

# Matching water and purpose

This 5 Minute Guide assists in matching water and purpose. It can be difficult to know the impact of alternative water on operating equipment and the quality of water required, even the risks to staff, product quality and productivity. Risks can include infectious disease, contamination, reduced product quality, to name a few.

High quality drinking water may not always be required for industrial or other processing purposes. Sometimes water can be reused, again and again instead of single pass usage. It is important to know when and how to reuse water and to match it correctly so it is fit for its intended use.

The cheapest to most expensive water saving actions are usually in the order of:

1. Avoid use
2. Reduce use
3. Reuse
4. Recycle

Many of the initiatives identified in this guide will fit into the reuse category and the costs incurred will be the re-routing of water flows around the plant.

## ‘Fit for purpose’

‘Fit for purpose’ is matching water of a certain quality to appropriate uses. For example recycled water from machines might be coloured and contain magnesium salts which are fine for use in one process, but not for use in another, e.g. this water may suit irrigation but not cooling towers.

The best official guides for the use of recycled water are EPA Victoria’s *Industrial Water Reuse Guidelines* (Publication IWRG632 — June 2009) and the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks* (NRMCC 2006).

## Sources and potential end use of ‘fit for purpose’ water

There are many sources and uses for fit for purpose water. The table opposite details these and includes ideas to use as a starting point and a confirmation of what can be used where.

### Sources of fit for purpose water can include:

- ✓ Rainwater
- ✓ Stormwater
- ✓ Cooling tower blow down
- ✓ Boiler blow down
- ✓ Steam trap condensate
- ✓ Clean in Place (CIP) rinses
- ✓ Pump seal water
- ✓ Acoustic water (water that is used for insulation purposes)
- ✓ Fire water testing
- ✓ Grey water from washing
- ✓ Local recycled water schemes
- ✓ Local/neighbour trade waste streams
- ✓ Product ‘wastewater’

### Areas where fit for purpose water may be suitable include:

- Cooling towers
- Wash down
- Toilet flushing
- Irrigation
- Low grade product
- Fire water testing
- Clean in Place (CIP) first rinses

### Other opportunities exist offsite and these can include:

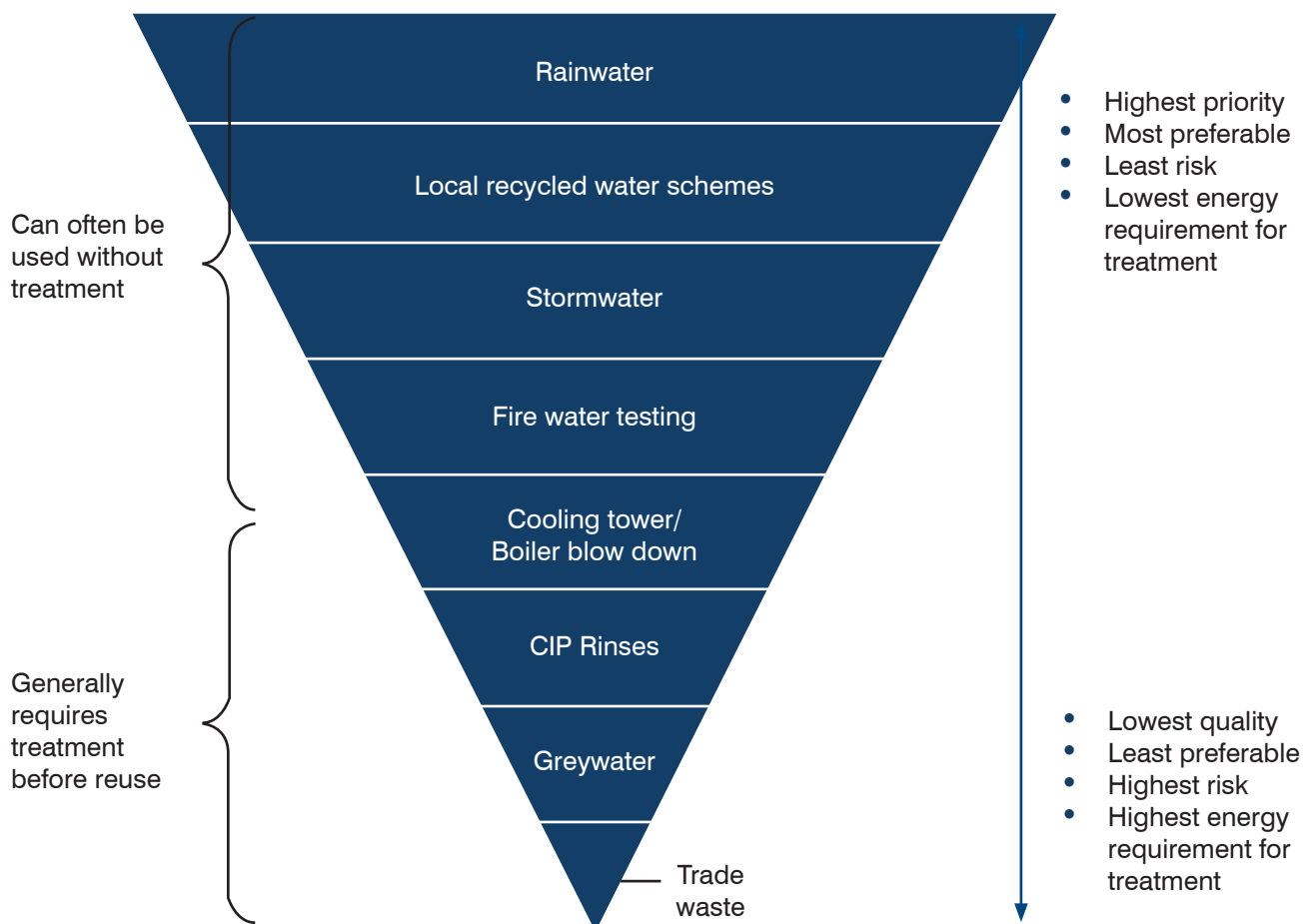
- Sharing across boundaries
- Dust suppression
- Cement making
- Local park or sporting field irrigation

## Quality and quantity queries

Rainwater, stormwater, industrial wastewater, and other non-potable waters will vary significantly in quality, quantity and reliability. It is very important to understand the risks of each water stream when selecting fit for purpose water for use.

Fig.1 below details an indicative hierarchy of water quality from best to worst. This is not prescriptive to all waters but can be used as a guide for expected quality of water.

**Fig.1 Water Quality Prism**



“The cheapest to most expensive water saving actions are usually;  
**Avoid use, Reduce use, Reuse, and Recycle.**”



## 14 Key Steps to identifying Potential End Uses

There are 14 key steps to identifying and implementing the replacement of potable water with fit for purpose water:

1. Record all the areas, processes and procedures where water is used around the plant
2. Ensure the waste hierarchy has been followed, including measures to avoid and reduce first. This could include closing cooling loops rather than a single use of the water before disposal. (e.g. once through heat exchangers)
3. Brainstorm with colleagues those areas where potable water could be replaced with fit for purpose water
4. Determine the total volume and quality (testing may be necessary) of fit for purpose water which is required (also known as the 'non-potable demand')
5. Remember to include seasonal variations for major items and the variable volumes
6. Investigate the site for water which is currently used and discharged to trade waste which might be suitable for reuse
7. Determine the volumes and quality of water which may be available for reuse. Include rainwater that can be harvested from roof areas. (If there is not a rain gauge rainfall data can be found at <http://reg.bom.gov.au/climate/averages>)
8. Compare the potential supply volumes and quality with the non-potable demand for water
9. Determine the quality requirements for each end use, for example, chlorine can affect the quality of product in plasterboard production
10. Figure out the infrastructure requirements for use of fit for purpose water, e.g. pipes, pumps, extra storage and treatment

11. Prepare a business case. Be sure to look at the overall impact of reuse of fit for purpose water including energy, chemicals, raw water savings, trade waste, staff handling procedures, reputation and community acceptance.
12. Assess the risks of using fit for purpose water; it may be useful to involve a third party to confirm the facts and plan
13. Implement and deliver infrastructure required for fit for purpose water
14. Measure and communicate success. Fit for purpose water offers a great marketing opportunity to promote environmental initiatives with staff, community, customers, local media and more.



### Success Story

*1. Dow Chemicals produces desalinated water for the boiler with a reverse osmosis plant. "The plant produces two streams, the high quality desalinated water and a more concentrated reject stream. Dow have been able to supplement their cooling tower feed water with the reject stream thereby replacing some of their potable water use. The volume of potable water replaced is estimated to be in the order of 35Ml/yr. Typically this reject stream would be considered a waste and discharged to trade waste; however, by utilising this fit for purpose water they are able to reduce their demand on potable water and trade waste impact."*

### Further reading

O'Neill, M and Lambert, D (2010) "Water resource efficiency and cleaner production" Australian Master Environment Guide, CCH Publishing, Sydney

# 5 MINUTE GUIDE SERIES

There are 9 titles in the 5 Minute Guide series. See also:

## How to improve boilers and steam efficiencies

This 5 Minute Guide examines boilers and their water usage. Boilers are a common major plant item, especially within manufacturing sectors. They use significant quantities of energy and water to produce hot water and/or steam under pressure. Ensuring they are operating efficiently can deliver significant water, energy and money savings.

There are a few basic steps that can be taken to optimise the efficiency of boilers.

### Steps to reduce the water use of boilers

#### Step 1: Stop Water Leaks

Check the boiler and pipe system for leaks as these are easily preventable losses. Significant water, energy and heat can be lost due to leaks in boiler and pipe systems. Check for leaks during shut down, maintenance activities and, where possible, on a monthly basis. Replacing the company's water bill can also identify problems.

#### Step 2: Check valves and tanks in the boiler and associated equipment to prevent overflow and overfill situations

Monitor water flows in the boiler and pipe system as this is the easiest way to detect leaks. Aim for a baseline of the plant's peak performance (e.g. after shutdown maintenance) in most boilers and record any deviations immediately. This can be done by installing flow meters and/or monitoring relevant parameters or setting alarms.

#### Step 3: Fit Pipe Lagging (Pipe Insulation)

Consider insulating any surface pipes, flanges, valves etc. ( hotter than 50°C as hot losses contribute directly to carbon emissions, energy use and clean air to conservation. Lagging or pipe insulation, when correctly applied, can significantly reduce thermal losses resulting in less energy, carbon emissions and water use as there is less heat lost to the surroundings. It is recommended that any surface pipes, flanges, valves etc.) hotter than 50°C be insulated. Heat losses also increase ambient temperature and impact upon other equipment, especially cooling systems.

## The new frontiers in water efficiency and conservation

This 5 Minute Guide provides an insight into two new frontiers in water efficiency and conservation. In the last decade drought and climate change impacts have created an increase in water harvesting and reuse, efficiencies with pumps, pipes, cooling systems, and sensibly, an increased competency in handling these opportunities.

The new frontier is beyond these site efficiencies and augmentation systems. It is beyond the plant gate. It is in the sharing of water across boundaries and in the supply chain of products. The current handful of examples are likely to grow and in another decade integrated water supply and treatment systems (local and continental), and integration with supply chains will become more widespread.

The regulated environment varies according to infrastructure and operating costs, volume of water, level of treatment and security of supply.

The two diagrams below detail the potential models for sharing water across boundaries and the different contractual requirements. Option 1 involves a direct arrangement between two neighbouring industrial sites, while Option 2 includes the local water authority as an intermediary in handling the distribution and recovery costs through water bills.

### 1. Sharing water across boundaries

There are a small and growing number of instances where water is being shared across industrial, manufacturing, residential and recreational neighbour's boundaries in Australia. Water sharing can be complicated because water is generally a public, shared and private, and governments control the price of water at a minimum level irrespective of supply, demand and supply.

It is now possible to trade between industrial sites and, in a formal way, as we can trade company shares through a stock exchange or indirectly through banking. These trading can be common in farming communities, for example the Murray Darling Basin. Generally, in other and industrial areas, trading water is most commonly a direct exchange of shares or sometimes have a side effect of not need the water, to a neighbour that does. Trading can also occur with waste water from the A/B process. Due to it will be a purpose need, however, such instances are still rare.

An alternative and less complicated option can be community water gifting.

## Establishing a water baseline and measuring success

This 5 Minute Guide provides the tools needed to define and measure water saving success. It is an easy and cost-effective process to measure past, present and future performance. Water bills and equipment guides contain readily available information which will provide a baseline of past and present performance to plan and improve for the future.

### Baseline Basics

A baseline is a value or standard by which things can be measured, compared and managed. Baselines can be measured in a number of ways. With regard to water use, baselines can be measured in dollars per annum (DPA), however it may be more accurate to measure baselines in terms of key performance indicators. For instance, this could be dollars per tonne of product produced or three per litre of liquid chemical produced.

A few reasons for establishing a baseline include:

- Baselines are important because they allow the tracking of efficiency and progress over time.
- Baselines allow for target setting and are the best part of understanding water usage.
- Until a baseline is established it is impossible to measure progress towards any water saving goals and to understand which efficiency actions work.

Baselines can also be used for energy savings, carbon emissions, waste production and other environmental performance indicators. Some actions improve both water and energy efficiency, and some others have contrary impacts on other factors. Promotion of efficiency objectives is required in such instances.

### Establishing a water use baseline

Establishing a water use baseline is simple. It requires the completion of the last 2 years of water bills and ideally the last year of production figures for the production indicators. On-site water meter readings and sub-meter data for equipment provided more accurate data. Sub-meter data for equipment will show the system is operating as designed and at optimum efficiency or per equipment guides.

The easiest way to establish a baseline is to input the water usage bill figures into a simple excel spreadsheet which can be set up with the following headings as shown in Fig 1.

Remember to input the water volume figures and not the charge amount as water cost rates change over time. Also, check with the accounts department as they may already be collating this type of data and it may be possible to adjust the water flow readings again. The accounts department may also be able to continue to input the data once the system is set-up.

Water bills are not necessarily issued on a regular cycle as they can depend on when the water authority was available to undertake a meter reading. It may also be necessary to adjust production figures if they were recorded in monthly volumes.

## Top 10 Water Saving Actions

This 5 Minute Guide discusses the Top 10 actions to save water. While water is seen to be cheap, there can be many hidden costs in its use. The true cost of water can include storage and tank costs, any water treatment chemicals required, and energy for heating, cooling and pumping.

To investigate the real costs and benefits the benefits of water saving options, calculate and use the full cost of water, not just what is on the company water bill. This is likely to include the true value and provide the company with a better understanding of production efficiency.

By understanding water saving actions and the true cost of water, a company's water saving can be improved and water saving goals can be included into the company's Environmental Policy, Personal Development Goals or Water Targets. The Water Care Study of the PACIA website documents how to include these issues into company goals. (<http://www.pacia.org.au/Docs/10%Water.pdf>)

### Top 10 Water Saving Actions

#### 1. Check for leaks

Leaks can be a waste of water and energy and waste large amounts of high quality water, costing the company a water bill. Above ground leaks are usually easy to find, however, below ground leaks in a building fabric can be much harder.

A physical inspection of all pipes and water using equipment such as a listening device can be used to find leaks and problems not visible during routine maintenance.

The easiest way to check for leaks that are hard to see is to monitor water usage during shut down. Take a meter reading before shut down and one immediately after. Any change would indicate a leak to find and repair.

#### 2. Ask operators why and how

An effective way to find out about water usage in the plant is to consult the staff and ask, "why?" and "how?". Sometimes this becomes both a "why" and a "how" question, and it is a process to do in particular ways but because "how" is a way to "how" it is often done. Understanding and questioning "why" can reveal where improvements or changes can be made.

Plant and equipment operators and other staff members also have ideas about how to save water, implement change and improve environmental outcomes. So ask the operators, and ask the staff, how they think they can save water, and ask them to implement it. This is a process of continuous improvement, create a sense of ownership, create champions for efficiency and company sustainability and ensure that new measures are successfully implemented.

## Rainwater Harvesting

This 5 Minute Guide provides the tools to evaluate how rainwater harvesting can save a company money and reduce their environmental impact.

### What is rainwater harvesting?

Non-collected rainwater is widely recognised as an excellent high quality water that can supplement mains water supplies. The quality depends on the roof and locality, and the use depends on the equipment. While it is often more expensive to install rainwater harvesting systems than people initially think, the cost may be offset by considerations such as:

- 1) It is not subject to water restrictions.
- 2) There are no ongoing purchase costs for water and water.
- 3) It generally results in good engagement with staff and community.

Rainwater is often collected from rooftops. Rainwater is collected from roofs and in comparatively clean, whereas domestic drains from toilets, showers and parking areas are not as clean as rain water, and often have a bad odour.

### Types of rainwater harvesting

Rainwater harvesting can either be 'roof' or 'day' (day) systems. Roof systems collect rainwater and direct the water into a tank. They may require additional management and pumping as water can be stored in a tank. Day systems collect water directly from the roof and undergird. Day systems collect water directly from the roof and undergird. The water quality and the use of the water will determine which system is the best to implement at the site.

## Reduce trade waste impact

This 5 Minute Guide provides the tools for companies to review and reduce their trade waste impact. Companies are beginning to realise the potential value of their wastewater and the savings that can be made in recycling, reusing and recycling costs, rather than disposal to sewer. Trade waste can often contain valuable materials, not to mention significant volumes of water which could potentially be reused.

Similarly, increasing water and public pressure to improve efficiency is resulting in companies investigating cost-effective ways of recycling, reusing or treating and recycling their wastewater. Business and society is increasingly recognising that 'water can be used more than once'.

### What is trade waste?

'Trade waste' is any wastewater discharged from commercial, industrial, laboratory or trade activities. It specifically excludes any wastewater discharged from domestic premises.

Discharge of trade waste requires a trade waste agreement, under which trade waste discharge is measured (in a factor or applied based on probable water use) and the quality of the trade waste analysed for pricing.

Trade waste is a blend of many waste streams, including cooling tower and boiler blow down, process by-products, unreacted chemicals and Clean in Place (CIP) waste streams.

Trade waste charges are based on volume and the concentration of contaminants. The primary contaminants upon which trade waste charges are calculated are:

- Biological Oxygen Demand (BOD),
- Total Suspended Solids (TSS),
- Total Nitrogen (TN) (or Total Kjeldahl Nitrogen (TKN)),
- Total Phosphorus (TP) and,
- Total Dissolved Solids (TDS).

Trade waste charges are calculated on the load of contaminants in kilograms per day, where load = volume of trade waste x concentration. (These charges vary between water authorities, e.g. City West Water does not charge for Phosphorus.)

## How to reduce the water use of Cooling Towers and Chillers

This 5 Minute Guide examines the water usage of cooling towers and chillers and provides the tools to reduce water usage.

Please note this is written with the assumption that current asset maintenance practices exist and this document is to be used as a guide to improve performance and efficiency.

### Heat is a by-product of manufacturing and machine operation

Heat is a by-product of manufacturing and machine operation. Heat that can be used for most processes requires the machinery and manufacturing goods to be cooled. Traditionally, machines are cooled by either air or cooling towers, but with the growing concern around energy, carbon and water efficiency and single sourcing systems (e.g. air cooling towers and below ground heat exchangers) are making a come back.

Companies should always seek to reduce heat loss with insulation and a hot and cold plant with valves, vents, hot and cold plant isolation. For more information read 'Top 10 Water Saving Actions' and 'Top 10 Water Saving Actions' and 'Top 10 Water Saving Actions' and 'Top 10 Water Saving Actions'.

### Types of Cooling Towers and Chillers

Cooling towers and chillers are different systems. A chiller refrigerates water and a cooling tower cools hot water from a system. For example a chiller cooling machine, engine and a compressor. It chills the water, but it is a cooling tower fan or heating pump where the chiller is in the water.

Chillers can be either:

- 1) Refrigerative
- 2) Absorptive

Refrigerative chillers consist of a traditional compressor, refrigerant gas, condenser and evaporator tube wrap.

Absorptive chillers are heat driven cooling systems and are often used in refrigeration or transportation equipment to provide chilled water. A good example is a gas fridge often used in camping or at remote sites.

## Understanding water, sewage and trade waste bills

This 5 Minute Guide examines water, sewage and trade waste bills and discusses how this important information can be used to assist in developing water savings initiatives. By understanding water bills and making use of the information, improvements in water efficiency and reductions in the cost of water can be made across the company.

### Water supply

Historically, water, sewage and trade waste costs have been ignored due to the relatively low cost for supply and disposal. However, with drought, climate change and community concern about water waste, many companies have become increasingly aware of the security and value, going beyond the purchase price of water to implement water saving initiatives. As a result of this, a growing number of companies monitor water use on a daily basis or on a monthly basis per unit of product manufactured.

### Reviewing of water bills

Reviewing water bills can assist in identifying times where water is being wasted or where leaks may be present. Companies can use the information to identify areas for improvement and take action to reduce water waste. This is a process of continuous improvement, create a sense of ownership, create champions for efficiency and company sustainability and ensure that new measures are successfully implemented.

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