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VEOLIA WATER
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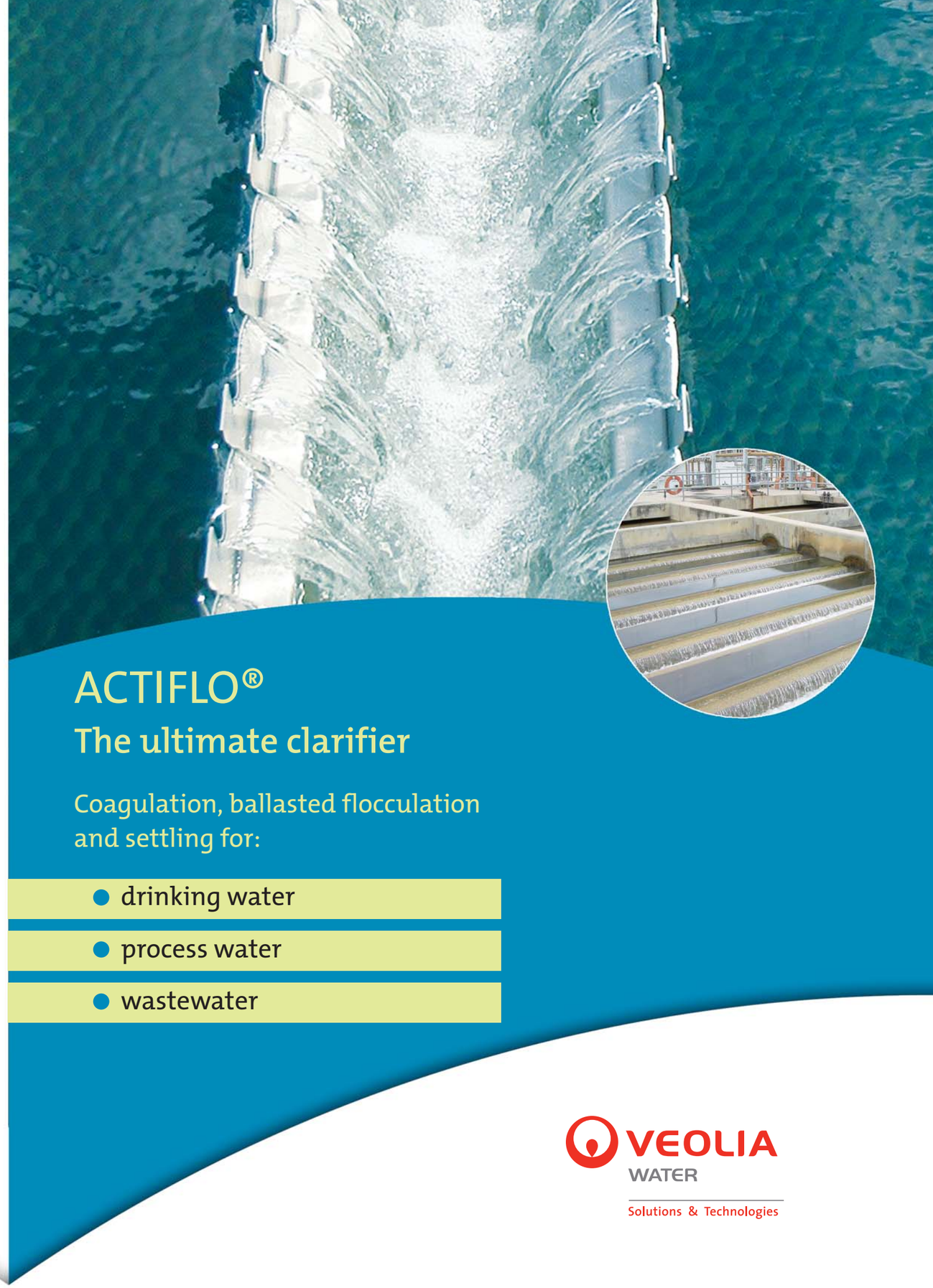

ACTIFLO®

The ultimate clarifier

Coagulation, ballasted flocculation and settling for:

- drinking water
- process water
- wastewater

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Ballasted clarification for a **very high rate** and **compact** process

Actiflo® is a **compact process** that operates with **microsand** (Actisand™) as a seed for **floc formation**. Actisand™ provides surface area that enhances flocculation and also acts as a ballast or weight to aid a rapid settlement.

Actiflo® is recommended for:

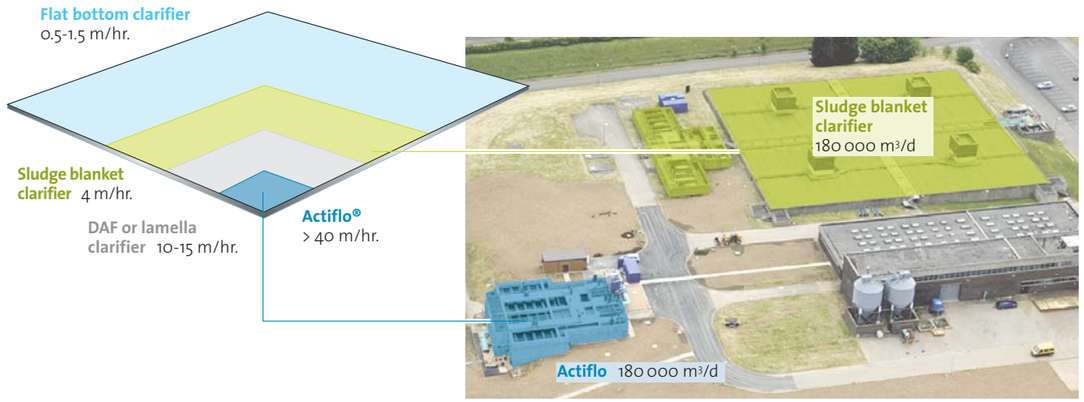
- **surface water** clarification,
- **industrial process water** production,
- **wastewater** treatment,
- **storm flow water** settlement.

Actiflo®: **compactness** displaying its **true potential**

The microsand ballasted flocs display **unique settling characteristics**, which allow for clarifier designs with **very high overflow rates** and **short retention times**. These designs result in footprints that are 5 times smaller than classic lamella clarifier or dissolved air flotation (DAF) and **up to 20 times smaller than conventional clarification systems**.

Major process **benefits**

- **High treatment efficiency;** removal rate of turbidity > 90%
- **Very small footprint** compared to conventional clarifiers; suited for restricted spaces and easy retrofit of existing plants
- **Reduced civil engineering**
- **Flexible**: reacts quickly to changing raw water quality; provides **consistently high quality effluent**
- **Very short start-up time** < 10 minutes
- The sludge produced can be thickened and dewatered easily
- Can be **entirely automated** and **remotely controlled**
- **Minimum equipment** to maintain, all **easily accessible**
- **15 years of operating experience** with more than **300 Actiflo® references worldwide**
- Prefabricated **package plants** (1 000 to 10 000 m³/d per unit) which can be **combined for larger flow rates**



Overview of the Iver plant, London - Heathrow (United Kingdom). Clarification, interozonation and granular activated carbon filtration for drinking water production.

Actiflo®: **rapid, flexible** and **performant**

Actiflo® is a very high-rate clarifier **exclusively developed and patented** by Veolia Water Solutions & Technologies.

- In **drinking water** applications, its removal efficiency exceeds **90% for turbidity**, colour, algae or arsenic;
- In **wastewater** applications, it consistently produces high quality water, even in varying raw water conditions, with removal efficiency:
  - higher than **90% for total suspended solids** (TSS), colloidal matter, total phosphorus, heavy metals and faecal coliforms,
  - of **60% for BOD** and COD.

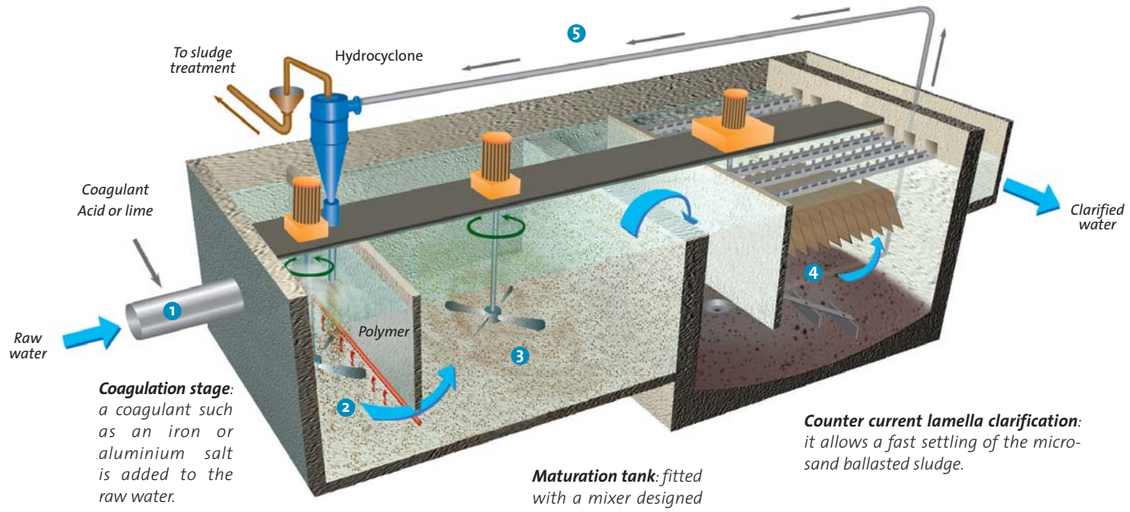
Depending on the application, the following upflow velocities are consistently achieved:

- drinking water: **40-80 m/hr**.
- process water: **50-100 m/hr**.
- highly loaded industrial effluents or municipal wastewater: **50-100 m/hr**.
- primary treatment of wastewater or storm flow treatment: **100-150 m/hr**.

For applications requiring a **high turn down ratio**, Actiflo® can also operate with microsand recirculation at a high overflow rate and without microsand at a rise rate lower than 20 m/hr. The microsand is simply stored in the process at low flows until it is required again. In this configuration, Actiflo® then becomes a conventional lamella clarifier (Actiflo® Duo).

The Actiflo® process

Recirculation: *the sludge is pumped to the hydrocyclone to be separated from the microsand. The clean microsand is returned into the injection tank to minimize loss; the sludge is continuously removed for further processing.*



Coagulation stage: *a coagulant such as an iron or aluminium salt is added to the raw water.*

Injection tank: *the flocs produced during the coagulation stage are ballasted by the dense microsand, which is continuously reinjected into the process.*

Maturation tank: *fitted with a mixer designed to produce the optimum velocity gradients, it allows flocs to swell and mature.*

Counter current lamella clarification: *it allows a fast settling of the micro-sand ballasted sludge.*

Actiflo®: a **versatile range of uses**

Drinking water

Actiflo® applies to both **surface and ground water** where improved performance and/or capital cost reduction is desired.
It is ideally suited for the treatment of:

- **rapidly fluctuating** water sources,
- **low temperature water** (1°C),
- **reservoir water** with very low turbidity,
- **sea or brackish water**.

Through the use of Actisand™, Actiflo® achieves **better performance than all existing clarification processes**, displaying consistent removal of:

- turbidity, colour, total organic carbon (TOC),
- algae, particle count, pathogens, cryptosporidium,
- oxidised iron, manganese and arsenic...

Actiflo® is particularly efficient to remove **taste and odour** associated with algal bloom. It can also be used for the **recovery of backwash water from rapid gravity filter** thus reducing water loss and running costs.

Wastewater

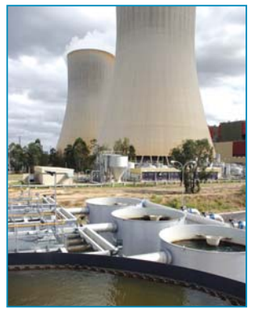
Actiflo® can be used in most municipal applications:

- **primary settlement**: due to the mass of microsand constantly in the process, Actiflo® handles very swift raw water quality variations and rapid flow changes;
- **treatment of biofilter backwash water**: due to its short residence time, the biological sludge is unlikely to go septic; it is therefore clarified extremely efficiently, with **superior levels of treatment compared to flotation**;
- **clarification of trickling filter effluents**, in replacement of a conventional clarifier;
- **storm water treatment** (combined sewer overflow): Actiflo® treats storm peak flows **as they occur**. In combination with UV disinfection (Actistar™), it delivers an effluent compliant with the most stringent bathing and shellfish water directives;
- **tertiary polishing** or **phosphorus removal**: whether it is used for suspended solids, colour or phosphorus removal, Actiflo® meets or exceeds water quality standards with removal rates usually higher than 90%. **The same Actiflo® unit** applies to storm flow treatment in **peak flow** and to tertiary treatment in **dry flow conditions**, with a significant removal of hormones (endocrine perturbators) for the latter;
- **water reuse** for crop irrigation or aquifer recharge, in combination with Discfilter and UV disinfection (Actidisc Plus™).

Industrial water and effluents

Actiflo® is an ideal solution for the **recycling of process water** and **pre-treatment of boiler feed or cooling tower make-up water**. Similarly it treats any type of **process water** as well as **most industrial effluents**.

- **solids and colour removal**: prior to membrane treatment, reverse osmosis (Actimem™), or in combination with Discfilter (Actidisc™), to produce process water for the pulp and paper or food industry;
- **removal of heavy metals** (lead, cadmium, zinc...) **and ashes** from power plant and steel mill effluents, or polishing treatment to remove suspended solids and associated pollutants;
- **lime soda softening** (Actisoft™) for the production of demineralised water.



Outstanding capabilities

The data listed below are typical plant performances. Details can be provided upon request.
Please ask your Veolia Water Solutions & Technologies representative for more information.

Performance for **municipal and industrial wastewater** applications

	Stormwater	Biofilter backwash Biological sludge	Primary settlement	Tertiary polishing
TSS	80-98%	75-99%	75-90%	50-80%
COD	65-90%	55-80%	55-80%	20-50%
Total phosphorus	50-95%	50-95%	50-95%	50-95%
Orthophosphate	50-98%	50-98%	50-98%	50-98%
Faecal coliforms (cells/ml)	1-1.5 log	1-1.5 log	1-1.5 log	1-1.5 log

Performance for **process and drinking water** applications

	Unit	Raw water (inlet value)	Actiflo® clarified (outlet value or removal)
Turbidity	NTU	0-2 000	0.2-2.0(1)
TSS	mg/l	0-3 000	0.5-5.0
True colour	mg/l Pt/Co	0-350	0-10
TOC	mg/l	1-30	30-60%
Algae	cells/ml	0-100 000	90-99%
Chlorophyll A	µg/l	0-100	90-99%
Manganese	mg/l	0-2.5	60-95%(2)
Arsenic	mg/l	0-2.0	50-90%(2)
Iron	mg/l	0-5.0	60-98%(3)
Particle count (2-15 µm)	unit/ml	< 2×10^6	1.5-3.0 log
Faecal coliforms	cells/ml	0-10^4	1.0-1.5 log
Bacteria	cells/ml, at 20°C	< 20 000	1.0-1.5 log

(1) if combined with sand filtration, filtered water typically < 0.5 NTU
(2) with pre-oxidation
(3) with pre-oxidation or aeration

With Actiflo®, algae is no longer an issue

At Shepparton (Australia), 2 Actiflo® units (25 000 m³/d) are used to treat effluent from a wastewater lagoon.

- During the summer months, effluent can be highly loaded with algae; it is first treated by the Actiflo® plant and then filtered in order to obtain an effluent suitable for irrigation.
- During winter, the Actiflo® plant is shut down and the effluent is directly discharged into the Goulburn river.

Effluent loaded with algae *Clarified water*

Actiflo® Package Plant: **fast-track and modular solutions**

For small to medium-sized applications (1 000 to 10 000 m³/d), a range of package plant solutions has been designed, also providing **built-in sand filtration** (Actifloc®) or **sludge thickening** (in combination with Actidyn™) when required.

- These units can be set in a multiple stream arrangement to handle much larger flows; they are ideal when **low cost fast-track, pre-tested treatment units** are required.
- These package plants, manufactured in stainless steel or glass reinforced plastic, can be delivered on a trailer and **installed within days**. The layout of these package solutions is extremely flexible and can be "shoe horned" into the most constrained sites.

ACTIFLO® **MOBILE PLANT**

- To demonstrate the effectiveness of the Actiflo® process, the services of an Actiflo® mobile plant **equipped with laboratory** can be provided.
- This unit is housed in a shipping container, mounted on a trailer, and once delivered on site it can be **operational within hours**.
- The range of Actiflo® mobile plants (from 40 to 160 m³/hr.) can also provide **temporary treatment** during plant failure or unforseen flow or quality variations.

An unrivalled track-record of **worldwide references**

The Actiflo® process is currently in operation worldwide in small communities and large metropolitan areas, as well as in various installations for the treatment of industrial water and effluents.

Calgary, Canada
Glenmore drinking water treatment plant

Actiflo® for **reduction of turbidity** (> 1 000 NTU during spring runoff) on a direct river abstraction supply - 2 x 550 000 m³/d

Stora Enso paper mill
Port Hawkesbury, Canada

Turnkey plant to supply high purity water. Actiflo® for **reduction of turbidity, iron, aluminium and manganese** contained in the raw water upstream of gravity filter (Dusenflo®) - 60 000 m³/d

Liverpool, United Kingdom
Sandon dock wastewater treatment plant

Actiflo® for **biofilter backwash water treatment** - 110 000 m³/d

Bäckhammars Bruk AB paper mill
Kristinehamn, Sweden
Production of process and cooling water for an integrated pulp and paper mill. Actiflo® for **reduction of turbidity, organic compounds and colour** upstream of disc filtration (Actidisc™) - 50 000 m³/d

Geneva, Switzerland
Aïre wastewater treatment plant

Actiflo® for **primary treatment, storm flow treatment** (wet weather) and **biofilter backwash water treatment** (Biostyr®) - 520 000 m³/d

Oslo, Norway
Oset drinking water treatment plant
Actiflo® for **drinking water clarification** upstream of high rate dual media filtration and UV disinfection - 390 000 m³/d

Syracuse, NY, USA
Onondaga wastewater treatment plant
Actiflo® for **tertiary polishing** and **phosphorus** removal down-stream of biofiltration (Biostyr®) - 200 000 m³/d

Barcelona, Spain
Baix Llobregat municipal wastewater reuse plant
Reuse of 5 millions m³/year of treated water for irrigation. Actiflo® for **tertiary treatment** upstream of disc filtration (Actidisc™) - 302 400 m³/d

Paris, France
Seine-Aval wastewater treatment plant

Actiflo® for **storm flow treatment** (wet weather) or **tertiary treatment** (dry weather) - 2 600 000 m³/d

Kuala Lumpur, Malaysia
Sungaï Selangor drinking water treatment plant

Actiflo® for **reduction of suspended solids, algae and turbidity** (up to 2 100 NTU during the tropical rainfall) on a direct river abstraction supply - 950 000 m³/d

Sydney, Australia
Illawarra wastewater reclamation plant

Actiflo® for **storm flow treatment** upstream of UV disinfection - 320 000 m³/d