THE GOLDILOCKS GUIDE TO

Landfill Gas Extraction

→ Not too much. Not too little. Just right.

Presented by Anthony Dixon



Acknowledgement & respect

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the original Custodians of the lands and water throughout Australia. We recognise their strength, diversity, resilience, and deep connections to Country and sky as nurtured across generations. We pay our respects to Elders, past and present, as they hold the memories, knowledges and spirit of Australia.

GHD is committed to partnering with and learning from Aboriginal and Torres Strait Islander peoples as we continue to foster sustainability in water, energy, and communities for the prosperity of future generations.



TODAY'S DISCUSSION

Presentation content

CONTEXT	How landfill conditions change and why "just right" is difficult.
BALANCE	The control window: too little, too much and optimised extraction.
EVIDENCE	How flow, pressure, gas quality, temperature, leachate levels and monitoring inform performance.
RESPONSE	Wellhead-vacuum tuning, blower/treatment capacity and when infrastructure upgrades are required.
VALUE + RISK	**Contract performance, carbon value and emerging PFAS considerations.**

Predominant focus: environmental considerations—control emissions, protect receptors and maintain compliance.

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THE OPERATING CONTEXT

Why “just right” is difficult

The changing landfill

Waste age	Gas generation changes across cells Variable waste permeability
Moisture	Leachate and rainfall alter performance
Settlement	Wells and pipe grades do not stay fixed
Filling + capping	Pathways and resistance keep changing
Utilisation	Gas quality can compete with migration control

Four questions

01 **Is the system extracting gas effectively?**

02 **Are environmental risks being controlled?**

03 **Is optimisation enough, or is an upgrade required?**

04 **What are the contract details with the contractor and its mechanisms to maintain and improve performance?**

THE GOLDILOCKS BALANCE

Too little. Too much. Just right.

Control window

TOO LITTLE	JUST RIGHT	TOO MUCH
Positive pressure in waste	Distributed negative pressure	Air intrusion and dilution
Surface emissions and odour	Stable composition and flow	Short-circuiting through cover
Lateral migration	Controlled surface emissions	Elevated O_2 / balance gas
Boundary-bore exceedances	Compliance at receptors	Heating and fire risk

The targets are environmental control, not maximum extraction, with optimised financial return.

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COMPLIANCE

Start with the environmental outcomes

What success looks like

A wellfield is performing only when it achieves the required outcomes.

ODOUR	No excessive odour at or beyond the boundary
SURFACE	Controlled surface emissions and cap leakage
SUBSURFACE	**< 1% v/v methane in surrounding gas bores**
SAFETY	No unacceptable air intrusion or heating
CAPTURE	Reliable collection, treatment and utilisation

1%

methane v/v

Design and operate to intervene before this investigation and corrective-action threshold is reached.

High flow alone is not evidence of compliant performance.

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Leachate levels can constrain gas recovery

01	**MEASURE**	Survey leachate levels across landfill risers and gas wells; compare elevations and trends.
02	**DIAGNOSE**	Determine whether liquid is locally perched or the waste mass is saturated to elevated levels.
03	**QUANTIFY**	If saturated, estimate the affected footprint, saturated thickness and recoverable leachate volume.
04	**DRAWDOWN**	Use the site's sustainable disposal or pumping rate to estimate the time needed to lower levels.
05	**VERIFY**	**Track liquid levels and well response; expect higher gas flow as submerged screen length is restored.**

Lowering widespread leachate levels can restore effective collection volume and improve gas recovery.

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Read the whole wellfield, not one parameter

The diagnostic dashboard

FLOW

What is being collected?

CH_4

Gas strength and capture

O_2

Direct air intrusion signal

BALANCE GAS

Persistent dilution indicator

PRESSURE

Control and distribution

TEMPERATURE

Heating / fire warning

LIQUID

Available screen + restriction

SPATIAL TREND

Where control is being lost?

No single parameter tells the full story.

Interpret well data together with surface methane, odour, perimeter bores, weather and plant status.

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Is the wellfield providing adequate coverage?

Design from the boundary inward



Conceptual source – pathway – receptor control

1. Do effective influence zones overlap?
2. Are edges and side slopes controlled?
3. Are screens above leachate levels?
4. Have settlement and cap works changed pathways?
5. Do monitoring trends reveal a coverage gap?

Nominal spacing is not proof of coverage.

SYSTEM CAPACITY CHECK

Match capacity to wellfield control

01	**DEFINE DUTY**	Set the negative-pressure objective across wells and manifolds—not only a total-flow target.
02	**MEASURE**	Record valve position, well flow and pressure, header vacuum, blower duty and flare/engine throughput.
03	**CALIBRATE**	Use field tests and vacuum-versus-distance response to calibrate pressure-loss and gas-flow predictions.
04	**CHECK BLOWER**	Compare required flow and vacuum with the fan curve, system resistance, turndown and redundancy.
05	**CHECK TREATMENT**	**Confirm measured and predicted peak gas can be burned within flare/engine capacity—with contingency.**

Confirm the full chain: wells → headers → blower → flare or engine.

Source: GHD, Horsley Park Review of landfill gas extraction system (2025).

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PRACTICAL WELLHEAD BENCHMARK

Start at –12 to –25 mbar (guide), then tune to the lowest vacuum

01	START	–12 to –25 mbar (5–10 inches water gauge).
02	CONTROL	Maintain control across all wells.
03	PROTECT	Avoid oxygen/air intrusion and heating.
04	FLOW	Deliver the gas flow.

Header/blower suction will be more negative because of pipe losses.

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PRACTICAL DECISION MATRIX

From monitoring results to diagnosis

Data → Cause → Action

Observed pattern	Investigate	Initial response
Low flow + stable vacuum	Restriction, condensate, submerged screen	Check liquid level and pipework
High vacuum + low CH_4 + elevated O_2	Air intrusion or over-extraction	Inspect seals and cover; adjust incrementally
Acceptable wells + surface methane	Coverage gap or cap defect	Survey hotspot; assess added collection
Rising methane in perimeter bore	Migration or weak boundary control	Verify; inspect nearby field; increase local control
Variable pressure + flow	Condensate slugging / unstable header	Inspect drainage and condensate controls

Change one thing at a time, record it, then verify the environmental response.

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When optimisation is not enough

Make the right intervention

OPTIMISE

- ✓ Rebalance valves
- ✓ Repair leaks and seals
- ✓ Remove condensate
- ✓ Restore blocked wells
- ✓ Repair cap defects
- ✓ Adjust plant vacuum

UPGRADE

- + Add wells or collectors
- + Extend or resize headers
- + Improve condensate removal
- + Add perimeter interception
- + Increase blower / flare capacity
- + Improve alarms and redundancy

Persistent hotspots, odour or migration trends point to a capacity or coverage limitation.

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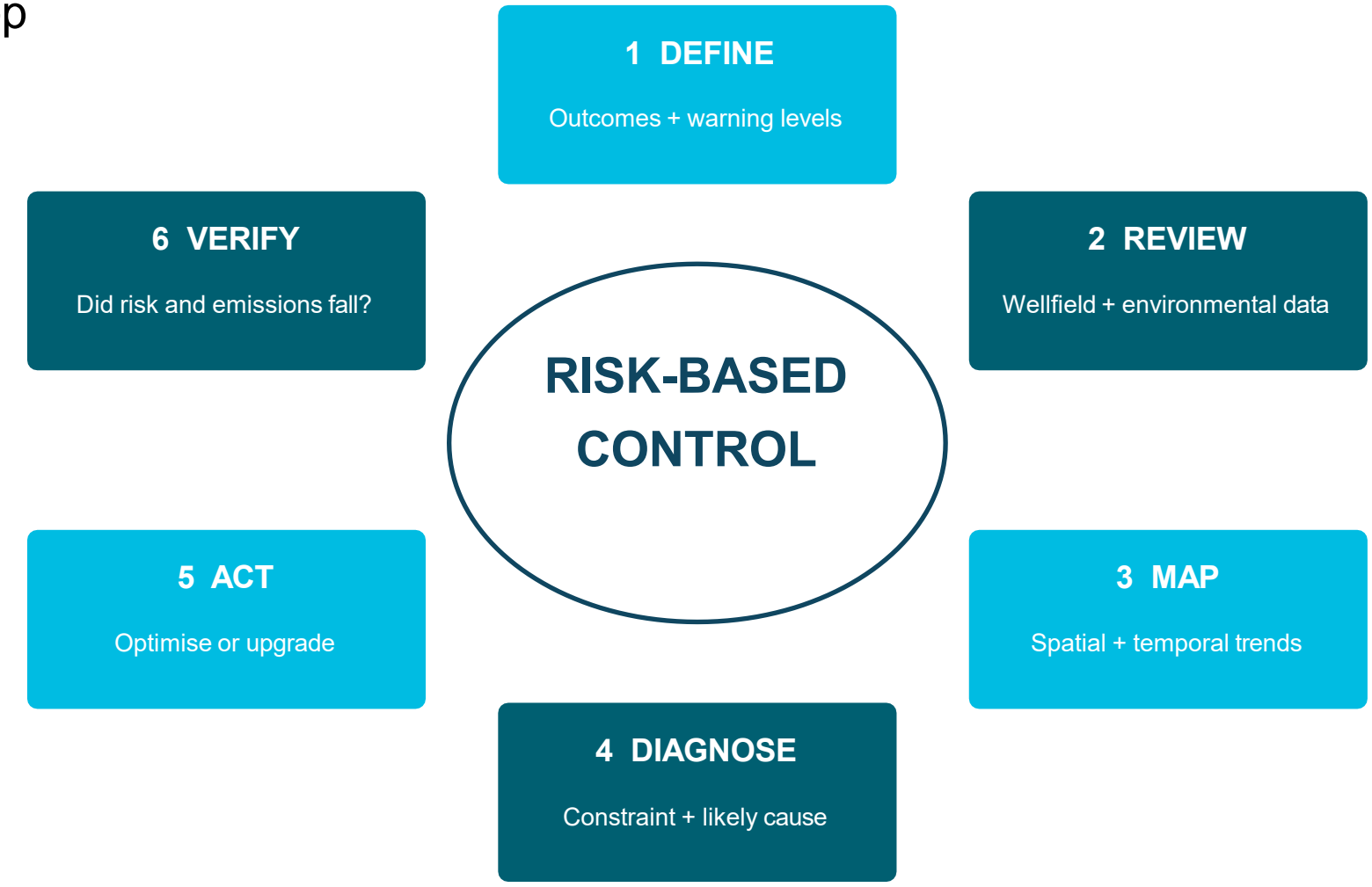
A structured review and response cycle

The operating loop



Priority: safety + migration → compliance → odour → emissions → resource recovery

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PFAS can leave landfills in gas—not only leachate

01	WHAT'S PRESENT	Volatile PFAS.
02	EVIDENCE	A 30-site US study found a 19,000 ng/m³ median of PFAS.
03	CONDENSATE	Gas condensate carries PFAS – manage with the leachate.
04	UNCERTAINTY	Worker/downwind risk and flare or engine destruction efficiency remain uncertain.
05	RESPONSE	**Sample raw gas, treated exhaust and condensate—not only aqueous PFAS.**

Treat PFAS as an emerging gas-pathway risk, separate from methane compliance.

Sources: De la Cruz et al., ES&T (2025); Smallwood et al., J Hazard Mater (2023); EREF (2026).

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Carbon revenue depends on additional abatement

What creates value—and what qualifies

REVENUE STACK

- ✓ Capture and flare methane
- ✓ Generate and sell electricity
- ✓ Create ACCUs from eligible abatement
- ✓ Upgrade landfill gas to biomethane
- ✓ Potential certificate value if eligible
- ✓ Use royalty or revenue-share models

ELIGIBILITY GATES

- + Register before the relevant activity starts
- + Use a device with sufficient destruction efficiency
- + Measure gas flow, methane and operating hours
- + Subtract regulatory and method baselines
- + Meet legal-right, reporting and audit rules
- + Plan around a generally suitable crediting period

The business case is driven by eligible abatement—not total gas extracted.

Sources: Clean Energy Regulator and DCCEEW, Landfill Gas Method 2025; F2025L01430.

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TAKEAWAYS

Five things to get right

01	**OUTCOMES**	Judge success by environmental performance (and financial gains), not flow alone.
02	**EVIDENCE**	Interpret composition, flow, pressure, temperature and trends together.
03	**COVERAGE**	Verify control using surface and perimeter monitoring.
04	**DECISION**	Distinguish tuning problems from infrastructure limitations.
05	**EARLY ACTION**	**Intervene before odour or methane at 1% v/v demonstrates lost control.**

Apply the right level of control, in the right locations, at the right time.

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* Thank you

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