps receive more regular inspection. The pumps used for extracting river water and for pumping raw water through treatment works are accessible and their performance can be checked by plant operatives while in use. 'Dosing' pumps (ie pumps which 'dose' untreated water with chemical

purifiers) and the associated monitoring and control equipment require regular attention to ensure that treated water complies with water quality standards and that expensive chemicals are not over-applied.

12.5. The principal variable operating cost is the electric power used in pumping. The selection of raw water sources and pumping schedules is made with a view to minimising pumping costs. This is done most often by pumping only at night to take advantage of cheaper electricity tariffs. Sometimes however pumping cannot be restricted to night time, for example if water from more than one source has to be mixed together to satisfy water quality standards or if a continuous flow of water has to be maintained through chemical processes in treatment works to avoid recalibration of dosing equipment. SWA does not monitor the power consumed by each pump. Total electricity supply for a number of purposes together is metered for each abstraction and treatment facility.

SWA: water supply and distribution

12.6. After treatment water is pumped to a service reservoir. Sufficient treated water is normally held for 24 hours' requirements of the customers in the area.

12.7. The annual operating strategy is based on the expected seasonal demands within each water supply area. A number of sources of treated water may be available for each water supply area. The quantities of water to meet demand are identified and scheduled from each source so that costs are kept as low as possible. The costs of supplying treated water to service reservoirs vary considerably; water from the most expensive sources may cost half as much again as from the cheapest.

12.8. As at the water sources, pumping cost is the principal variable cost in supply and distribution. Pumping to the service reservoirs is normally controlled by automatic devices which start pumps when the reservoir level falls below a predetermined point and stop them when a pre-set upper level is reached. These systems also ensure that pumping is carried out only when the cheapest electricity is available. Telemetry and control systems allow operators to take control themselves to cope with unexpected events such as a major demand for water for fire-fighting or a burst main. From the service reservoir the treated water falls by gravity to customers as they use it.

Application of new technology

12.9. SWA is applying computer modelling techniques to the distribution of treated water from the service reservoirs. The effect of changing one part of the complex network of pipes used to distribute water to customers can now be analysed. Traditionally this calculation required so much time by engineering staff that it was made only occasionally. The reduction of data processing costs and time in recent years has now made such calculations worthwhile before any significant changes are made in the distribution network. SWA also uses these techniques to find anomalies in measured flows of water which might indicate leakage.

12.10. The modelling techniques used by SWA were developed by the WRc. The technique used to analyse the flows of water in complex networks of pipes is based on WRc's WATNET computer program. WATNET was initially designed to simulate the hydraulic performance of a supply and distribution system including a number of service reservoirs each supplying groups of customers. SWA is studying an enhanced version of WATNET in order to derive complete performance information for the whole daily cycle of demand and supply.

12.11. WRc is producing from time to time mathematical models for scheduling sources so as to minimise the overall cost of treatment and pumping. SWA plans to take advantage of these models as they become available. It also expects to be able to use costing routines for electricity and chemicals from April 1986 and short-term prediction for pump scheduling thereafter.

12.12. Other industry-wide developments in technology include advances in pump design and water treatment equipment. There has been a steady improvement in pump efficiency over the years and variable speed pumps are now more readily available at reasonable cost. Water treatment is increasingly being automated with a consequent reduction in manpower costs. Most applications of new technology involve computers for the processing of data to monitor or control pumping and treatment sites and the use of telecontrol systems to make possible remote operation of equipment.

SWA: implementation of technology

12.13. Each division has autonomy in the choice of equipment. SWA intends that the new Directorate of Technical Services will provide direction from the centre on equipment standards in order to secure a more integrated approach by all divisions.

12.14. At present technical and operating standards and procedures are not disseminated systematically from Headquarters. A limited number of Instructions and Advisory Sheets are issued centrally and re-issued from time to time. Ensuring that the current issue of each is in the hands of the individuals requiring it is a responsibility of divisional managers. It is left to the discretion of the staff in each division to include such documents in the division's technical manual.

12.15. This divisional autonomy has led to a proliferation of systems and to difficulties of communication or comparision. The WRc WATNET model for water distribution analysis, for example, has been implemented in the Kent and Hampshire divisions mainly for design purposes but also to investigate leaks and levels of service and reliability. The existing telecontrol system in Kent using private telephone lines differs from that now being installed in Hampshire which incorporates recently developed programmable logic controllers and uses public telephone lines. However the two systems are not incompatible and could communicate through the central computer. The Isle of Wight also has centralised telecontrol, but Sussex has three separate control areas monitored from the divisional office at Falmer. The pace of development of telecontrol systems in SWA is determined by progress at the WRc.

SWA: maintenance

12.16. Maintenance of the traditional infrastructure for water supply—mostly pipelines and buildings—is carried out following regular inspection and when a breakdown occurs. The rate of deterioration caused by both the soil around and the water within the pipes has been identified by SWA as the main determinant of the amount of maintenance needed.

12.17. An additional factor which affects the likelihood of a failure is the original standard of installation of the pipeline. Records are kept of pipelines known to have been subject to failures. SWA is participating through its membership of the WAA Sewers and Water Mains Committee in the WRc's preparation of a manual on the rehabilitation of water mains. SWA intends to register the technical details of all pipelines in accordance with the WRc manual once it is finalised. At present only networks subject to detailed analysis by, for example, WATNET or which have particular problems are fully documented.

12.18. Maintenance of pipelines is undertaken partly by direct labour and partly by contractors. In general the use of contractors has been increasing for pipe-laying and valve replacement. This has led to a reduction of direct labour employed. SWA currently employs about 250 workers for pipe maintenance and 50 for electrical and mechanical (E & M) maintenance.

12.19. The costs incurred in pipe-laying tasks vary with ground conditions. In particular the cost of reinstating highways after repairs to pipes has become significant and can now be up to half the cost of pipe maintenance. It has increased because highway authorities are requiring more demanding specifications for reinstatement and have raised their inspection charges.

12.20. SWA has few surface storage reservoirs for raw water and does not have the problems with old dams experienced by other water authorities. Prompted by the need to maintain bacteriological standards of treated water, it has recently examined its policy for inspection and record-keeping of service reservoirs and clear water tanks at treatment works on which there were considerable variations in practice from division to division. All divisions are now required to adopt the same frequency of internal and external inspection for reservoirs in the capacity range 450 to 25,000 cubic metres and to keep a register of inspections.

12.21. Maintaining equipment incorporating new technology requires a greater range of skills than those needed for traditional equipment. SWA is in the process of implementing Planned Preventive Maintenance (PPM), with a view to preventing the condition of any item of equipment falling below a satisfactory level. The planning of preventive maintenance is a difficult management task since the optimum frequency of periodic inspection and/or replacement can be established only if sufficient statistical data exist. SWA has decided to organise all its data using a computer software package known as COMAC. This is to be enhanced so as to make full use of its potential to tabulate labour time and materials used in the maintenance of specific items of equipment, in order to achieve optimum frequencies for maintenance. COMAC will also be

enhanced to provide information needed for the specification of new works and for replacement of equipment. It will be used by all divisions. Staff are presently being trained so that all divisions will be working on a common programme.

Companies: water supply, treatment and distribution

12.22. The description of the general characteristics and operation of a water resource and supply system, as set out in paragraphs 12.2 to 12.8 above for SWA, applies generally to the companies. The water supply and distribution systems of the companies show many common features but vary in detail sufficiently to give rise to large cost differences.

Water sources

12.23. Eastbourne has relatively limited potential sources; this has prompted the company to devise a system for transferring water throughout its area of supply, keeping in mind the yield of each source and the total treatment and pumping costs. Folkestone satisfies some demand from local groundwater sources, but has to pump water for Folkestone itself over the North Downs. Mid Kent's water supply system covers a very large rural area. Water is abstracted from 31 boreholes and springs spread across the county and from the River Medway. It is pumped to 63 service reservoirs, which are generally remote from the sources, via treatment works and 50 booster stations. Mid-Sussex is also involved in considerable pumping of water because it is hilly and because half of its supply is drawn from two abstraction points on the River Ouse. Portsmouth is in the fortunate position of being able to match supply and demand by the use of relatively local sources throughout its area. West Kent has its principal source of supply in the north of its area but much of its demand is in the south, and has to be met by pumping supplies over the intervening high ground.

Treatment and distribution

12.24. Eastbourne and Mid-Sussex have to give extensive chemical treatment to more of the water they supply than the other companies. Forty per cent of Eastbourne's total source yield is groundwater requiring full treatment and many other sources are high in iron and manganese which also require extensive treatment before distribution. This means that its chemical costs are the highest relative to the volume of water supplied of any of the six companies. Over three-quarters of Mid-Sussex's water supply also requires relatively extensive chemical treatment.

12.25. All the companies pay considerable attention to saving electricity by carrying out as much pumping as possible at times when electricity tariffs are low. This is simpler for the smaller companies whose distribution systems are less complex than those of the larger ones, though the options available to the smaller companies are more limited. In Mid-Sussex, however, the availability of pumps is insufficient to ensure that all electricity is used at the cheapest night tariff. As most of Portsmouth's customers are in low-lying areas, and it obtains electricity at a cheaper tariff from the Southern Electricity Board than the other companies do from the South Eastern Electricity Board, Portsmouth's energy costs compare favourably with those of the other companies.

Companies: new technology

12.26. There are some considerable differences in the use of new technology, illustrated by the examples of Eastbourne and Mid Kent. Eastbourne is preparing to renew its centralised operational monitoring and control systems with more sophisticated developments in instrumentation, control and automation (ICA) now available. It is also examining the potential for Expert Systems for operational control purposes. Mid Kent, on the other hand, which installed a monitoring system as long ago as 1963, has just completed a feasibility study which indicates that a company-wide telemetry scheme might now be justified by manpower savings. All companies participate in the WRc's technical development programmes.

12.27. In seeking an alternative to conventional steel rising mains suitable for use in the corrosive water found in some of its boreholes Mid-Sussex pioneered the use of flexible rising mains in the SWA area. Eastbourne has also used such mains, which are of a composite construction of high strength synthetic polyester and thermoplastic elastomer. The mains can be relatively easily hauled to the surface over a wellhead roller thus making scheduled maintenance of the borehole pump more economical.

12.28. Folkestone is at an early stage of automation. Mid-Sussex is currently investigating the possibility of integrating its three independent telecontrol systems, and also told us of other innovations. These include booster pumps with variable speed drives controlled by flow-modulated pressure switches, and the automatic resetting of lightning arrestors to save staff time in the aftermath of storms. Portsmouth's borehole sources are controlled by local microprocessors which are automatically monitored from the centre. West Kent has locally automated sources of supply and booster stations with overriding remote control from the centre. Its computerised ICA system also monitors levels of all service reservoirs and all operations at the manned Pembury Treatment Works.

Companies: maintenance

12.29. The approach to maintenance of plant and equipment differs widely. Eastbourne has records and maintenance schedules for all plant, printed by computer. In Folkestone most equipment is serviced on failure, but some is given scheduled maintenance. It plans to extend scheduled maintenance to all its equipment, using its fully computerised equipment register. Mid Kent carries out its maintenance in accordance with manufacturers' instructions and has not formulated its own preventive maintenance schedule. Mid-Sussex keeps comprehensive plant history cards. If delays occur in obtaining spare parts from manufacturers it has been able to manufacture its own on occasion. Portsmouth keeps no central plant file but separate sheets for each plant item are used for overhauls. It has been studying various computerised methods of keeping mains records, particularly detailed maintenance histories. Portsmouth benefits from having relatively few large plants needing less maintenance staff and a simple approach to maintenance management. West Kent combines its plant file and plant maintenance record sheets.

12.30. Table 12.1. shows the number of staff employed by the six companies on electrical and mechanical duties, mostly maintenance of equipment. Mid

Kent argued that the fact that it had more of such staff than others arose in part from the size of its operations and its comparatively large number of pumps and standby diesel generators, but also reflected its use of direct labour for the installation of all new plant and equipment, and for maintenance of new vehicles.

TABLE 12.1 **Personnel employed by companies to undertake electrical and mechanical duties**

	Instrument/ electronics	*Electricians*	*Mech. fitters*	*Fitters mates*	*Totals*
Eastbourne	4	4	7	0	15
Folkestone	0	2	6	1	9
Mid Kent	1	5	9	5*	20
Mid-Sussex	4	2	3	0	9
Portsmouth	1	4	5	1	11
West Kent		4 (multi-skilled)		0	4

Source: The companies.

* Also act as relief plant attendants.

Contracting out

SWA: policy on use of direct labour and contractors

12.31. While it is clearly essential in running a water supply and distribution system to have a direct labour force to ensure continuous operation, maintenance and monitoring, some requirements may be better met by employing outside contractors. Since its formation SWA has always made substantial use of contractors for capital works, such as building projects or installing large mains, and for some forms of maintenance, eg involving mains renovations and highway reinstatement. In 1984–85 the capital expenditure work contracted out amounted to about £16·5 million, as well as about £1·8 million of revenue expenditure work.

SWA's Key Issue study

12.32. SWA's policy on contracting work out was examined in a Key Issue study approved by the Board in June 1984. The study was undertaken following the setting up of a working party involving DoE and MAFF to develop a Code of Practice for direct labour in the water industry, covering DoE services and MAFF grant-aided capital works. (Mostly these services and capital works fall outside the terms of reference of this inquiry but SWA expects some 'common services' and plant and vehicle maintenance to be covered by the provisions of the code.) DoE and MAFF had agreed that for the areas of work covered by the code water authorities should retain sufficient direct labour to cover emergency and call-out work only. The directly employed workforce would handle other work to the extent that it had time and capacity available; otherwise, such work would be subject to the provisions of the code. The full details of the code have yet to be settled.

12.33. The main policy finding of the Key Issue study was that a proposal for contracting out would be acceptable if it led to worthwhile net cost savings

without lowering the quality of service and if each of the following criteria were satisfied:

(*a*) SWA and its customers are safeguarded in the event of a failure of performance by the contractor; and

(*b*) the costs and benefits of contracting can be measured, ie the contractor's performance can be monitored and the benefits to customers quantified.

12.34. The study concluded that the approach to further contracting out of direct labour should be a gradual one so as to maintain good industrial relations and that no major changes should be made before the proposed DoE/MAFF Code of Practice had been agreed. It also recommended that divisional managers should consider whether the private sector could be more involved in parts of their operations. The areas that appeared to have the greatest potential were (for water supply) laying of service pipes, repairs and maintenance of mains and service pipes, and vehicle and plant maintenance.

12.35. As part of the Key Issue study SWA also reviewed the cost of providing professional services in-house against contracting out. A report by a firm of management consultants indicated that it was significantly cheaper to use in-house design staff rather than consulting engineers. This result however was arrived at by comparing SWA's actual costs against 1979 rates promulgated by the Association of Consulting Engineers. These rates are normally used now only as a starting basis for lower competitive quotations. In response to a proposal by DoE that some part of each water authority's design work should be contracted out, SWA has set a target of 22 per cent for contracted-out design work.

12.36. The RMB returned to the Key Issue study in December 1984 and again in January 1985. It commissioned the collection of further cost information from divisions. The collection of that information is not yet complete and the situation will be reviewed in May 1986. The exercise has been delayed by developments within SWA, such as the setting up of the Directorate of Technical Services. Thus contracting out has not been extended to new areas of SWA operations in 1985 apart from recreational, fishing and sailing, activities.

12.37. SWA has told us that it accepts the view that wherever possible the cost of carrying out work in-house should be tested against bids from private contractors and has moved significantly in this direction—for example, in relation to cleaning, catering, grounds maintenance, building maintenance, vehicle servicing, mainlaying, mains repairs and sea defence work. In some cases the comparison takes the form of competitive tenders. More usually SWA monitors the comparative costs of in-house and private contractors' work with the aim of ensuring that managers are obtaining the most competitive rates.

Contracting out in the companies

12.38. All the companies employ contract labour to some extent but most of them do not have formal policy guidance on the use of contractors and do not monitor and compare costs of in-house and contractors' work on a routine basis. Given the small scale of their operations, the companies consider that

there is limited scope for them to contract out work in many functions if their own core of direct labour is to retain the necessary skills.

12.39. Eastbourne may be regarded as fairly typical of the companies in holding that some things are best performed by contractors. These include major civil engineering capital works projects and operations, for example borehole drilling and mains renovation. For other things the decision whether to use in-house or contract labour is arrived at on a case-by-case basis subject to ensuring that a contractor's standards of work are at least as high as those achieved in-house. This covers such work as main and service pipe laying and repairs and plant and vehicle maintenance, as well as such ancillary activities as grounds maintenance and cleaning. Decisions on whether or not to contract out are infrequent because the benefit of changing from in-house to contract (or *vice-versa*) has to take account of the costs of changing. The decision is based on what seems the most appropriate course in the consumers' long-term interest.

12.40. The use made of contractors varies from company to company. Eastbourne, Mid-Sussex and Portsmouth use contractors for all civil engineering work and most mainlaying and relining. Mid-Sussex and Portsmouth also use contractors to back up their direct labour mains repairers. Folkestone, Mid Kent and West Kent use contractors for civil engineering works but use mostly in-house labour for mainlaying and repairs. All six companies make some use of contract labour for ancillary functions such as cleaning, catering, or grounds maintenance, Portsmouth, in particular, having sought to contract all such activities wherever possible.

12.41. West Kent uses contract labour only for peaks in small mainlaying and maintenance functions. Following the introduction of WIPP schemes in 1969–70, West Kent adopted a deliberate policy of keeping as much work as possible in-house so as to maintain a direct labour force sufficient to tackle the 'base load' of the company's work. As the company's policy is to employ contractors only for occasional peaks, West Kent does not seek to make direct cost comparison of in-house and contractors' work. It is at present considering the use of annual 'term' contracts for such work as it does contract out.

The views of the trade unions

12.42. The unions accepted that contractors should be used to deal with peaks in the workload, or to provide special services or expertise, but they argued that comparing contractors' bids and in-house costs could be misleading as a guide to comparative efficiency. Account should be taken of the introduction of new technology and reductions in manpower. The unions considered that the cost savings to be made by putting out to contract ancillary services such as catering were marginal. They also argued that, while there might be initial savings from contracting out, a water undertaking which became reliant on outside contractors for various services and lost its in-house capability would risk having to pay much higher prices to contractors later on.

12.43. The unions were particularly critical of what they saw as artificial targets for putting specific levels or proportions of work out to contract. They

cited as an example SWA's engineering design work (see paragraph 12.35). They argued that if it was established that work could be performed more cheaply in-house than by contractors offering the same standards and expertise, then the work should not be put out to contract.

Conclusions

Operations and maintenance

12.44. During the course of our inquiry SWA has set up a Directorate of Technical Services (DTS) which has been given a wide remit in the operations and maintenance field. It should identify best practices and see that they are applied by all divisions, while continuing to encourage initiatives in the divisions.

12.45. The DTS should disseminate standards and performance requirements and ensure that divisions comply with them.

12.46. SWA should actively continue its present policy of developing models and other means of improving the efficiency of its extracting, treatment and distribution systems while taking full advantage of the WRc development programme in this field.

12.47. SWA should set a timetable for improving the records for maintaining its equipment in order to establish optimum frequencies for maintenance, and as an information base for the future specification of new works and replacement of items of equipment.

12.48. All available information on the state of SWA's mains should be carefully and consistently recorded. SWA will need a reliable mains inventory if it is to be in a position fully to implement the programmes recommended in the forthcoming WRc manual on water mains rehabilitation.

12.49. The companies should continue to participate individually in the WRc's technical development programmes.

12.50. The companies should consider whether better arrangements can be made for the dissemination of best practices and improved methods and procedures: the WCA could play a central role here (as it has done in preparing guidelines for capital investment appraisal).

Contracting out

12.51. Subject to maintaining essential in-house capability, SWA should seek tenders for as much work as possible of the kind covered by the draft DoE/MAFF Code of Practice. Where it decides not to seek tenders, SWA should monitor carefully the costs of comparable in-house and contractors' work.

12.52. SWA should adopt a similar policy with regard to the kinds of work which its Key Issue study suggested should be considered for putting out to contract (see paragraph 12.34).

12.53. SWA should be guided by the results of careful cost comparisons rather than set arbitrary targets or ratios for levels of work to be put out to contract.

12.54. The companies should review regularly the costs of ancillary services and contract them out if that would reduce costs. For other activities and operations, such as construction activities and the operation of parts of the supply system, they should regularly test their in-house costs by calling for tenders from outside contractors.

12.55. SWA and the companies should take account of the point made in paragraph 12.42, that if they became too reliant on contractors they could be exposed to the risk of paying much higher prices later.

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