# 9. Water Resource Use

## 9.1 Water Management

The water balance shown in Table 9-1 and in Figure 7-1 is based on the predicted 2021 residual waste composition which includes a waste moisture content of 34.5%. This assumes a moderate adoption of FOGO. Maximum predicted adoption of FOGO (Section 6.2.2) will reduce the moisture content of the existing residual waste from the present 45% to around 29.6% as a consequence of removing food waste from the residual bin waste.

The quantity of water used on an annual basis is expected to be approximately 104ML (311.3m$^3$/d) with approximately 2.7ML captured from roof runoff. It is expected that the majority of the water will be obtained from the City West Water (CWW) mains supply. Domestic sewerage will be discharged to the CWW sewerage system. Approximately 30% of the water arrives in the MSW and another third is generated within the gasifier by the reaction of hydrogen and oxygen.

| Input Water | m$^3$/day | Output Water | m$^3$/day |
|---|---|---|---|
| Mains Water | 303.3 | Total Stack Emissions | 496.3 |
| Water generated in gasification process ($H_2$+0) | 206 | Water generated in gasification process ($H_2$+0) | 206 |
| Water in MSW | 207 | Water in MSW | 207 |
| Captured Rain Water | 8 | Reject from WTP to alkali Scrubber | 61.6 |
| | | Blowdown from Boiler to alkali Scrubber | 17.8 |
| | | Mains Water to alkali Scrubber | 3.9 |
| | | Gasifier loss evaporation | 57.6 |
| | | Line loss (steam traps etc.) | 94.6 |
| | | Gasifier Loss – water in slag | 14.4 |
| | | Water loss in Fly Ash treatment | 20 |
| | | Miscellaneous water loss - washdown etc. | 30 |
| | | Loss in Domestic Sewerage | 11.4 |
| Total | 724.3 | Total | 724.3 |

**Table 9-1: Summarised Water Balance for the Proposed WtE Project**

The majority of the incoming potable water enters the process through a water treatment plant comprising ultra-filtration/Reverse Osmosis treatment followed by ion exchange treatment prior to being directed to the heat recovery steam generation (HRSG) system. The concentrate (reject) streams from these processes are used to supply makeup water for alkali preparation in the flue gas treatment area (61.6m$^3$/d).

Steam leaving the turbine is directed to an air-cooled chiller condenser with the condensate being recirculated back into the HRSG system. Blowdown from the boiler in the HRSG system is also used in the alkali preparation (17.8$m^3$/d) and discharged through the stack as steam.

Water is lost from the system with the removal of gasifier slag (14.4$m^3$/d) and in the stabilisation of fly ash (20$m^3$/d). The majority of the water losses are attributable to steam discharges (648.5$m^3$/d) with the loss through the stack the most significant (496.3$m^3$/d). The majority of this loss results from moisture in the residual waste and water manufactured in the gasifier (83%).

Leachate generated from the MSW in the waste feed bunker is directed into a leachate tank from where it is injected into the gasifier with the MSW. As a consequence of this process, no wastewater treatment is required and no wastewater is expected to be discharged. No discharge to trade waste is anticipated. Water input from the mains and the MSW is balanced by the loss through steam and evaporation with the contained salts reporting to the gasifier slag or the fly ash for recycling or disposal.

Considerable effort has been made in the design to minimise mains water use. The gasifier consumes all the leachate from the MSW. All reject streams generated in the process including the UF/RO concentrate, back flush and CIP wash water, Ion exchange regeneration solutions and boiler blowdown are also reused in appropriate areas within the process.

The technology chosen for the steam condensing system is air cooled rather than cooling through water fed cooling towers provides for considerable equivalent water savings. The acid gas scrubber is a semi-dry system also selected to minimise water use. The small quantities of water required for cleaning wash down and maintenance requirements (miscellaneous water in Table 7-1) will be directed to in-ground sumps and pumped to either the gasifier slag pool, the alkali makeup area or to the leachate pool for reuse.

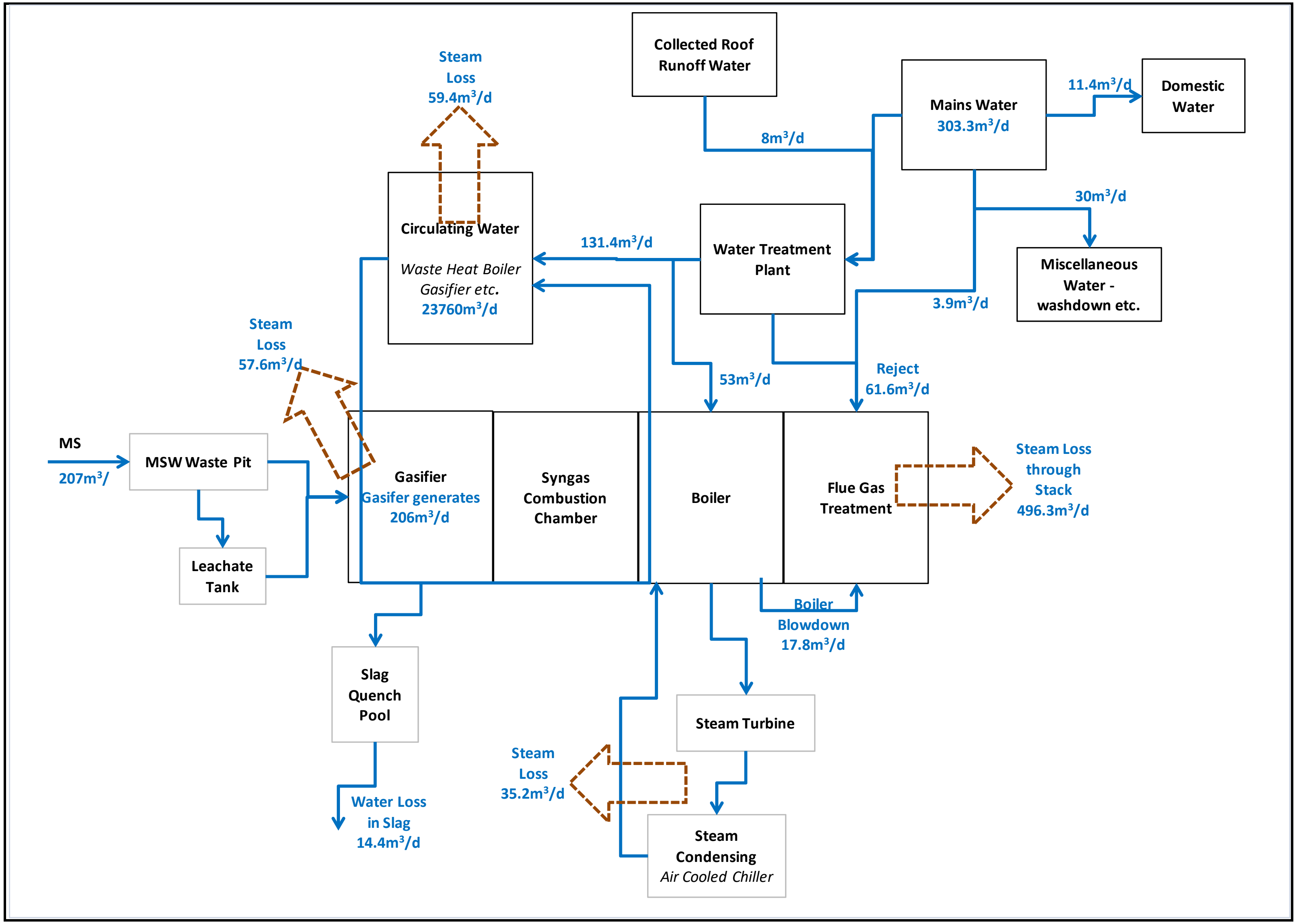


**Figure 9-1: Schematic Flow Chart of Water Management on REA Project Site**

## 9.2 Best Practice

### 9.2.1 Benchmarking Water Use

Water use in thermal EfW Projects varies considerably with the technology incorporated into the process. Major water use within the process relates to steam condensation, flue gas scrubbing and wastewater treatment and disposal. Water free or low water technologies are available for most of the major water use areas and plants that incorporate more of these options will have considerably lower water use. Estimates of water use from a range of thermal EfW Projects show substantial variation. Plants adopting water free systems where available can reduce water consumption to as low as 200L/t of MSW processed. On the other hand, facilities constructed using water cooling and wet scrubbing can have consumptions as high as 3000L/t of MSW processed. The REA Project incorporates air cooling for condensation and semi-dry flue gas cleaning and has a projected water consumption of 505L/t MSW treated. This situates the Project at the lower end of the range for water consumption in thermal EfW plants indicating that the technologies included in the process are best practice. This is highlighted by the Best Available Techniques for Waste Incineration (2006) (BAT) which suggest a range of techniques for reducing water consumption. These are listed in Table 9-2 with the equivalent system included in the REA Project.

| BAT for Waste Incineration | Environmental Benefits | REA WtE Process | Compliance |
|---|---|---|---|
| Water free technologies for gas cleaning can be achieved by the use of dry and semi-wet process that do not give rise to waste water | No discharge of wastewater.<br><br>Reduction in consumptions associated with wastewater treatment.<br><br>Recovery of salts in the scrubber residue. | REA propose a semi-dry alkali injection and dry activated carbon injection gas scrubbing system which does not produce wastewater. | Yes |
| Boiler water requires regular draining in order to reduce the dissolved solids levels and to maintain the system. This waste water stream can be fed to the scrubbers (semi-dry and wet) instead of separate treatment/discharge. | Reduction in water consumption by replacement of scrubber feed-water. | REA propose to reuse boiler blowdown for the treatment of fly ash | Yes |
| Because the incineration process itself provides a means of concentration and removal of pollutants from waste streams, it is possible for low to medium volume waste water effluents to be fed into the incineration process at appropriate points. | If well designed and operated, such a system can allow the waste incinerator to:<br><br>1. Concentrate inorganic pollutants into solid wastes (e.g. with FGT residues or WWT residues)<br><br>2. Reduce water consumption<br><br>3. Eliminate, or limit, the need for effluent discharges. | REA will direct MSW leachate from the bunker to the gasifier for treatment. No effluent discharges from the site. | Yes |
| The techniques involves the separation of the drainage of clean rainwater so that it does not mix with potential and actual contaminated streams. | Reduction in the volume of waste water requiring treatment | REA propose to include all process areas under cover separating the process from rainfall. Runoff generated from the roof areas will be capture for reuse in the process | Yes |

**Table 9-2: Range of BAT Techniques for Reducing Water Consumption**