REMOTE OPERATION OF A DESALINATION PLANT: GREAT KEPPEL ISLAND ROCKHAMPTON CASE STUDY

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REMOTE OPERATION OF A DESALINATION PLANT: GREAT KEPPEL ISLAND RESORT CASE STUDY

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ABSTRACT

Drought conditions in Australia have resulted in an increased interest in reverse osmosis systems used to desalinate brackish and/or seawater and produce water for drinking and other municipal/community use.

In 2003, Contiki Resorts who at the time operated the Great Keppel Island Resort identified that the water quality for the island resort guests was not within the guidelines for the drinking water standards. Tests on the island bores had showed high TDS (well above 2500 us/cm) which was increasing rapidly indicating that the aquifer was being contaminated by sea water. After considering a number of options the resort management concluded that desalination of sea water was the only sustainable solution for the island's growing drinking water requirements. **OSMO**FLO® responded to these requirements by designing, constructing and installing a desalination plant capable of producing 300,000 Litre per day.

KEY WORDS

Reverse Osmosis, Rental, Drinking Standards, Environmental Impact Study, Desalination, Ground Water, Plant Connect™

1.0 INTRODUCTION

Great Keppel Island Resort, situated off the coast of Rockhampton, has been through many changes and difficult times but none more damaging to the resorts reputation than the water quality being provided to the guests. With the high TDS, post mix drink machines and ice machines were turned off, the washing of clothes was becoming an issue, but most of all, the whole water infrastructure for the island resort was being damaged by the high salt content being pumped through on a daily basis. Leaking pipes and damaged hot water systems were becoming a maintenance nightmare.

Figure 1: ***Great Keppel Island desalination plant.***

Once the island was restored with the operation of the desalination plant, response from guest and staff was huge. The island has been saved.

Over the last three years the plant has successfully been operated and monitored from **OSMO**FLO® Brisbane office. This remote operation setup was designed to ensure expert operation of the plant thus minimising shutdowns for maintenance and membrane cleaning and was successful in meeting client's needs 24/7.

2.0 DISCUSSION

OSMOFLO® delivered this 300 kL/d desalination plant project for Great Keppel Island Resort on a build, own, operate basis (BOO). This provided the client with a highly reliable potable water supply on an all risks included basis. The client's involvement in plant operation was very small – limited to only daily inspections of plant equipment and some minor routine work. The design of our desalination plant was very important for the long term trouble free operation.

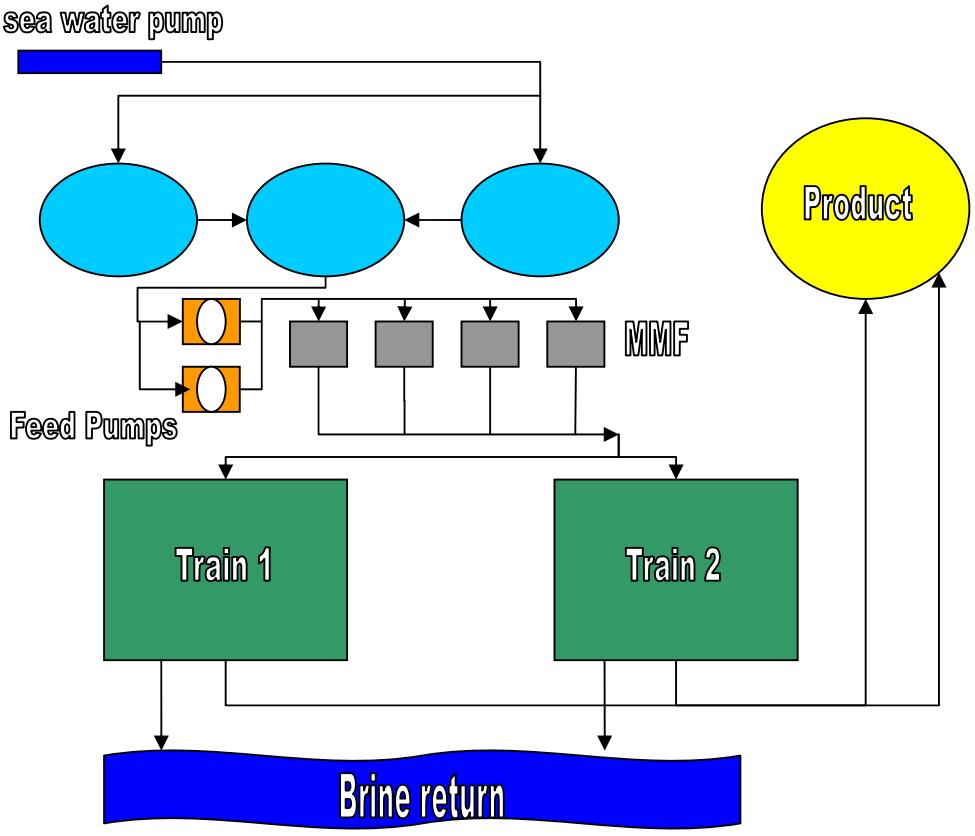

Figure 2: ***Basic layout of plant.***

Listed below are specific aspects of the design that have helped the successful life of the Great Keppel Island Desalination Plant and have prevented/reduced costly onsite repairs;

1. Two 50% capacity trains design provided for flexibility in the production rate, as well as for the required redundancy due to the critical nature of this installation (no other good potable water source was available on the island).

2. High grade stainless steel materials being used for the high pressure pipe fabrication.
3. Housing of the plant in robust, insulated shipping containers for noise reduction and sheltering of the system from weather.
4. Air-conditioning for temperature control.
5. High pressure pump being specifically selected for lower running costs and minimal maintenance.
6. High quality sea-water membranes selected for optimum performance at lower energy use.
7. Basic MMF pre-treatment with intergraded manifolds to enable individual units to be isolated thus providing for on-line backwashing sequence.
8. Reliable remote communications with the plant control system via a GSM modem.
9. Human-machine interface (HMI) touch-screen for quick reference and on-site diagnosis.
10. Duty/Standby arrangements to ensure minimal shutdown and reduce loss of water production.

Optimised operation and quality maintenance are both critical for a reliable operation of a desalination plant. **OSMO**FLO® comprehensive technical support services include both of those aspects, thus helping clients with limited operating resources and reverse osmosis/membrane plant expertise achieve best outcomes from their plants. Currently over 150 membrane plant installations in Australia and several overseas, benefit from these services.

Continuous on-line monitoring of RO systems, with weekly attention of designated **OSMO**FLO® Service Engineer – "Plant Owner" ensures the plant operation is optimised and removes risks associated with unexpected errors that may occur.

Range of operating variables, are also continuously data-logged, inclusive of plant pressures and flows. This information is regularly reviewed by technical experts from **OSMO**FLO®. It flags up warnings in case of declining plant performance, and provides basis for informed decisions on operation adjustments required due to any raw water changes and on membrane cleaning requirements.

Real time data used by technical advisors can assist in rectifying up to 90% of faults and minimising major down times.

Expert plant design results in reduced down times, such as the 4-20ma adjustability on valves and pump drives based on process feedback in the form of selected pressures, flow rates, conductivity and other process parameters. This not only helps in optimising plant operation but also reduces load on membranes and other equipment thus minimising on-site servicing requirements and lengthening the plant's life.

Further collection of information from analysing water samples from the plant, such as that of permeate quality and brine salinity/turbidity, provides for client ensuring the required water quality supplied and for environmental authorities for close monitoring of the return of brine back to the ocean. These tests are usually are done by local laboratory representatives who are able to carry out the tasks within a given time frame. The Environmental Authorities use this information to be able to provide a licence to discharge back to the ocean.

2.1 Plant Connect™

Today's state of the art technology is used to dial into the memory of the plant's PLC and remotely collect data from all parameters daily. For this purpose **OSMO**FLO® has developed a proprietary program called Plant Connect™. This program can download all operating information within minutes and convert it into excel format for quick reference and easy graphing for analyses. Multiple parameters can be seen instantly on graph layouts to show all aspects of the plant over time. The program also allows remote plant diagnostics and troubleshooting in real time.

With this program, reports complete with graphs and snapshot of data are provided to the client typically on monthly basis or as required. For remotely located water treatment plants, parameters monitored cover all areas of the operation in some cases even include brine discharge readings and product totals although these values can be read locally. These reports are complemented with laboratory testing results of samples taken from the plant, although these require additional time for completion of the analyses.

Relatively remote location of the GKI desalination plant had provided some additional challenges such as, unreliable remote communication. Due to the old and damaged services it was not possible to rely on standard phone line for the communication. In this case, a GSM modem was found to be much more reliable. This provided the required 24/7 communication direct to the PLC for our technical engineers. In this way they were able to monitor and download crucial data from the system and to respond to any plant calls without delay.

The utilisation of GSM modems also enables the plant not to be restricted by PABX or other phone systems which **OSMO**FLO® have found to be an issue in the past. With the SIM card costs being included in the contract, the client is not disturbed by extra phone call costs to and from the plant during a response to critical faults. In this way the client is provided with the whole package.

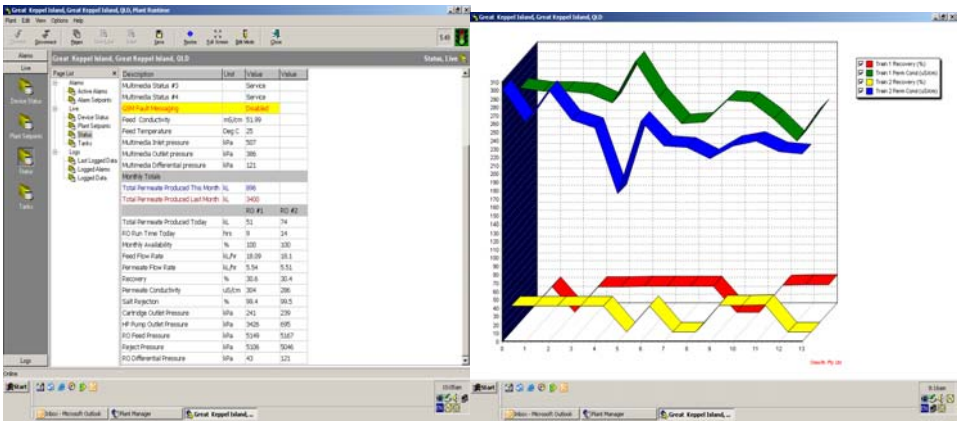

Figure 3: ***Plant Connect™ online data and graphs.***

GSM modem used on this plant has two features. One is the remote access to the plant's PLC and the other one is the call out service which is programmed to, under certain conditions, send a pre-recorded message to the **OSMO**FLO® technical support group. Individual messages were set up for a number of possible fault conditions that may occur. The plant then automatically sends the correct message within a minute of the fault occuring. This feature ensures the client that the plant will be responded to quickly and

reduce down times which may be crucial if, at the time water storage levels are low.

2.2 Onsite Requirements

Documents and manuals of all parts of the plant are kept in hardcopy and electronic form onsite and are also available to the off-site technical support personnel. Listings of spare parts and routine check sheets such as the items listed below are provided to the site operators as soon as the plant is operational:

1. Full list of spare parts to be ordered and stored in a cool dry location.
2. Consumables ordered and stock sheets designed for monitoring and exchanging on a monthly basis.
3. Training of local staff for local running of the plant and daily checks that are required to be fulfilled. (Local representatives are the eyes for the plant. It is expected that the client may be required to assist in the time of need or when then plant may not be remotely accessed due to outside influences.)
4. Maintenance program designed for Daily, Monthly and Annual checks and service.

To ensure quick resolution of any mechanical issues with the plant the on-site spare parts cabinet is also well stocked with critical spares at all times.

Figure 4: ***Internal view of the twin plant containers***

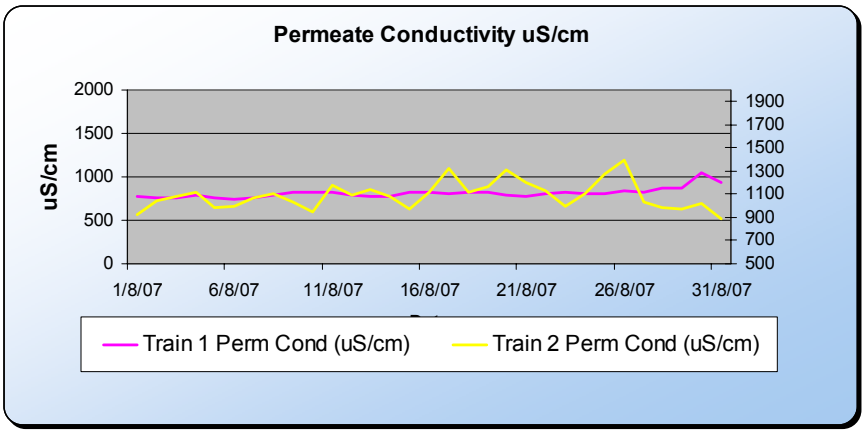

Figure 5: *Typical Plant Connect™ Graphs from data transfer – Great Keppel Island*

2.3 Other Remote Sites

Kau Sai Chau Island – Hong Kong

The Hong Kong Jockey Club in 2006 contracted for the supply of a 1.5MLD RO unit to desalinate seawater. The product water is used for irrigation purposes during annual dry seasons. The site is located on an island approximately 20km NE of Hong Kong city, with travel to site involving a ferry trip from the nearby town of Sai Kung. Suitable operators would not be based on the island, and the consultants identified a major benefit if the plant could be operated remotely.

The plant consisted of Multimedia filtration, chemical dosing and a containerised RO system. The RO unit operates at a pressure of 65-bar and fitted with an energy recovery device. The Communications package allows the plant to be remotely monitored and operated from Australia. During weather extremes the sea water source is contaminated with high levels of turbidity. Instrumentation then ensures the turbidity levels are monitored, and plant operation can be suspended for a few days until the water source improves. Sufficient storage reservoirs on the island ensure continuous water supply. Routine servicing of the plant, such as filter changes and replenishing chemical storage is managed by occasional visits by Hong Kong based sub-contractors. An annual major service is supported by visits from Australia. Data relayed from the site ensures a service engineer is well prepared beforehand.

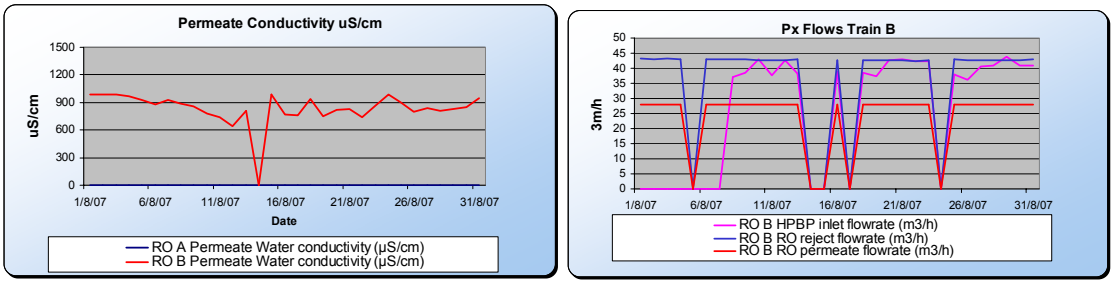

Figure 6: *Typical permeate water conductivity and recovery reports from data transfer – KSC, Hong Kong*

3.0 CONCLUSIONS

The case studies demonstrate that a RO plant can be installed relatively quickly then operated remotely to reduce the need for extensive training of the on-site operators. In turn, the on-site operators can be trained on routine plant operation, then rely on highly experienced staff located at a control centre to manage performance trends, and make decisions on plant optimisation and trouble-shooting. The GKI (BOO) Desalination Plant project included a comprehensive all risks included potable water supply services to the Great Keppel Island Resort. Under the agreement OSMOFLO® not only provided a state-of-the-art plant facility but also through close monitoring and optimisation of plant operation, and regular maintenance work ensured it remained in top condition. Through all this the GKI Resort benefited from a reliable supply of potable water within quantity and quality specifications for more than three years. The expert design and optimised operation provided for very little on-site service work being required, while the monitoring resulted in quick actioning and rectification of all minor faults that occurred

during this time. The setting of maintenance goal to zero tolerance of any sea water leaks within the system, helped greatly towards longevity of all plant instruments and other equipment.