LESSONS LEARNED – THIRTEEN YEARS OF TREATMENT OPERATIONS IN THE HUNTER

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ABSTRACT

Hunter Water Australia has been contracted since 1998 to operate and maintain six water treatment plants and eighteen wastewater treatment plants in the lower Hunter region of NSW. The contract model is management fee plus reimbursable fees and incorporates profit adjustment based on cost and water/effluent quality performance. Incentives are also in place to encourage innovation and optimisation. Embedded 'relationship' principles encourage operation as 'one-team' with a common set of objectives. Strong focus on continuous improvement has allowed refinement of systems for process monitoring and control, risk reduction and asset management. This paper provides an overview of our current operation, including commentary on lessons learned and the results achieved.

1.0 INTRODUCTION

Hunter Water Australia (HWA) has been contracted to operate and maintain six water treatment plants (since 1998) and eighteen wastewater treatment plants (since 2001) in the lower Hunter region of NSW. Performance and pricing is tightly regulated. Treated water quality must comply with the Australian Drinking Water Guidelines and wastewater discharges must comply with Environmental Protection Licences. The operating contract is structured to provide incentive for achieving treated water quality targets and minimising operating costs. Incentives are also in place to encourage innovation and optimisation.

The contract Principal retains ownership of the assets and responsibility for upgrades. HWA acts as a steward of the assets to ensure that performance and function is maintained. The contract also allows for adjustment of work scope including commissioning new plants, upgrading existing plants, and taking on responsibility for additional functions.

As with any enterprise, the contracted operation of treatment plants brings both challenges and opportunities. Important objectives when the contract was formed included establishing a model that would:

- Improve the cost efficiency of service delivery
- Improve water quality performance and wastewater licence compliance
- Maintain the function, performance and condition of assets
- Foster creation of a more efficient, capable, flexible and sustainable workforce
- Facilitate creation of sustainable systems for operational management
- Support and complement a large program of plant upgrades
- Facilitate expansion of the contract work scope over time
- Allow for future open-tendering of the operations contract
- Support the growth of services outside the region.

Of course, preceding events and existing relationships meant that some issues were

unique.
However, many experiences are common across the water industry. A key aim of this paper is to identify and examine some of these common areas to pass on the benefits of lessons learned to other organisations. The information presented should be relevant for both operators and their managers to gain some insights into proven concepts that could be effectively applied elsewhere.

2.0 RESULTS

Figures 1 and 2 below provide a broad overview of historical performance in some key areas. The improvements achieved over multiple years give credibility to the effectiveness of the approach taken.

2.1 Water Quality and Effluent Quality Performance

Producing safe and palatable water is the most important function of a water treatment plant. The contract requires daily compliance testing for key treated water parameters. Target limits are set and every result outside its corresponding limits incurs water quality 'points'. Health related parameters such as chlorine residual have a higher weighting than aesthetic parameters such as colour. Monthly contract payments are adjusted up or down depending on the results. This model provides a strong incentive to improve and performance has consistently improved over the duration of the contract. Total annual numbers of DECCW licence exceedances (50th percentile and 90th percentile) for the 18 wastewater plants have also decreased during the period of contract operation.

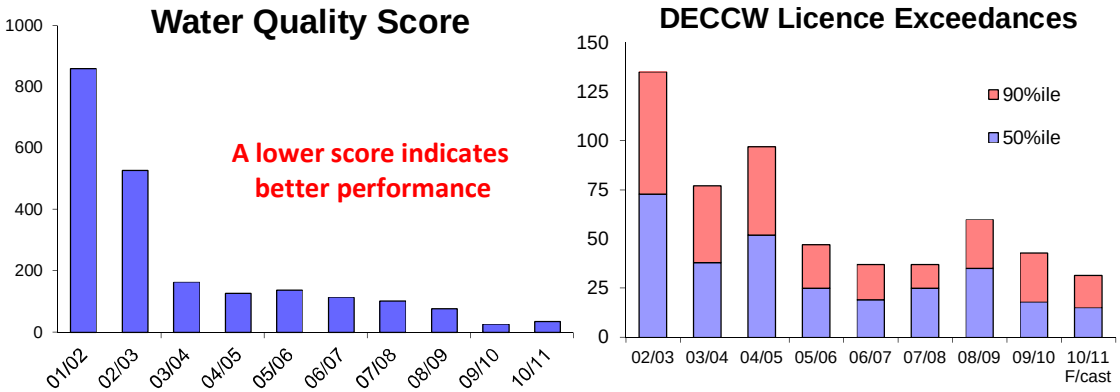

Figure 1: ***Historical water quality and effluent quality results***

2.2 Process and Equipment Faults

The treatment plants are highly automated and are not attended continuously by operators. Problems that occur outside normal work hours must be resolved either remotely or by an operator being recalled to the site. The graphs below show that, in the water treatment area, the total annual number of problems occurring outside normal hours has been reduced by around 44% over 10 years and the subset of these problems that required an operator to be recalled to site was reduced by 86%.

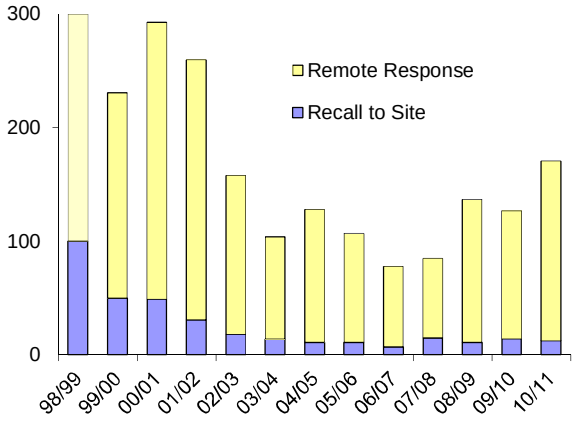

Figure 2: ***Historical data for WTP faults outside normal work hours***

3.0 DISCUSSION

Operational management systems have been developed to improve the capability, efficiency and focus of workgroups. These systems cover areas such as:

- Technical information, operational data and incidents/issues information
- Root cause analysis, risk assessment, and options analysis
- Task prioritisation, scheduling and assignment

The brevity of this paper does not allow detailed discussion of all of the above areas. Therefore, the following discussion concentrates on management of operational data and incidents/issues information. These systems incorporate continuous improvement, risk assessment and effective resource allocation, which are core concepts of the approach taken to achieve overall objectives.

MS-Excel based systems are heavily utilised for data and information management. In contrast to corporate systems supported by a central IT group that are commonly used for such purposes, spreadsheet based systems are highly flexible and adaptable to meet the needs of small to medium sized operating groups. Engineers and operators are usually comfortable with mainstream spreadsheet applications, which streamline implementation and ongoing operation.

3.1 Operational Data Management

Often a lot of monitoring and testing is undertaken but there is only limited assessment of the data collected. An effective data management system will maximise the value obtained from the data collected. HWA's data management spreadsheet files incorporate the following features:

- Key parameters are identified and definitions are documented
- Validation values are defined for each parameter to allow automatic identification of data 'exceptions'
- Data exceptions include:
    - Abnormal data
    - Outside contract limits
    - Outside control limits
    - Significant increasing/decreasing trend

- Bias of results above or below target
- Significant change
- Discrepancy against target
- Data not entered at expected frequency

- Monitoring parameters, definitions and validation values are modified over time based on experience and the proven 'value' of the data
- Control charts for key parameters are embedded in the data files to enable regular assessment to identify trends
- Hyperlinks to troubleshooting flowcharts are embedded to assist with interpretation and response to data exceptions
- Operators record actions taken in response to all data exceptions daily and a report is auto-emailed to their supervisor to facilitate prompt overview, feedback, and to assist with training.

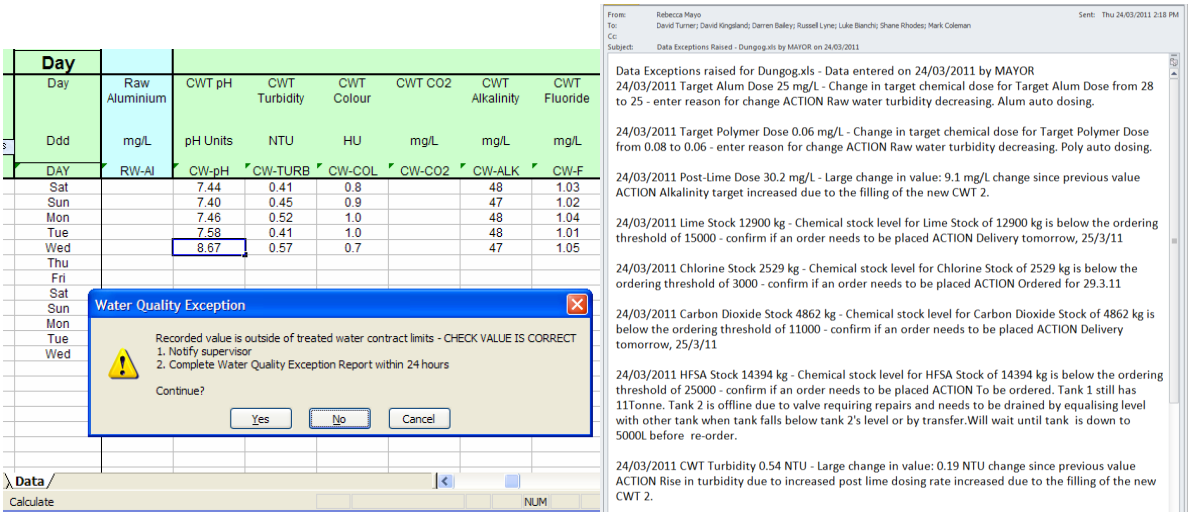

Figure 3: ***Plant data management system interface & example 'data exception' email***

The main features that differentiate this system from how spreadsheets are typically used to store operational data are that multiple checks are in place to automatically identify potentially abnormal data, and there is an automatic communication loop in place to ensure that prompt and appropriate action is taken in response to any abnormal data.

The interface and layout of the data spreadsheets is operator-friendly and a consistent format is used for all sites. This format also makes it straightforward to set up systems for new sites. The files are hosted on a central file server, accessed via a wide area network and backed up daily.

3.2 Management of Operational Issues

A major challenge for operators is that available resources can be distracted and consumed by day to day issues and imperatives. There can be a tendency to move from one crisis to another. Such issues have a high profile and reward systems, both formal and informal, are often biased towards recognising individuals who are good at 'putting out fires'. Strategic efforts applied to reducing risk and improving performance can be less tangible or immediate and can therefore be overlooked and undervalued. Good ideas can be forgotten or otherwise fail to get support. Resources can also be directed to lower priority areas simply because higher priority issues haven't been effectively communicated or

documented.

Available resources are limited. There are a multitude of possible activities that could be done at any given time and choices need to be made by individuals every day about what to work on. The amount of resources applied to a given area is often a function of the performance standard being achieved compared to the standard required. However, the standard being achieved is affected by many factors including:

- Capability of the workgroup
- Efficiency of the workgroup
- What work is actually done

The effectiveness of a workgroup can be significantly altered by how the efforts of the workgroup are applied.

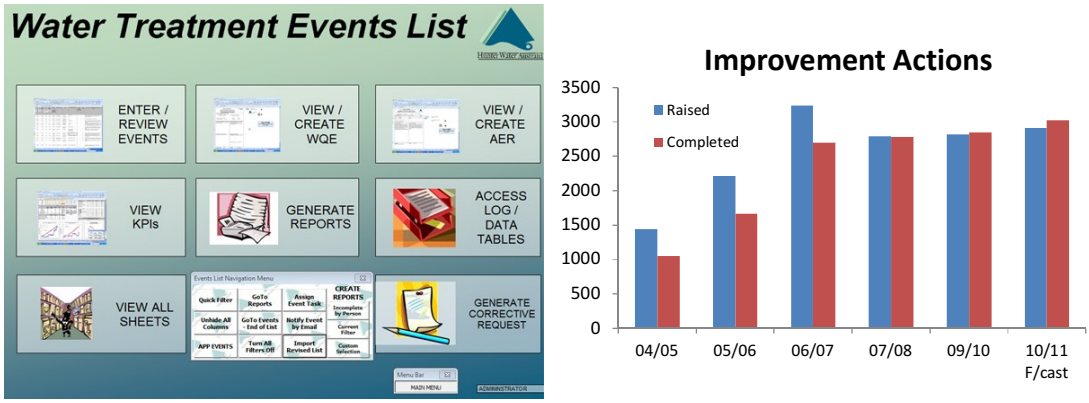

Figure 4: ***Issue management system interface and improvement action data***

To maximise long-term effectiveness of HWA operations teams, details of all significant incidents and issues are recorded in a central register. The register covers all plants and all areas including issues with equipment, process, compliance, safety, normal hours, after hours, innovations, and asset deficiencies.

Each issue is assessed to identify root cause(s) and quantify risks before identifying options to reduce the risk to an acceptable level. Risk is quantified following a standard protocol that considers safety, compliance, security, cost, and aesthetics. In all cases where capital expenditure is being considered a business case is prepared to determine if the benefits are sufficient to justify the effort and cost required. Responsibility for implementing identified changes is assigned by a team leader or manager and prioritised on the basis of the risk-reduction/benefit achieved compared to effort/cost applied. The progress status of all assigned activities is also regularly updated in the register.

The issue management spreadsheet incorporates the following features:

- Accessible to the entire workgroup to record issues and update progress/status
- Streamlined process for assigning tasks and notifying issues by integrating with MS-Outlook
- Automatic file backups

This approach creates a simple way to record issues, a systematic way to assess risks and opportunities, and a streamlined way to assign and monitor progress on implementing changes to achieve the best outcomes.

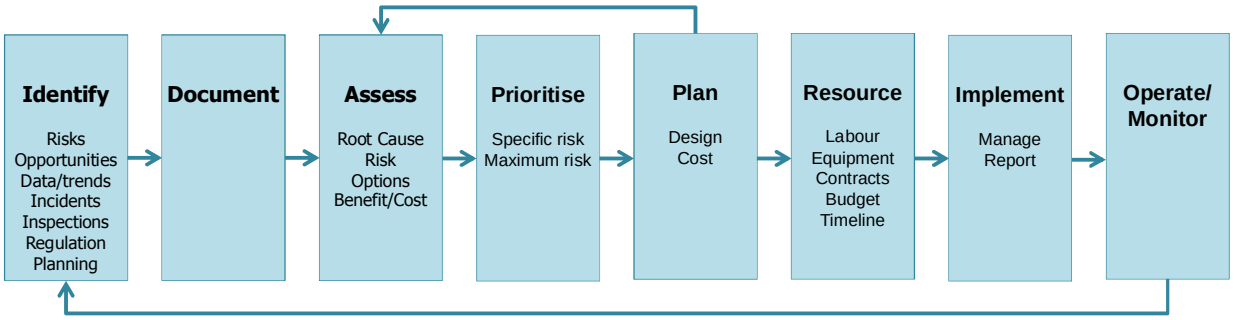

Figure 5: ***Work flow associated with issue management***

Other benefits include:

- A comprehensive historical record of incidents, issues and changes implemented for the plants
- An effective way to identify recurring issues and issues common across multiple sites
- Information for employee performance assessment and recognition

4.0 CONCLUSIONS

The desire to improve efficiency and effectiveness of workgroups is a common goal throughout industry. Relatively simple systems can be used to maximise the value of data and information to help achieve this goal. The examples cited have proven to be effective by enabling comprehensive collection of data/information, followed by systematic assessment and disciplined implementation of improvements. Simplicity, flexibility, access, and open-communication are also common themes. Effective systems for managing operational data and information are fundamental to achieving continuous improvement.