Managing H_2S Risk in Sealed Regional Sewer Networks: Data-Limited Septicity Modelling and Catchment-Specific Controls

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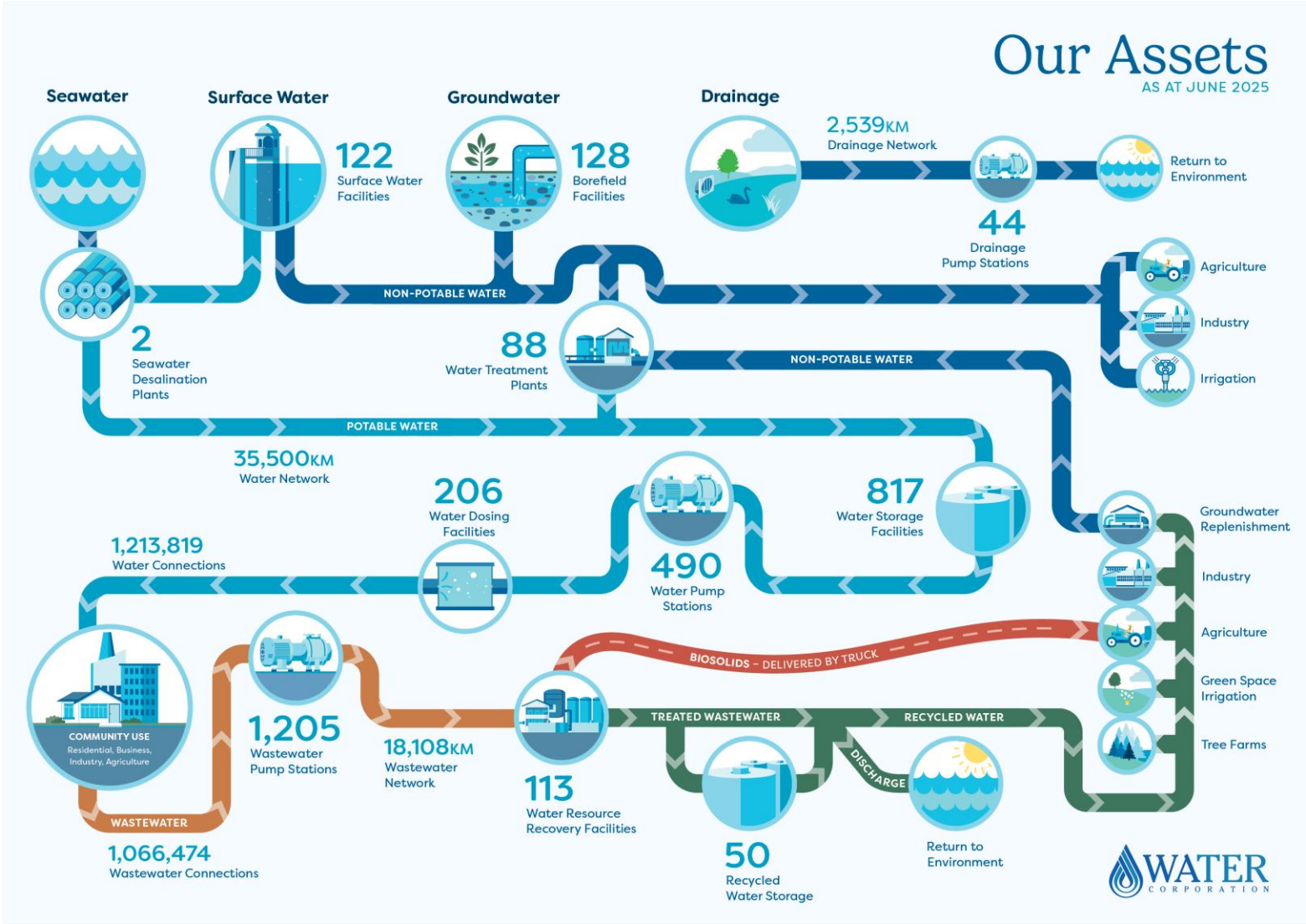
Water Corporation is an integrated water utility operating across Western Australia We are the principal supplier of water, wastewater, drainage and bulk irrigation to homes, businesses and farms.

We operate and maintain all wastewater conveyance and treatment in Western Australia.



Most of our sewer network operates as a sealed system, which limits gas release but can increase the need for active gas and odour management.

1. Hydrogen sulfide exposure
2. Methane accumulation
3. Odour complaints
4. Corrosion

The risks are connected

Odour

Hydrogen sulfide can be detected at very low concentrations and can generate community complaints.

Corrosion

Hydrogen sulfide can convert to sulfuric acid, accelerating the deterioration of exposed assets.

Worker safety

Hydrogen sulfide can be toxic, requiring strict controls to protect our people.

Explosion risk

Methane becomes explosive within specific concentration ranges.

Greenhouse gas emissions

Methane is a potent greenhouse gas, with emissions from wastewater treatment plants (WWTPs) requiring reporting.

How we manage these risks

Lining and sealing

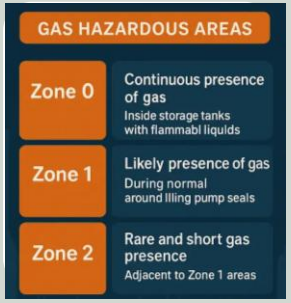
We seal our systems and line key assets to reduce odour and corrosion.

Odour control and dosing

We use odour control units and chemical dosing to manage gas generation and emissions.

Worker protection

We provide personal gas monitors and implement strict safety procedures.



Hazardous area management

We use hazardous area assessments and classifications to identify explosion risks.

Research and innovation

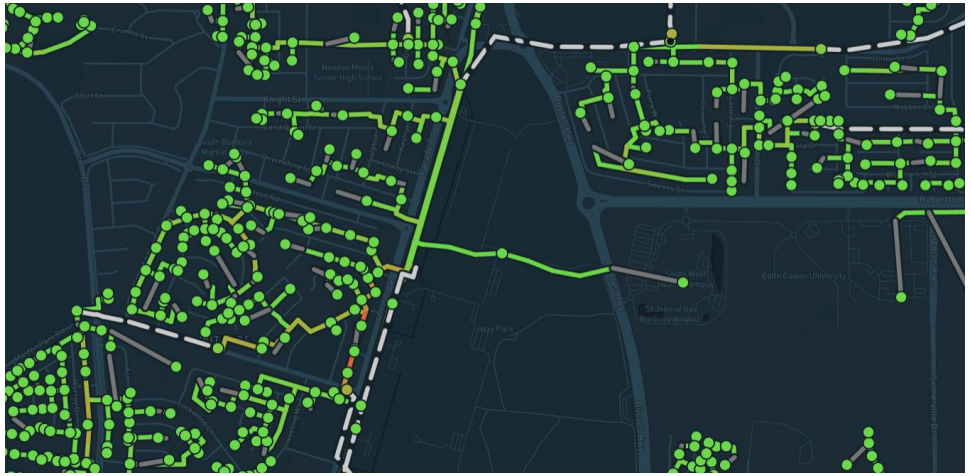
We continue to investigate new solutions through our research and development program.

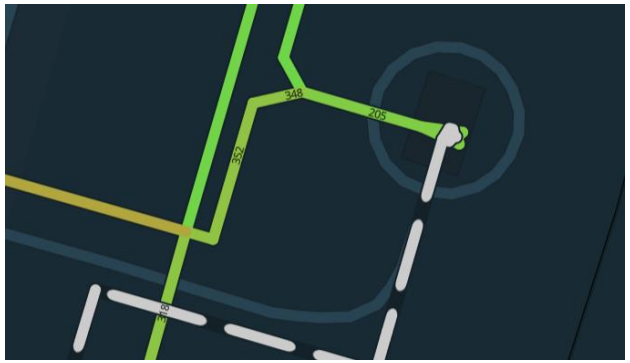
Modelling informs action

- SeweX assists in granular risk assessment and options-effectiveness analysis.

- It predicts gas concentrations and wastewater quality for an entire network.

- It investigates the effectiveness of interventions such as chemical dosing.





Applying the framework to a regional WA network

One sealed network · five distinct catchments · limited monitoring

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Could passive ventilation control H_2S in this network?

The test: reduce H_2S in a sealed network without creating unmanaged odour release points

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Catchments behaved differently

5

gravity sub-catchments feeding pump stations

35–38°C

sampled wastewater temperature range

- Predominantly sealed network with no natural ventilation points
- Different pipe sizes, flow profiles and site constraints
- Pressure-sewer contributions at key upstream interfaces
- H_2S monitoring at only two available locations
- Incomplete flow, pump-runtime and pressure-sewer information

A practical screening approach

INPUTS

Asset and GIS data
Min / average / max DWF
BOD_5, sulfate, sulfide
Alkalinity, pH, temperature
Available H_2S monitoring

MODEL

Pomeroy–Parkhurst basis
Gas-phase H_2S along mains
Passive and forced airflow
Minimum / average / peak scenarios
MHL pH-suppression scenarios

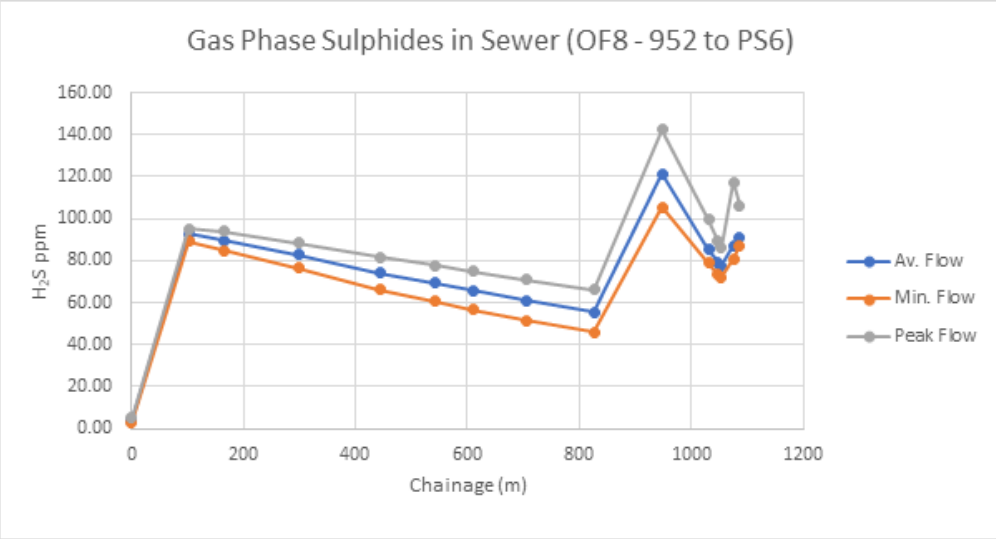
DECISION RULE

10 ppmv planning threshold
Compare four control types
Rank technical performance first
Then test constructability and cost
H_2S is not a full odour metric

Engineering screening tool—not a fully calibrated network model.

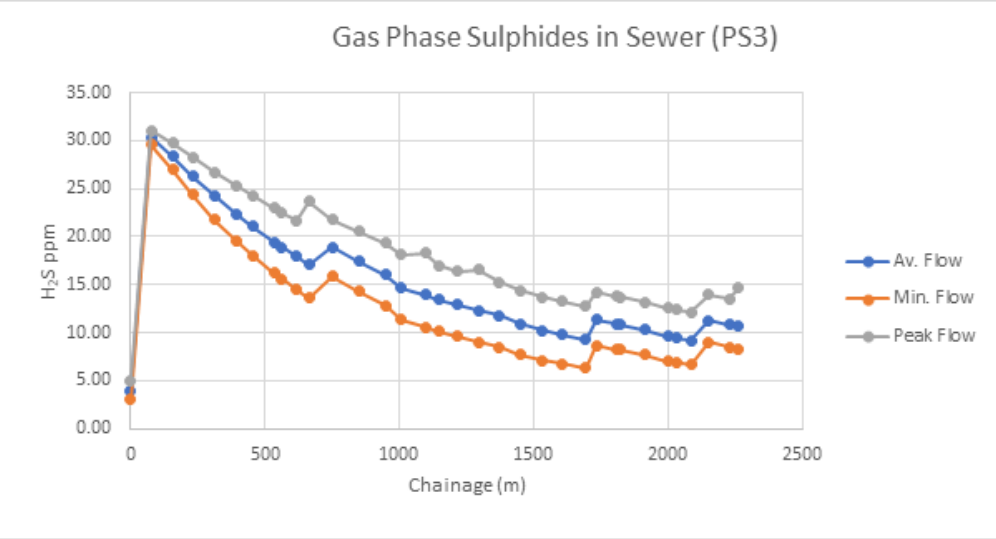
Risk varied by catchment

HIGHEST-RISK TRUNK



Average ≈81 ppm; modelled peak >140 ppm in the 300 mm main.

MODERATE-RISK GRAVITY



Lower overall risk, but predicted H_2S still exceeded the 10 ppm planning threshold.

Passive vents made little difference

<1%

modelled H_2S reduction across the assessed sewer lines

Model condition
12 m high × 100 mm diameter vents

- Passive airflow was low.
- Some vents could induct fresh air; others could educt odorous air.
- The 10 ppm planning threshold was not achieved.
- Passive ventilation was not recommended as the primary control for this network.

Site-specific finding—not a rule for every sealed sewer network.

Extraction depended on location

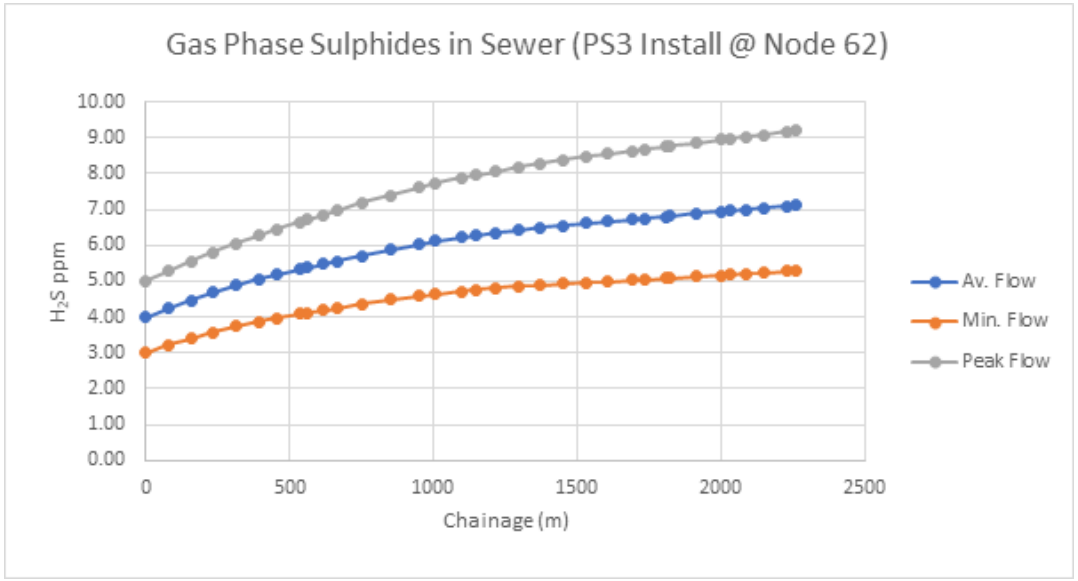
LARGER CENTRAL TRUNK

403 m^3/h at the downstream pump station reduced H_2S to about 20 ppm—better, but still above the planning threshold.

Moving upstream and increasing capacity to 1,149 m^3/h was predicted to reduce H_2S below 10 ppm.

Location mattered as much as capacity.

MODERATE-RISK GRAVITY EXAMPLE



Appropriately located extraction was predicted to remain below 10 ppm.

Hybrid control was needed

MECHANICAL ONLY

>10 ppm

Existing 1,149 m^3/h extraction reduced H_2S but left residual exceedances in trunk sections.

TARGETED MHL ONLY

Partial

Strong local suppression, but downstream rebound or spikes remained in the highest-risk line.

HYBRID

<10 ppm

Targeted MHL plus existing treated extraction maintained modelled H_2S well below the threshold.

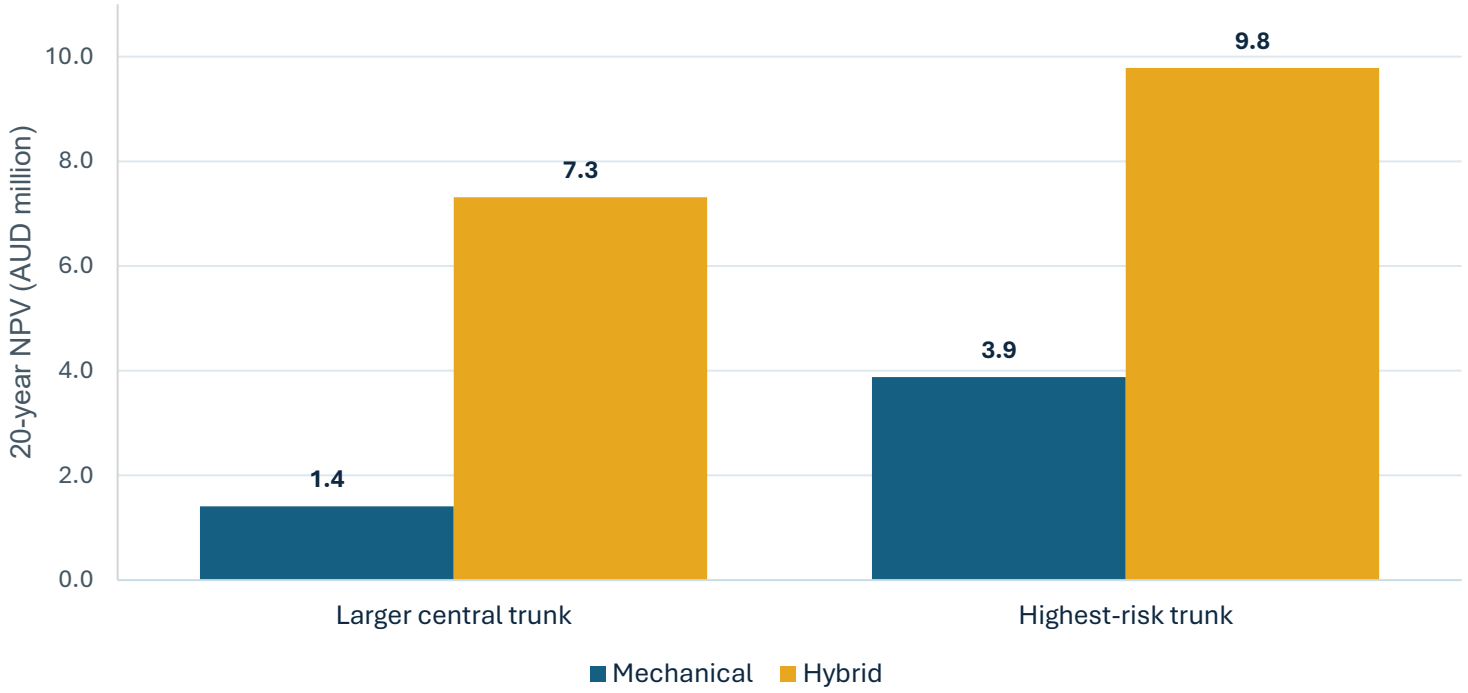
Use chemistry only where controlled extraction leaves residual risk.

Controls varied by catchment

Catchment type	Preferred control	Why
Highest-risk trunk	Controlled mechanical extraction + targeted MHL	Ventilation alone was insufficient across all sections.
Larger central trunk	Move extraction upstream and/or increase capacity	Upstream pressure-sewer contribution and trunk accumulation drove risk.
Moderate-risk gravity	Mechanical extraction + activated carbon where constructible	Generally sufficient, subject to power, access, footprint and treated discharge.

A single network-wide control would over-treat some catchments and under-treat others.

Cost favoured extraction



Performance comes first

NPV ranks options only after they meet the performance requirement.

The lowest-cost control is not the preferred control if residual H_2S remains unacceptable.

Preliminary comparison: 20 years, 7% discount rate. Excludes common renewals and some operating costs.

Targeted validation comes next

WHAT THE MODEL CAN DO NOW

- Rank catchments by likely H_2S risk
- Eliminate controls with negligible benefit
- Identify where extraction is likely to work
- Focus site investigation and investment

WHAT TO CONFIRM NEXT

- Time-correlated H_2S, flow and wastewater sampling
- Pump runtimes and diurnal profiles
- Pressure-sewer contributions and interfaces
- Site feasibility and treated discharge monitoring
- Model update and calibration

The uncertainty tells us where to collect better data—not to stop the decision.

Any questions?

For this network, passive vents were not enough.

Controlled extraction was the practical baseline, with MHL reserved for the highest-risk trunk.

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