



The
Vertical Gravity Separator
(VGS*)

Separating Waste from Water

ACQUA International Group [“ACQUA”]

ACQUA are involved in the extraction of waste from water using proprietary technologies sold under the following brand names:

- *Vertical Gravity Separator (VGS*)*
- *Induced Cyclonic Separator (IC-SEP*)*
- *Cyclonic Falling Film Evaporator (CycloVap*)*
- *Inline Swirl Generator Hydrocyclone Head (ISG*)*
 - *Liquid/Liquid*
 - *Solid/Liquid*
- *Liquid Skimmer (Skimmer*)*

The ACQUA technologies are involved in the following market segments and applications:

- *Oil-water separation*
- *Fat, oil and grease recovery/removal*
- *Marine bilge water treatment and marina oil slicks clean-up*
- *Soil remediation*
- *Tertiary sewage treatment*
- *Recovery of backwash water*
- *Removal of suspended solids*
- *Treatment of wastewater from food and chemical manufacturing, pulp and fines recovery.*

* Indicates International Patents Pending

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1 THE VERTICAL GRAVITY SEPARATOR (VGS*)

The Vertical Gravity Separator is a cylindrical multi-plate oil water separator, that uses gravity as its separating mechanism. The VGS* has been acclaimed by a major water authority as "the best technology of its kind" thanks to the unique blend of features and performance.

Current water authority policies require businesses to pre-treat their wastewater or incur disposal fees based on discharge to the sewer. Although businesses may currently be inside wastewater penalty limits, but as regulations tighten, they can expect to incur larger penalties.

Thanks to the ingenious use gravity, the VGS* can be used in many applications with extremely high efficiency levels, minimal maintenance time, while providing businesses excellent value.

There are 2 ranges of VGS* available:

Hydrocarbon/Water (OWS) VGS* is designed treat non-emulsified oil and water.

Fat, Oil and Grease (FOG) VGS* is designed to treat greasy wastewater generated by the preparation of food.

Both separators can be supplied as a package, including a Liquid Skimmer (Skimmer*) and a pump. Furthermore, the VGS* can be used a stand-alone separator of to supplement the performance of other systems.



1.1 Features and Benefits

- Superior design.
- Highly competitive price.
- Simple to install.
- Easy to use.
- Very low maintenance.
- Quick to clean.
- Portable
- Cost effective effluent treatment.
- Produces clean water and reclaimed oil.
- Maintains interceptor tank separation/spill capacity.
- Removes potentially hazardous vapours.
- Reduces the risk of high pollution penalties.
- Can be produced in plastic (MDPE) or Stainless Steel (316 2B).
- Fully automatic system (FOG option).
- Elimination of bacteria build-up (FOG)
- Major reductions in the number of costly pit pump outs (FOG)
- Reduced drain blockages (FOG).

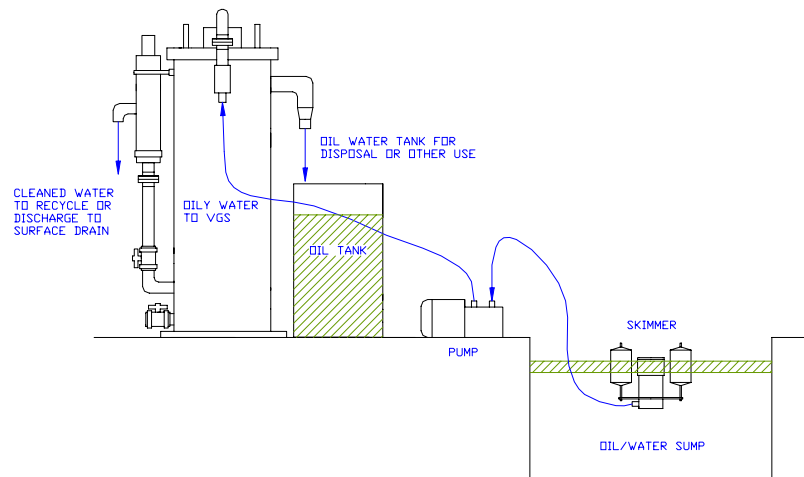
1.2 Applications

OWS VGS*	FOG VGS*
• Oil Refineries	• Restaurants and Food Outlets
• Mechanical Workshops	• Shopping Centres
• Service Stations	• Clubs and Hotels
• Metal Production and Recycling	• Sporting Stadiums
• Power Stations	• Resorts
• Process Water Recycling	• Schools and Colleges
• Vehicle Dismantling/Repair	• Mining Sites
• Remediation Systems	• Hospitals and Nursing Homes
• Waste Processing	• Factory Canteens
	• Abattoirs
	• Processing Plants

1.3 How does the VGS* work?

The Skimmer* takes just a few millimetres from the surface of the liquid in the retention pit. This allows the VGS* to treat the zone of highest concentration, and most relevant fraction of the liquid. Thanks to this process, the VGS* can treat liquid from vessels that contain thousands of litres.

The wastewater is fed into the VGS*, via a pump, where gravity takes effect. The VGS* works by ingenious control of both fluid velocity and pressure, which gently coax impurities from the water. The liquid enters the VGS* and then flows up a series of continuous spiral oleophilic plates (SPAK).



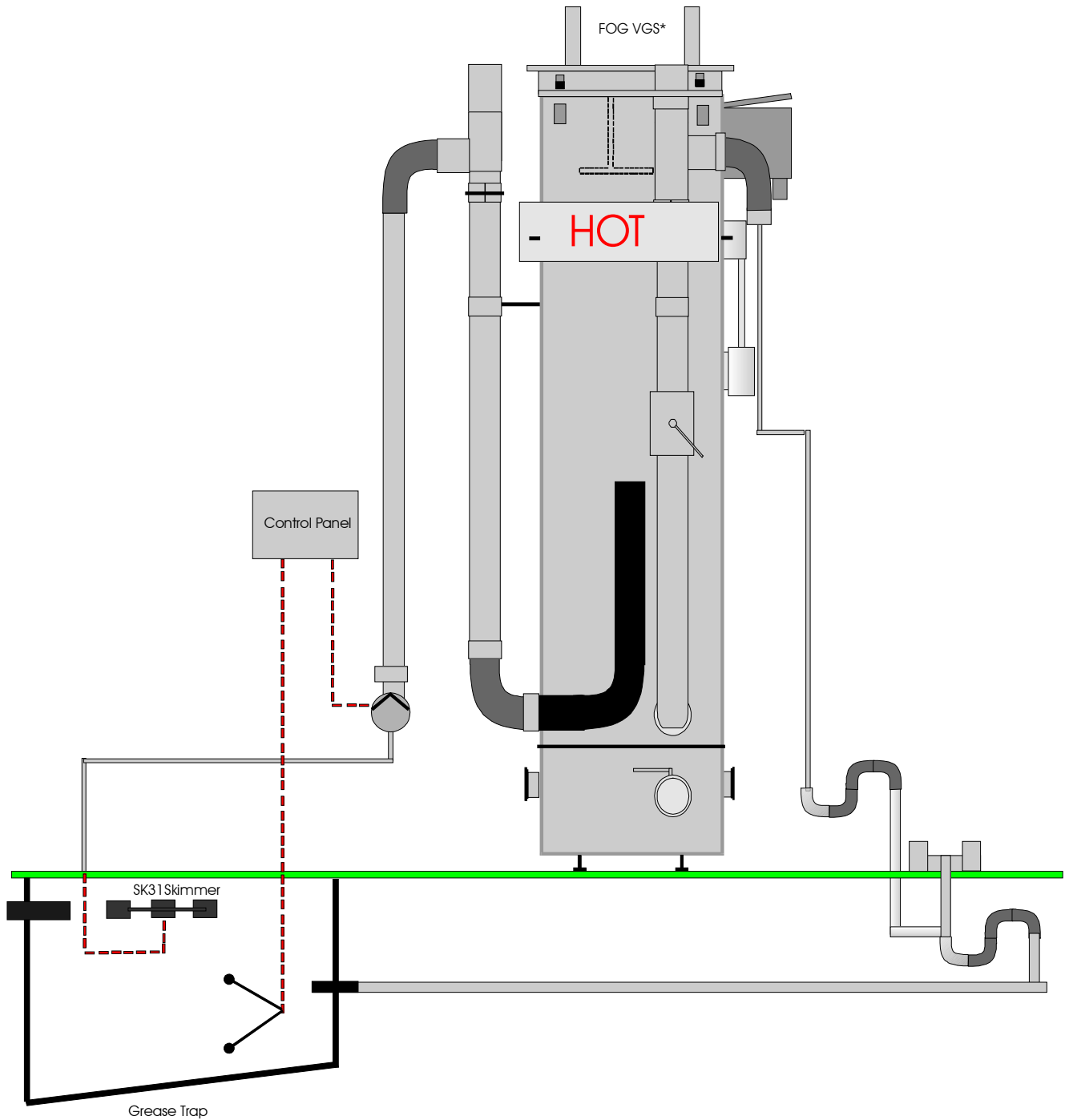
This allows high density suspended solids to fall into a sludge retaining area at the bottom of the VGS*, and for the free fat, oil, grease and hydrocarbon oil and low density suspended solids to rise to the surface of the VGS*.

The low-density materials, collected at the top of the VGS*, then flow into a retaining tank, and can then be disposed of as required. The sludge that forms at the bottom of the VGS* is periodically released through a valve on the VGS*, as maintenance schedules dictate.

The clean water discharges from an outlet at the side of the VGS* and can be disposed of as necessary, or recycled for later use.

2 DIAGRAM

2.1 The Vertical Gravity Separator (VGS*)



3 TECHNICAL DATA

McDonalds

3.1 McDonalds

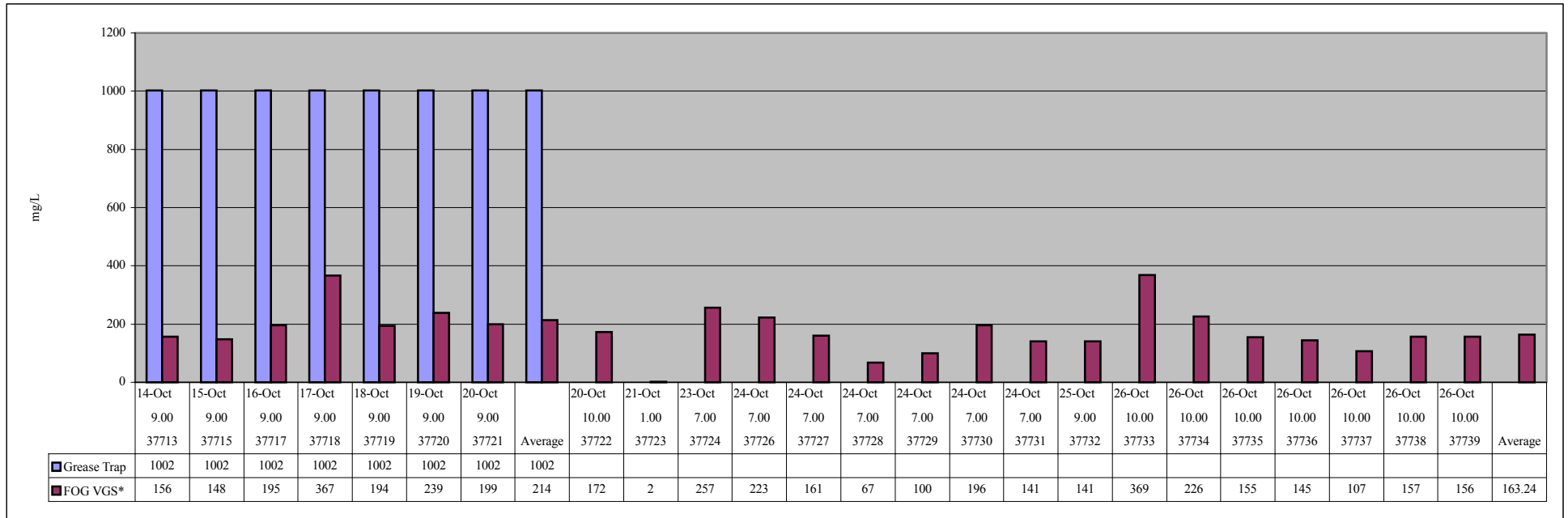
The following graphs detail samples taken by Sydney Water on 2 FOG VGS* installations. Typically, water authorities monitor pre-treatment systems in order to determine whether the quality of water discharged to the sewer is of an acceptable level. If the levels are unacceptable, water authorities will charge a business dependant on the water quality.

The samples taken demonstrate the levels from the pre-existing system, and the newly installation FOG VGS* for:

- Total Grease and Oil
- Total Suspended Solids (TSS)
- Biological Oxygen Demand (BOD)

McDonalds Revesby

Total Oil and Grease

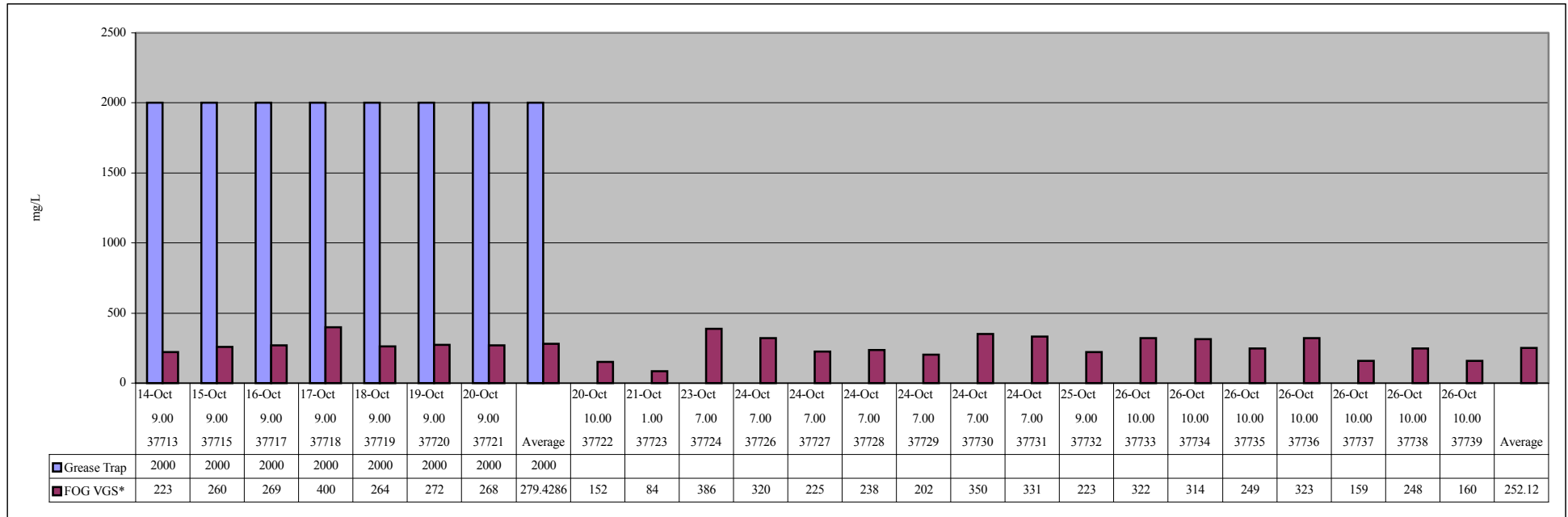


Notes

- The first 7 samples are composite samples. The remainders are either discreet or grab samples.
- Sample 37713 - Cooking oil changed. Deep fryers cleaned.
- Sample 37718 - Additional in-store cleaning due to "Inspection".
- The Grease Trap Results are based on 1 day of composite sampling.

McDonalds Revesby

Suspended Solids

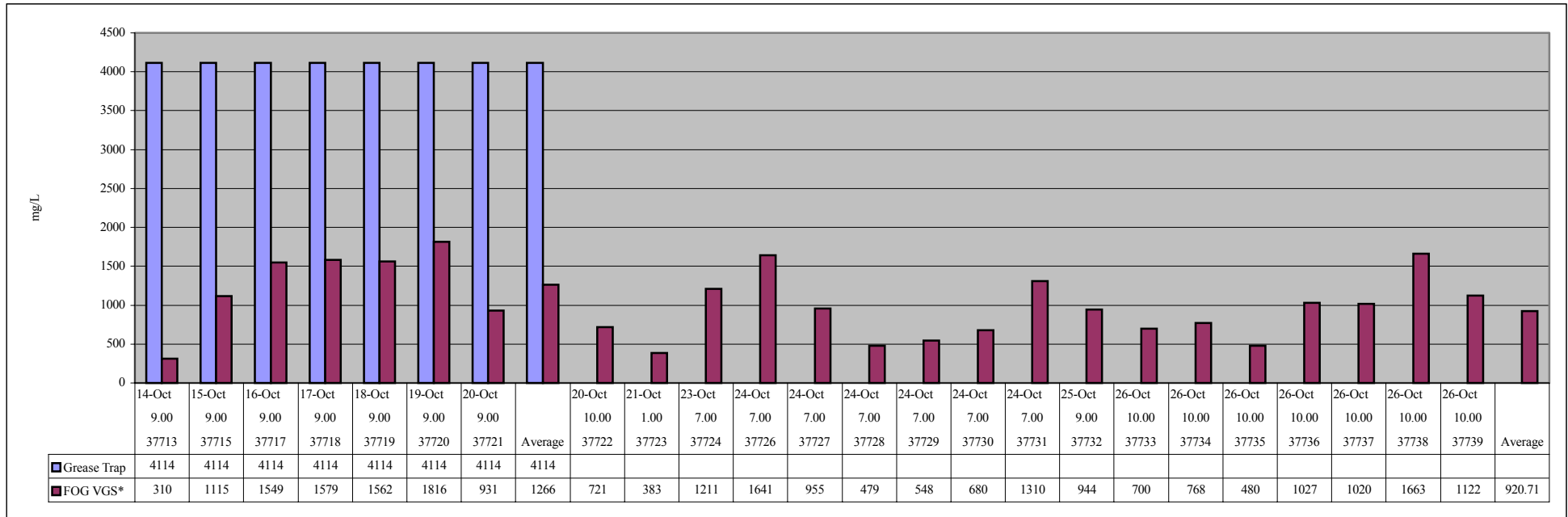


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McDonalds Revesby

Biological Oxygen Demand (BOD)

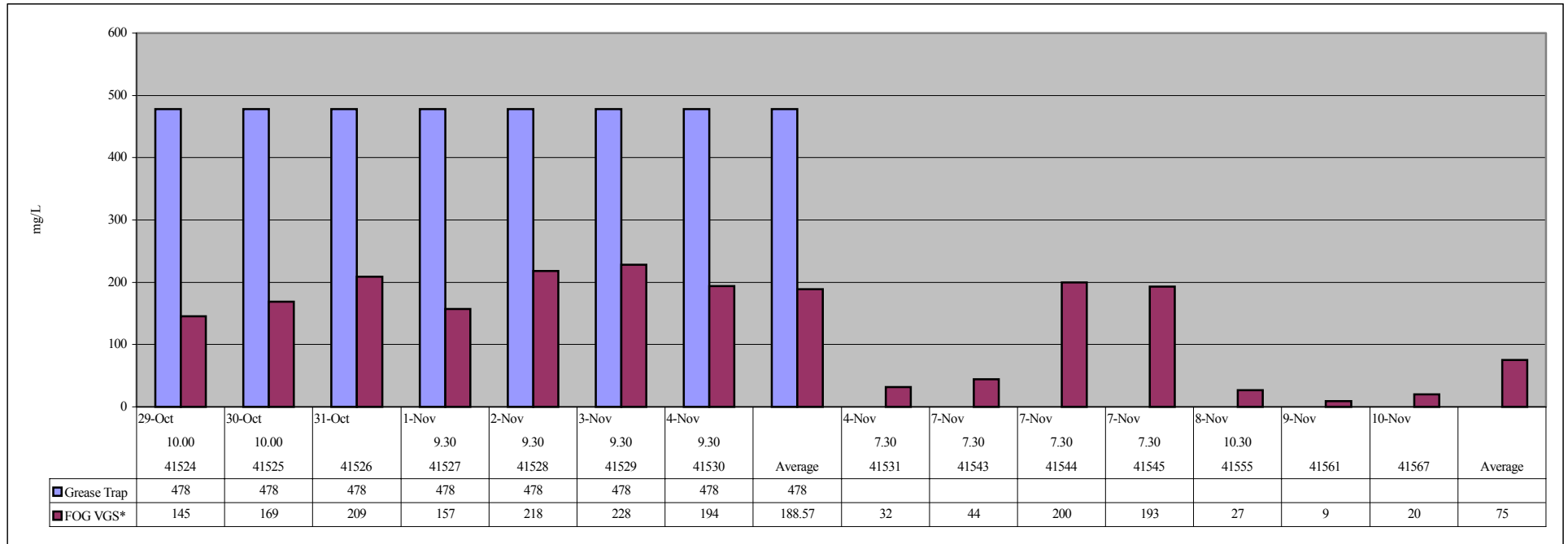


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McDonalds South Hurstville

Total Oil and Grease

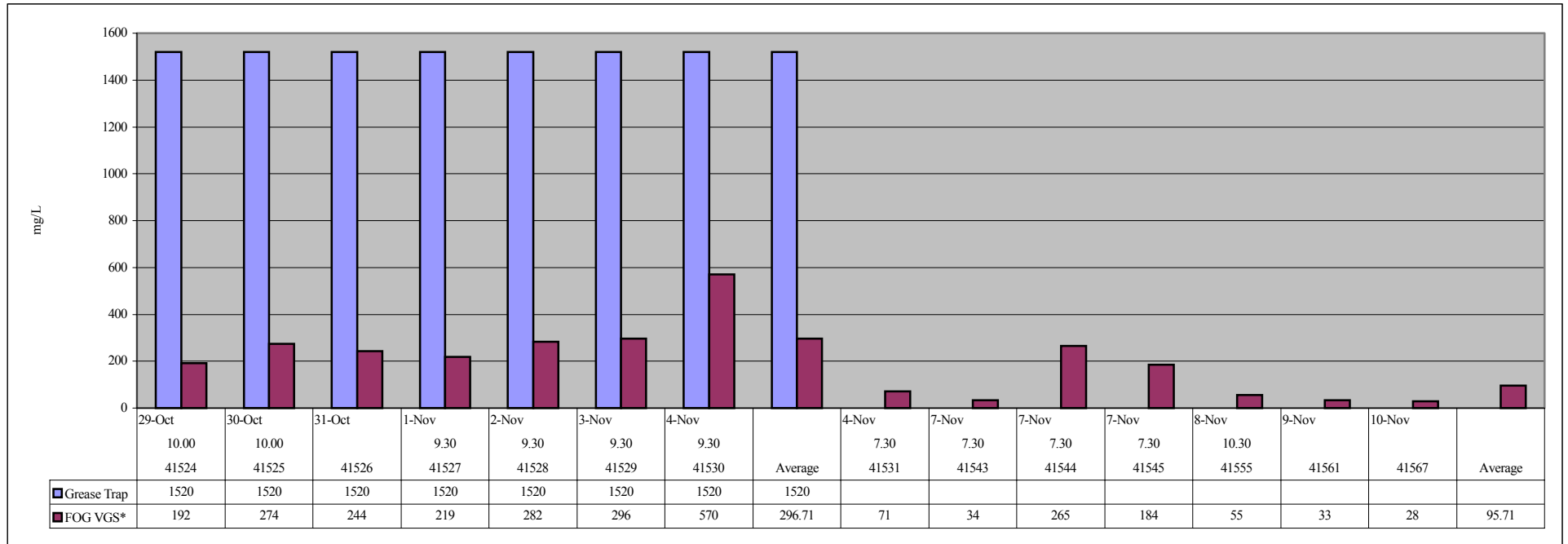


Notes

- The first 7 samples are composite samples. The remainder is either discrete or grab samples.
- Sample 41524 - Additional in-store cleaning due to "Inspection".
- Sample 41527 - Fortnightly clean of the "Soft Serve" machine (i.e. dairy products).
- Sample 41528 - Cooking oil changed. Deep fryers cleaned.
- Samples 41543, 41544, and 41545 - Annual clean of the exhaust hoods in the kitchen.
- The "Grease Trap" results are based on 1 day of composite sampling.

McDonalds South Hurstville

Suspended Solids

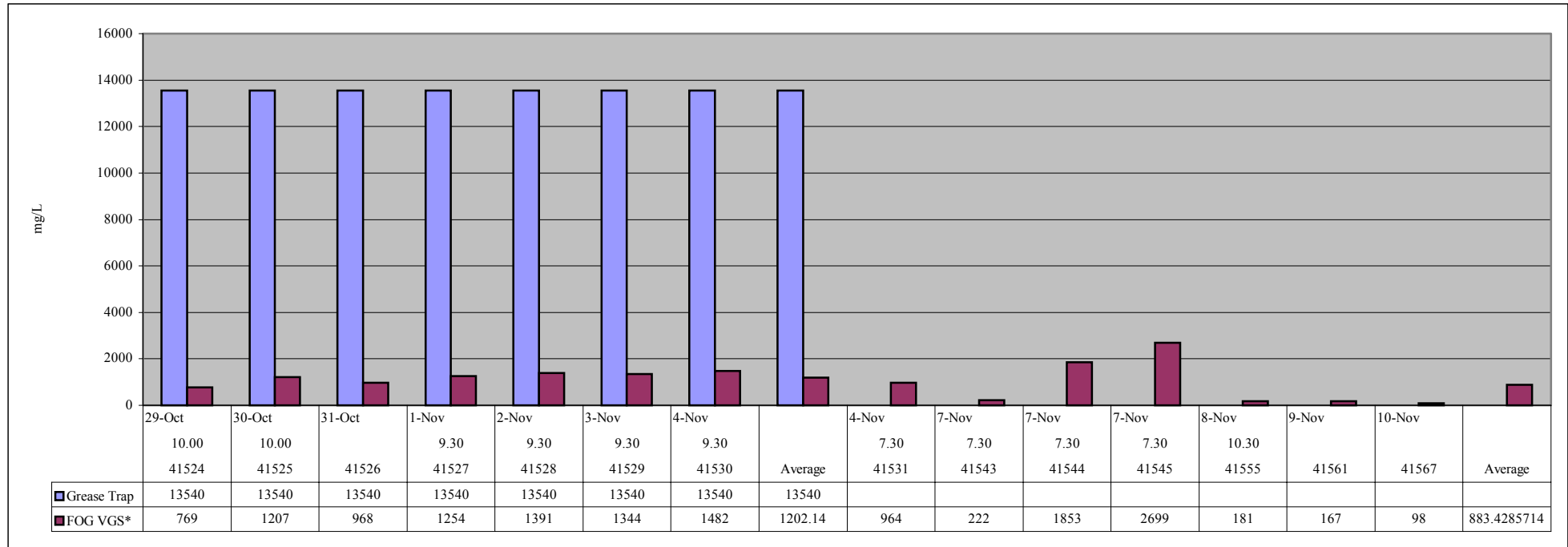


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McDonalds South Hurstville

Biological Oxygen Demand (BOD)



Notes

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4 PROJECT SUMMARIES

SPC Limited

Delta Juice Co Ltd

Port of Brisbane Corporation

IT Environmental

4.1 Enterra Group

Client	Enterra Group
Location	Docklands, Victoria, Australia
Product	Hydrocarbon Oil (OWS) Vertical Gravity Separator (VGS*) and Inline Swirl Generator (ISG*)

Objective

The objective of this project is to purify contaminated groundwater. Chemicals are not to be used, and water contamination must be reduced to a level whereby trade waste discharge fees are minimized. Since the water will also be used on the remediation site for dust control, health and safety requirements dictate that water quality is paramount.

Background

For more than a century, parts of the Docklands Precinct have been used for heavy industrial uses. The West Melbourne Gasworks in particular was used for the manufacture of coal gas, and the storage of large quantities of what are now regarded as toxic chemicals. As part of an ongoing initiative to create employment and stimulate growth through privately funded infrastructure projects, The Victorian government has now decided to redevelop the Docklands area, one of the largest joint government and private

Before the West Melbourne Gasworks site can be sold to a private developer, the present owner must decontaminate the site. During its history, various governmental bodies have owned the West Melbourne Gasworks site. As such, the Victorian Government has the responsibility of cleaning up the site. They have subsequently tendered out the



industry projects in Victoria's history. A key to the development is the construction of low, medium and high density housing, along with the necessary governmental infrastructure. decontamination works. The soil is contaminated mainly with liquid hydrocarbons, but also with coal dust, BTEX and other mineral oil derivative chemicals. Enterra JV has been employed to oversee the site decontamination. They will sort and decontaminate the soil as appropriate.

Solution

The soil decontamination process exposes vast quantities of similarly contaminated groundwater. The exposed water also needs to be decontaminated before being sent to the sewer or being sprayed on site for dust control.

Since Enterra JV are also responsible for the water discharged from the site, they have employed ACQUA to undertake the processing of the water and to ensure the discharge of clean water from the site. As most of the contamination is in the form of hydrocarbons, ACQUA have determined that hydrocyclones can be used in place of traditional chemical treatment.

Unfortunately the proximity of the site to the Yarra River allows for hydraulic stresses which lead to groundwater flows into the site. This water also becomes contaminated, and this water also needs to be treated.

The system supplied by ACQUA employs two hydrocyclones, a patented OWS VGS* and a series of retention tanks. The hydrocyclone exploits the principle of density difference for phase separation. The light phase is separated from the heavy phase by inducing centrifugal forces inside a special chamber. The patented ISG* is the heart of the system.

The first stage consists of an 8-head solid/liquid hydrocyclone. The sand and silt sucked up from the excavation pits is separated from the oily water stream prior to the second stage treatment. The oily water then passes to a second multi head hydrocyclone. This unit swirls the oily water at extremely high speed to force the oil away from the water. The oil rich phase is further concentrated using another patented technology, the OWS VGS*.

The resulting clarified water is settled for a short period before being discharged to sewer. The purity of the water is such that trade waste charges are minimized. Alternatively, the processed water may be sprayed on site for dust control, thus saving on town water charges, and further reducing trade waste charges by decreasing the volume of water being sent to the sewer.

4.2 Prix Car Services

Client	Prix Car Services
Location	Melbourne, Victoria, Australia
Product	Hydrocarbon/Water (OWS) Vertical Gravity Separator (VGS*)

Objective

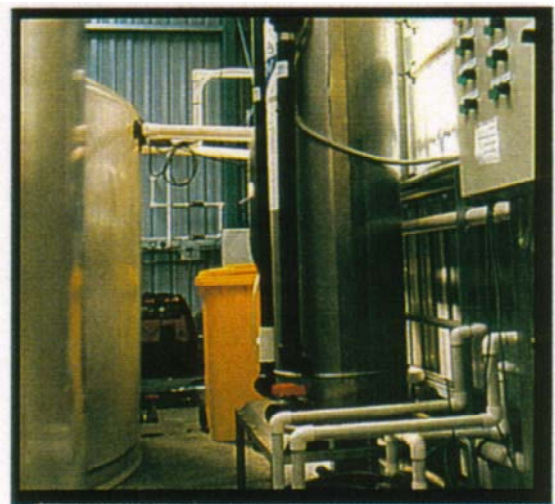
To remove BTEX hydrocarbons (Benzene, Toluene, Ethyl Benzene and Xylene) from wash water to achieve Water Authority standards.

Background

Prix Car Services use a 10% kerosene and hot water mix high pressure sprayed onto imported cars to remove the protective wax coating. Whilst the free kerosene is relatively easily removed the remaining wash water is an emulsion of kerosene and wax.

Solution

ACQUA designed and installed a treatment plant for the removal of free kerosene and the separation of the emulsified kerosene and wax. An OWS VGS* separator skimming the surface of the wash down collection pit is used to separate the free kerosene, which is collected in tanks. The discharge from the OWS VGS* is an emulsion of kerosene and wax, which is dosed with a de-emulsifier, mixed and allowed to stand in a large tank. Air agitation is activated during the standing cycle and finally a skimming system removes the de-emulsified layer on the surface of the tank. The water underneath is clean enough to allow 50% or greater recycling with the removing water discharged to sewer within the Water Authority's limits. The makeup water



for the system is supplied from rainwater collection tanks so that no mains water is required for the washdown system of 18,000 L/day.

4.3 Safeway

Client	Safeway (Woolworths)
Location	Melbourne, Victoria, Australia
Product	Fat, Oil and Grease (FOG) Vertical Gravity Separator (VGS*)

Objective

To reduce pump out costs from grease traps at Safeway supermarkets and to reduce trade waste charges.

Background

Safeway grease traps were being pumped out monthly but were still not meeting Water Authority requirements for discharge to sewer. Safeway was incurring high pump out costs and trade waste charges and was under pressure from Water Authorities to comply with their requirements.



Solution

Initial trialing with the FOG VGS* showed a 90% reduction in BOD, 80% reduction in suspended solids as well as a significant reduction in total oil and grease. The removal of free oil and grease with the FOG VGS* is also extremely effective.

Safeway have now installed the system at 16 stores in Melbourne and plan to install them nationally as the payback on the installation cost is excellent. At Safeway stores with 2 or more grease traps a system of using only 1 FOG VGS* to handle 2 grease traps has been implemented.

4.2 Adelaide Convention Centre

Client	Adelaide Convention Centre
Location	Adelaide, South Australia, Australia
Product	Fat, Oil and Grease (FOG) Vertical Gravity Separator (VGS*) and Inline Swirl Generator (ISG*)

Objective

To remove large suspended solids and fat, oil and grease from a wastewater stream of 9,000kg/hr from the waste emanating from the restaurant kitchens at the new Adelaide Convention Centre. The wastewater needs to be clean enough so that it can be discharged to sewer at minimal discharge costs, while other operating costs also need to be minimized.



Background

The wastewater from these restaurant kitchens is very high in suspended solids and fat, oil and grease. The client required a compact system to remove as much as possible of the above contaminants. Due to the stringent space and local water authority requirements, the FOG VGS* was chosen as the best option for treating the waste.

The FOG VGS* is a fat, oil and grease separator that contains numerous oil coalescing cones, which create a low-pressure zone in the middle drawing fat, oil and grease waste to the surface of the unit where it can be collected.

Solution

Two problems exist with this waste stream that cannot be overcome with a FOG VGS* alone. Firstly, the flow contains large solids that need to be removed with a wedge-wire screen. The flow can then be stored temporarily in a feed tank. Secondly, the required flowrate of wastewater is above the normal capacity of a single FOG VGS*, so an ISG* hydrocyclone was designed to split the flow into a heavy (water rich) stream and a light (oil rich) stream.

The hydrocyclone exploits the principle of density difference for phase separation. The light phase is separated from the heavy phase by inducing centrifugal forces inside a special chamber. The water stream can be discharged to sewer, while the oil stream is allowed to flow to the FOG VGS*.

Fat, oil and grease and fine suspended solids are then further concentrated and rejected to a collection tank where it is maintained in liquid form for disposal by a waste collection contractor.

Performance figures of the FOG VGS* and ISG* system, are detailed below.

Biological Oxygen Demand (BOD)	2mg/L
Total Fat, Oil and Grease	9mg/L
Total Suspended Solids (TSS)	2.9mg/L

5 LIST OF VGS* PROJECTS

Detailed below is a list of separation systems that utilise an OWS VGS* or a FOG VGS*, that have been installed by ACQUA.

Client	Country	Throughput (L/hr)	Application
Backpackers Hotel	Australia	3,000	FOG Wastewater
Baileys on the Boulevard	Australia	2,000	FOG Wastewater
Bells Hotel and Brewery	Australia	3,000	FOG Wastewater
Buddhist Temple	Australia	2,500	FOG Wastewater
Centra Hotel	Australia	3,000	FOG Wastewater
Commonwealth Golf Course	Australia	2,500	FOG Wastewater
Don Small Goods	Australia	2,500	FOG Wastewater
East Meets West Restaurant	Australia	2,500	FOG Wastewater
KFC	Australia	3,000	FOG Wastewater
Kraft Foods	Australia	3,000	FOG Wastewater
McCains	Australia	3,000	FOG Wastewater
McDonalds	Australia	3,000	FOG Wastewater
Nestle	Australia	3,000	FOG Wastewater
Nestle	PNG	3,000	FOG Wastewater
Nuttlex	Australia	3,000	FOG Wastewater
Phu Vin Vietnamese Restaurant	Australia	2,000	FOG Wastewater
Portsea Hotel	Australia	3,000	FOG Wastewater
Posh Nosh Restaurants	Australia	2,500	FOG Wastewater
Safeway (Woolworths)	Australia	3,000	FOG Wastewater
Saizerya	Australia	3,000	FOG Wastewater
St Kilda Marina	Australia	3,000	FOG Wastewater
Vehecc Trattoria	Australia	2,000	FOG Wastewater
Yo Yogi Japanese Restaurant	Australia	2,000	FOG Wastewater
Ajax Fasteners	Australia	1,500	OWS Wastewater
Aqua Block Plumbing Services	Australia	1,500	OWS Wastewater
Ballarat Diesel	Australia	1,500	OWS Wastewater
Bib Stillwell Ford	Australia	1,500	OWS Wastewater
BJP Constructions	Australia	1,500	OWS Wastewater
Busch Auto	Australia	1,000	OWS Wastewater
Carrera Motors	Australia	1,000	OWS Wastewater
CC Stockfeed	Australia	1,500	OWS Wastewater

Cobram Toyota	Australia	1,500	OWS Wastewater
Custom Tech Detailing	Australia	1,000	OWS Wastewater
Dee Why Auto Wreckers	Australia	1,500	OWS Wastewater
Easons Car Centre	Australia	1,000	OWS Wastewater
Echuca Truck Sales	Australia	1,500	OWS Wastewater
Environmental Waste Services	Australia	1,000	OWS Wastewater
Hertz Car Rentals	Australia	1,000	OWS Wastewater
Independent Storage	Australia	1,500	OWS Wastewater
International Construction	Australia	1,500	OWS Wastewater
Jack Budd Drilling	Australia	1,500	OWS Wastewater
Kennards Hire	Australia	1,500	OWS Wastewater
Kennedy Plumbing	Australia	1,500	OWS Wastewater
Lubri Maxx	Australia	1,500	OWS Wastewater
M1 Detailing	Australia	1,000	OWS Wastewater
Mentone SAAB	Australia	1,500	OWS Wastewater
Morley Ford	Australia	1,500	OWS Wastewater
Oasis Truck Wash	Australia	3,000	OWS Wastewater
Peter Lamb Plumbing	Australia	1,000	OWS Wastewater
Peter Stevens Machinery	Australia	1,500	OWS Wastewater
Preston Motors	Australia	1,000	OWS Wastewater
Pro Automotive	Australia	1,500	OWS Wastewater
Quaker Chemicals	Australia	3,000	OWS Wastewater
Ringwood Auto	Australia	1,000	OWS Wastewater
Seetal Spray	Australia	1,000	OWS Wastewater
Shepparton RWC	Australia	1,000	OWS Wastewater
South Melbourne Plumbing	Australia	1,500	OWS Wastewater
Southern Recycling	Australia	3,000	OWS Wastewater
Star Track Express	Australia	2,000	OWS Wastewater
Strapp Ford	Australia	1,500	OWS Wastewater
Tas Fuel	Australia	1,500	OWS Wastewater
Teris Hazardous Waste	Australia	3,000	OWS Wastewater
Total Constructions	Australia	1,500	OWS Wastewater
Tradelink	Australia	1,000	OWS Wastewater
Venture Industries	Australia	1,500	OWS Wastewater
Vic Containers	Australia	1,500	OWS Wastewater
Waste Cycle	Australia	3,000	OWS Wastewater

6 INDUSTRY INTEGRATION FLOWCHART

This industry integration flowchart illustrates the applications for the VGS* and other ACQUA proprietary technologies.

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