# OPTIMISATION OF IMAGE FLAT WATER TREATMENT PLANT

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## 1.0 INTRODUCTION

The South Maroochy System was the original water supply to the Maroochy Shire, now part of the Sunshine Coast Regional Council. It was constructed progressively between 1959 (Intake Weir) to 1979 (Cooloolabin Dam).

The South Maroochy System to this day supplies approximately 45% of the old Maroochy Shire, which includes townships such as Nambour, Woombye, Palmwoods to the south, and Eumundi, Coolum, South Peregian to the north.

### 1.1 Storages

There are four raw water storages that make up the South Maroochy System comprising:

1. **Intake Weir**, which is a 12-metre high concrete weir at the junction of the upper South Maroochy River and Low Creek. Flow is diverted to Poona Dam via 2.4km gravity main. It also diverts to Poona Dam, water released from Cooloolabin Dam via Low Creek when the run of the river flow is low.

2. **Poona Dam** is a 9-metre high earth walled dam, which is used as a balancing storage for the treatment plant. As described previously, it collects water gravitated from the Intake Weir (& released water from Cooloolabin Dam) and water pumped from Wappa Dam. Water is gravity fed into the treatment plant from Poona Dam along a 1km long pipeline. Capacity of Poona Dam is around 683ML.

3. **Wappa Dam** is a 24-metre high concrete dam with a storage capacity of 4610ML. It's crest level is well below the levels of Poona Dam and the treatment plant so all water must be pumped to Poona Dam or alternatively to the treatment plant direct via a 3.3km long rising main.

4. **Cooloolabin Dam** is a17-metre high concrete dam with earth saddle dams to the east and north east of the main dam wall. The dam wall was built on Rocky Creek and capacity sits at around 13600ML. Water released from Cooloolabin Dam is piped 2.2km under gravity to an outfall on Low Creek which then allows for the released water to naturally gravitate into the Intake Weir.

Quality of source water selection and monitoring are one of the most important barrier measures utilised at the treatment plant.

The standard operating philosophy is summarised as follows:

- Draw all water from Poona Dam
- Support Poona Dam with flows from the Intake Weir and water pumped from Wappa Dam.
- Support the Intake weir with releases from Cooloolabin Dam.

- The operating philosophy is superseded in the event of severe drought or algal bloom, when Drought Management Plans or Cyanobacteria Management Plans are implemented.

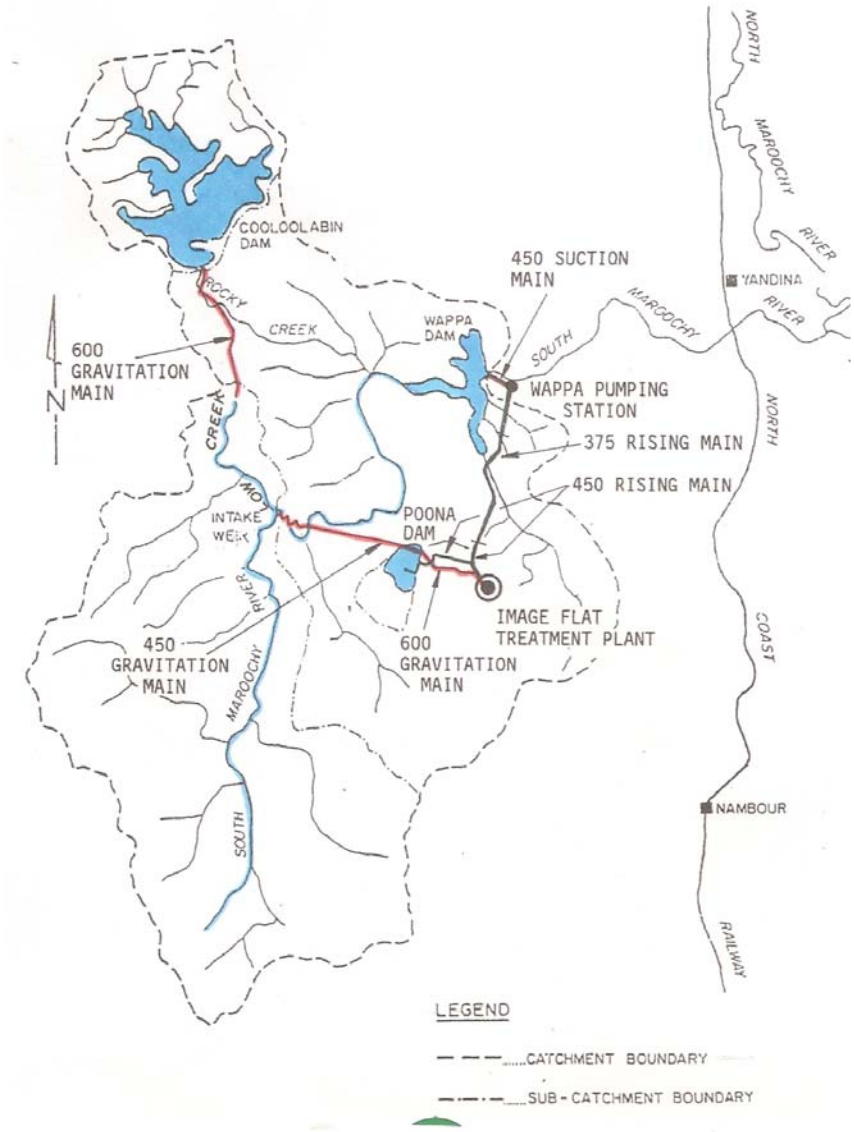


**Figure 1:** ***Diagram showing the South Maroochy water supply system***

## 1.2 The Image Flat WTP

The water extracted from the above sites is wholly treated at the Image Flat Water Treatment Plant. The Image Flat WTP is constructed with two 'side by side' treatment plants that run parallel to each other. The basic treatment train for the treatment plants is identical, dosing Alum solution, coagulation, sedimentation, filtration followed by chlorination.

The treatment plants are currently set to run at as follows:

No1 Plant - No1 & 2 filters (160L/s)

No2 Plant – No 3 filter (160L/s)

The total daily through put is around 18ML per day.

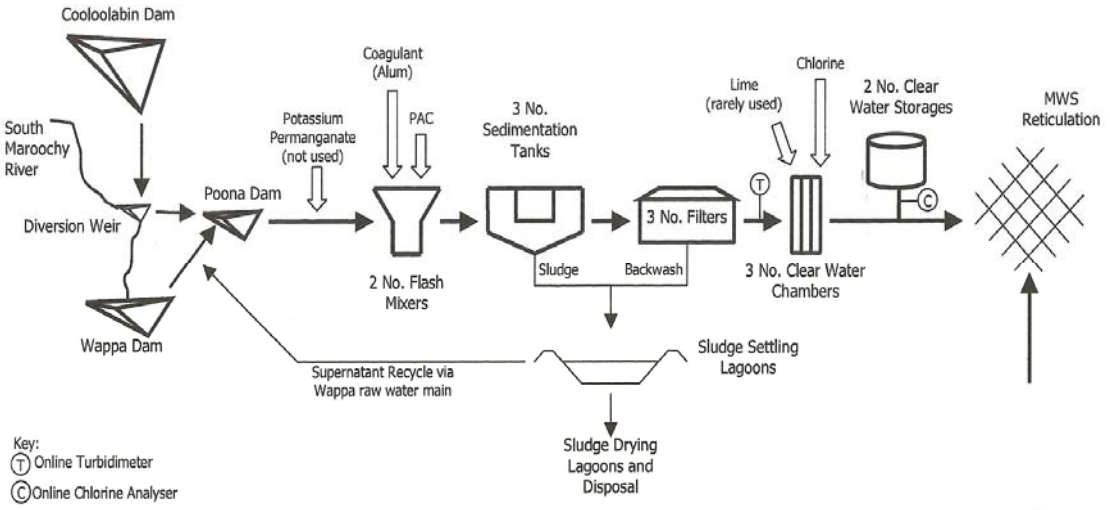


**Figure 2:** ***Image Flat WTP Process Diagram***

The selected sourced water drawn from Poona Dam normally has the characteristics of moderate colour, low turbidity, water with sufficient alkalinity of 50-70 mg/l as calcium carbonate. Treatment is at present limited to Alum solution for coagulation.

Trials of other Coagulants have been conducted as well as various polymers used as coagulant aids. Varying success was achieved.

Other chemicals used in the treatment process are Lime for post pH correction and chlorine for disinfection of the filtered water. Powdered Activated Carbon (PAC) is currently dosed to the head of the treatment plant to control taste and odours and for the removal of any potential toxins. Poona and Wappa Dams often suffer from cyanobacteria blooms to varying degrees.

A Potassium Permanganate dosing plant is in place but is rarely utilised, as manganese levels are normally low in the water entering the plant for treatment, and the filters are quite effective at the removal of moderate levels of soluble manganese.

## 2.0 DISCUSSION

Historically up until the past 5 years water quality targets have been largely in line with achieving what was indicated as being required under ADWG.

Many changes have occurred since that time:

- A HACCP audit was carried out in 2005 by GHD that highlighted our areas of high risk. The risk assessment process separately considered each element of the water supply system, from catchment through to tap.
- New ADWG were implemented that took on a catchments to tap approach, recognition of barriers used to control water quality and also the need for acceptable aesthetic water quality parameters, rather than just health related aspects.
- Maroochy Water Services introduced ISO 9001 and ISO14001 as part of a Total Management Plan. Much emphasis was also placed on levels of service for our

customers

- In 2008, Seqwater took over control and management of all Raw Water Storages and Water Treatment Plants
- As a result of recent legislative changes there is now a clearly identified charter for the supply of safe, high quality water for our customers

The follow on from this is that the staff at IFWTP were challenged with finding ways of optimising the operation of 40-year-old infrastructure to consistently meet new stringent water parameters. No significant upgrades have taken place at the site since original construction and it remains as a conventional WTP without any of the extra barriers that are available in advanced WTPs.

A review of the South Maroochy Storage Management Plan (1993) and 2005 HACCP report was instrumental in being able to define target areas where there was the potential to significantly improve the performance of the treatment processes with minimal expenditure.

- Better raw water management and selection.
- Installation of continuous In-line monitoring of Dosed water pH.
- Filter optimisation by identifying appropriate control limits and targets for filtered water qualities.
- Turbidity parameters on filtered water tightened.
- On-line monitoring patched back to SCADA in the control room and accessible remotely / after hours via laptop.

A proactive approach by all staff members, utilising skills and monitoring techniques developed through training, resulted in positive achievements and outcomes.

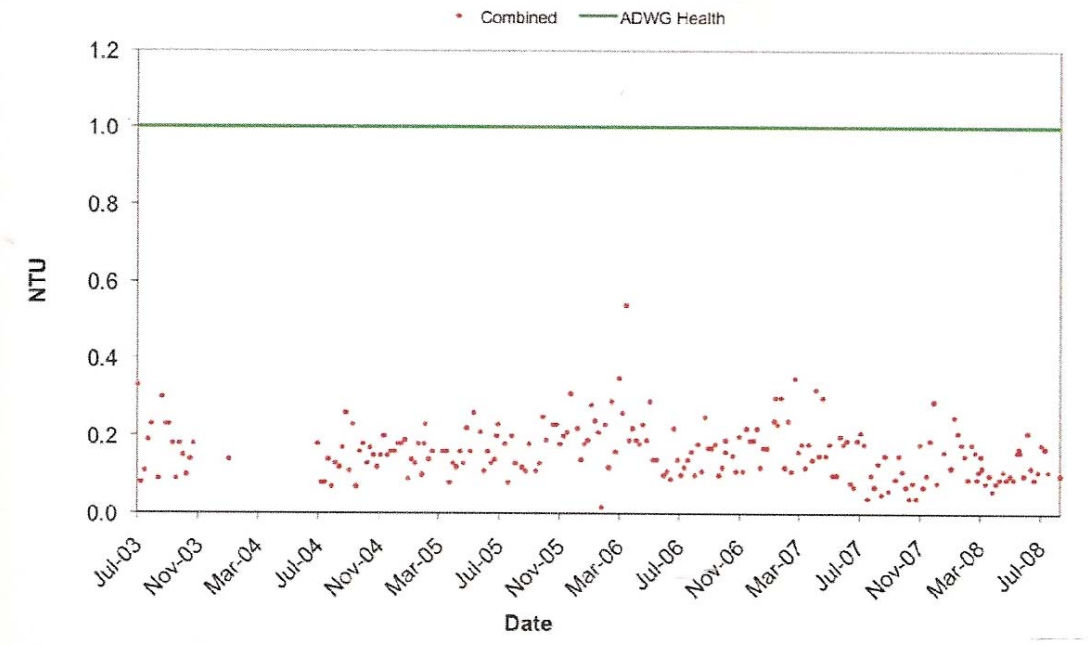


**Figure 3:** ***Image Flat WTP Treated Water turbidity***

This was demonstrated through the selection of better quality Raw Water entering the treatment plant and improvements in the coagulation and flocculation processes becoming evident. In this improvement, efficient dosage rates of Alum solution and Powdered Activated Carbon became not only effective in the removal of turbidity,

colour, iron, manganese and pathogens but also economical over a period of time.
The Alum dosage rate is varied according to the raw water characteristics and checked by 'drop-test' twice per day. The dose is manually adjusted upon jar test results and operator experience. The delivery of the set dosage of alum is then flow paced.

Installation of an in-line pH meter on the dosed water assists in the control of alum dosage and helps identify when pre-lime dosing is required to maintain effective coagulation. The operational target limits for the dosed water pH is between 6.8 to 7.0.

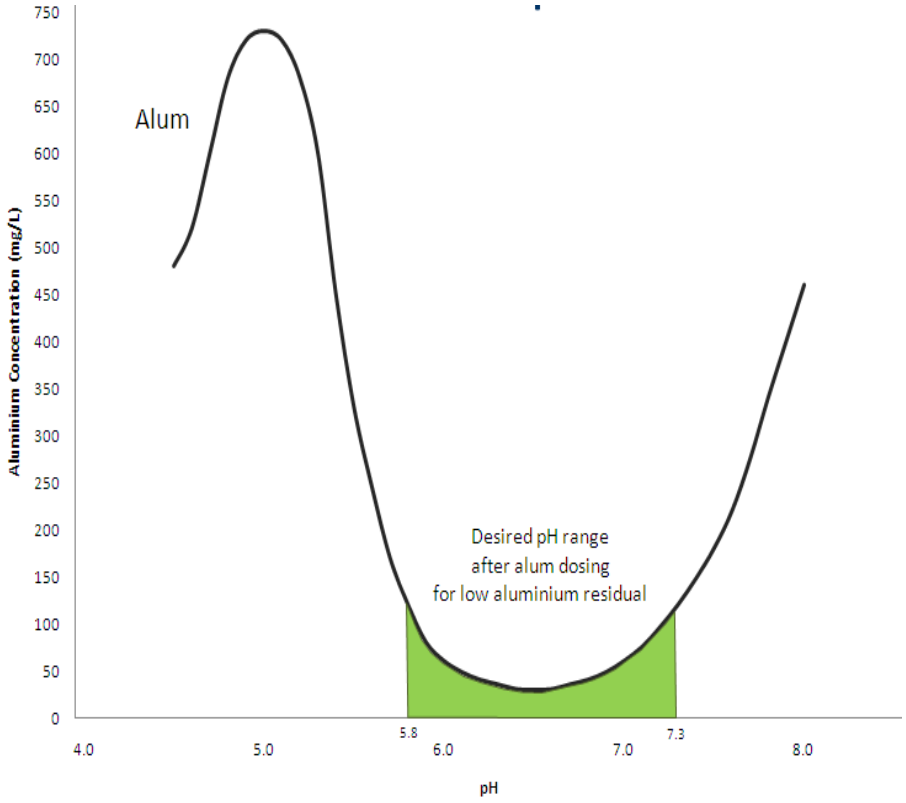


**Figure 4:** ***Alum V's pH for Alum***

Corrective action is required when the pH limits are <6.7 or >7.2 for a period of one hour or more. Operator experience indicates that there is a tight range for successful coagulation / flocculation at the Image Flat WTP. Outside of the specified range would warrant action from the operator.

- Operators will take a grab sample and test the pH of the dosed water.
- Monitor floc size.
- The operation of the alum dosing system checked.
- Check the raw water characteristics for change and any significant alterations in raw water quality will result in optimising of the dosing regime, which includes jar testing.
- Reasons in raw water quality change should be investigated.

With a major improvement in coagulation and flocculation, increased log removal with sedimentation was identified particularly for Cryptosporidium and Giardia and the quality of the settled water laundered from the sedimentation tanks was vastly improved. The improvement of the settled water also reduced the amount of carry-over floc onto the filters and thus the amount of floc that would settle on top of the launders. This alone

meant less frequency of housekeeping duties such as cleaning launders.
With the reduced loading onto the filters, filter performance was improved with extended run times and lowered turbidity levels of the filtered water exiting. The average filtered water produced over the last 12 to 18 months has consistently met the operational target of 0.1ntu. This level of filtered water turbidity is achievable for the treatment process and if the process has moved away from this level, action and investigation is required to ensure that treated water quality is not compromised. Filtration is the main and final barrier for Cryptosporidium and Giardia. There is a positive relationship between turbidity removal and the removal of these pathogens.

Some recommended actions to increased filtered water turbidity

- Take a grab sample and verify results.
- Check the coagulation sedimentation processes.
- If the issue relates to an individual filter, it should be taken off-line and backwashed.
- If the issue is not rectified, further investigation is required.
- If the issue relates to incoming raw water quality, the filtration rate may be reduced or an alternate raw water source with better water quality characteristic utilised.

The filters can automatically backwash on a factor of time or head loss across the filter bed. The filters are also manually backwashed based on monitored filtered water turbidity levels and run times by the operator.

## 3.0 CONCLUSIONS

"Are we doing what we planned to do?"

Verification activities include:

- Establishment and confirmation of implementation of the HACCP plan and identified areas of non-conformity.
- Confirm relevant equipment / instruments are correctly calibrated and maintained.
- Confirm that corrective action is implemented when 'action' or 'critical' limits are exceeded.
- Confirm that operational staff is competent through on-going training and treatment chemicals comply with required specifications.
- Documentation of all relevant activities

The end result of our optimisation of the old Image Flat Water Treatment Plant is clearly demonstrated by the consistently high quality of water produced.

## 4.0 ACKNOWLEDGEMENTS

IFWTP Staff

## 5.0 REFERENCES

GHD – Maroochy Water Service, *Maroochy Water Supply System Report – 2005*

Seqwater Image Flat Water Treatment Plant HACCP Plan - 2008