



BLANKETmaster™ White Paper

Clarifier-by-clarifier sludge blanket control

Summary

The sludge blanket is one of the most direct indicators of clarifier performance. Conventional control holds return sludge flow constant or as a fixed ratio to influent flow, divided equally among clarifiers, and cannot follow daily load changes, differences between clarifiers or wet weather. BLANKETmaster sets the return sludge flow of each clarifier from its own measured blanket depth, within a target and a maximum set by operators, checks every reading before using it, and never commands zero return sludge flow.

1. Why the blanket matters

- **Effluent quality.** A high or unstable blanket increases the risk of solids carryover and raises effluent suspended solids and BOD (see section 5).
- **Protection of the biological process.** An excessively high blanket can wash settled biomass over the effluent weir, removing it from the process instead of returning it to the aeration tanks.
- **Early warning.** Blanket depth responds quickly to changes in solids loading, settleability and hydraulic loading, ahead of any effluent excursion.
- **Pumping and thickening.** A blanket held lower than necessary wastes pumping energy and sends thinner sludge to thickening and digestion.

2. Why conventional control falls short

1. **Fixed ratio.** Return sludge held as a ratio to influent controls the blanket in steady dry weather. In wet weather, as influent flow and solids load rise, the blanket can rise sharply.
2. **Equal split.** Dividing the return flow equally ignores differences between clarifiers in inflow, loading and settling. Clarifiers do not receive equal flow, so their blankets differ.
3. **Manual readings.** Blanket depth checked a few times a day cannot follow changes within the day.
4. **Timers.** In primary clarifiers and gravity thickeners, timer-based sludge pumping cannot follow a flow that changes through the day, so blanket depth and sludge concentration vary.

3. The BLANKETmaster approach

- **Operator targets.** Operators set the blanket depth target and the maximum blanket depth.
- **Clarifier-by-clarifier control.** The return sludge flow of each clarifier is set from its own measured blanket, rather than as an equal share of a plant-wide flow.
- **Learning the daily pattern.** The system learns the time-of-day pattern of loading, so that it acts ahead of regular rises such as the morning peak.
- **Wet-weather mode.** When influent flow stays well above its usual level for that time of day, the control changes to protect the clarifiers.
- **Validation of every reading.** Spikes, frozen readings, readings outside the tank and changes faster than the solids balance allows are rejected and not acted on, and operators are alerted.
- **Safe limits.** Return sludge flow is never commanded to zero.
- **Advisory mode.** During commissioning, the system calculates and records the flows it would command without sending them, so that operators can compare them with current practice.
- **Standard communication.** BLANKETmaster exchanges data with the plant SCADA system using the standard OPC protocol.

4. Instruments

BLANKETmaster uses a sludge blanket analyzer in each clarifier together with the existing return sludge valves, pumps and flow meters. These can be bought from any supplier. Ekster & Associates sells no hardware, but provides recommended performance specifications.

5. Measured results in primary clarifiers

A full-scale study at the 167 MGD San Jose/Santa Clara Water Pollution Control Plant operated two parallel primary clarifiers at different blanket depths.

Primary effluent at peak flow	Blanket 1.4–1.7 m	Blanket above 2.0 m	Difference
Suspended solids (TSS), mg/L	96	120	+25%
Soluble BOD, mg/L	92	113	+23%
BOD, mg/L	120	175	+46%
Dissolved hydrogen sulfide, mg/L	0.4	0.7	+75%

At low flow the differences were small.

The higher blanket increased the release of BOD from the solids stored in the hopper. Sludge concentration was maintained as long as the blanket stayed above 1.37 m (4.5 ft) above the hopper floor, which defines the lower limit of the target band. Manual blanket monitoring and pump adjustment took an estimated 16.1 operator hours per week; automatic control based on blanket measurement needed only weekly sensor cleaning (about 5 minutes per sensor) and calibration checks (under 2 minutes per sensor).

No measured results for secondary clarifiers have been published.

6. Operator authority

BLANKETmaster acts automatically, but operators keep authority. They set the target and maximum blanket depths and can override the system at any time. Every reading is checked before it is used. Faulty readings are detected and not acted on, and operators are alerted.

7. BLANKETmaster and SRTmaster together

Holding every clarifier near its blanket target keeps the solids inventory in the aeration tanks more stable, which makes SRTmaster's control of sludge age more precise.

8. Next step

A free plant assessment reviews a plant's clarifier data and current return sludge control. Send one year of operating data and energy bills. You will receive a written estimate of savings in kWh and dollars, the assumptions behind it, any changes required before installation, and a fixed price. If your plant is already operating efficiently, the estimate will say so.

References

1. Ekster & Associates (2026). RAS / Sludge Blanket Control System — Control Algorithm, revision AI (internal reference).
2. Ekster, A., Pena, C. and Berdeen, B. Automated Pump Control of Primary Clarifier Sludge Blanket Level. San Jose/Santa Clara Water Pollution Control Plant.
3. Ekster & Associates. Sludge Blanket Control vs. Ratio Control (modeling note).