

Risk-informed and sustainable redevelopment of a contaminated industrial site.

Integrated remediation design enabling liability
transfer and rapid brownfield reuse



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Your soil. Our Responsibility.

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This is the introductory presentation of the GreenSoil Group, a leading expert in sustainable soil remediation. For more information visit www.greensoilgroup.com or contact your GreenSoil Group representative.

Presentation roadmap

01

Background

site contamination
and
redevelopment
potential

02

Deadlock

why pump-and-
treat did not
unlock the site

03

Stakeholders

commercial,
regulatory and
social
requirements

04

Solution

source removal,
underground
in-situ
treatment and
liability transfer

05

Results

handover,
active
remediation
and aftercare

Project snapshot

Transfer of liabilities to enable redevelopment of a large-scale CVOC-impacted site

Core proposition

- ❑ Fixed-price total package
- ❑ Demolition, asbestos removal and remediation integrated
- ❑ Underground treatment design compatible with redevelopment
- ❑ Active risk management and long-term aftercare pathway

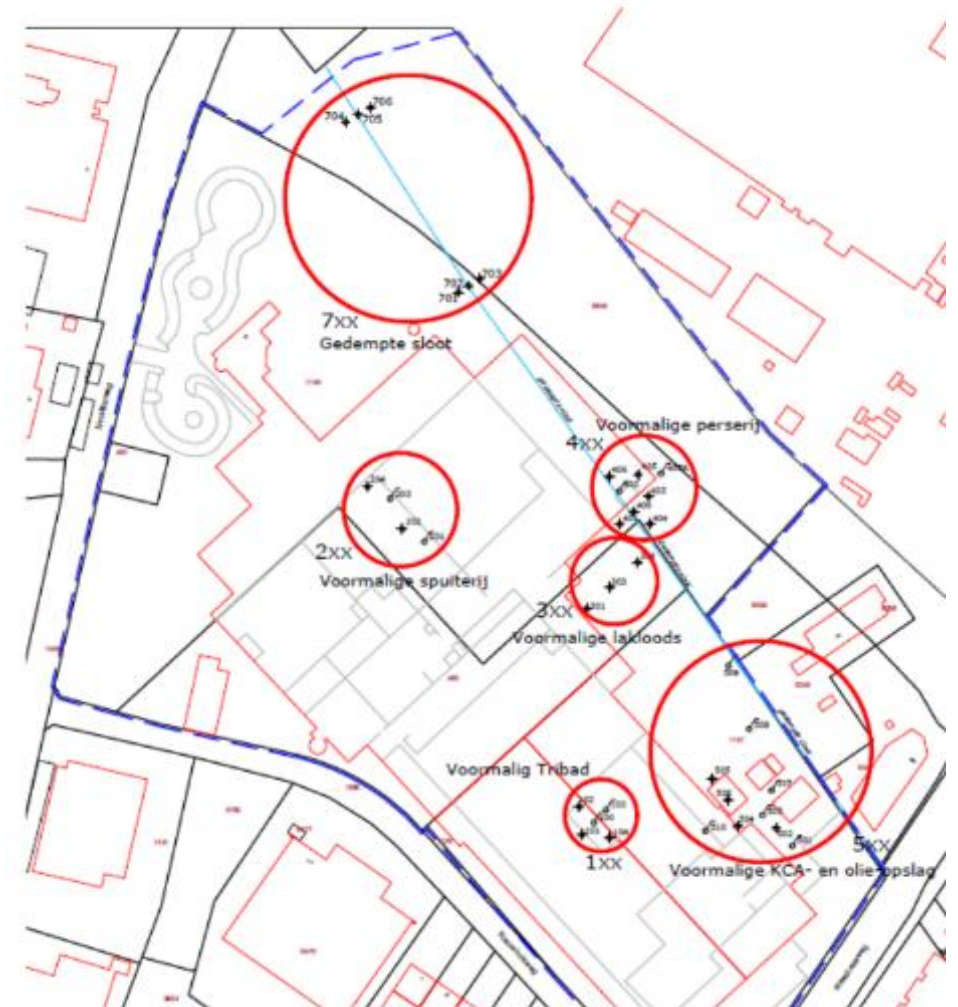
Client:	Confidential
Location:	Venray, The Netherlands
Contamination:	cVOCs in soil and groundwater
Contract type:	Lump sum + liability take-over
Period:	Q2 2018 – Q4 2025
Contract value:	> €1.5 million

Site and contamination setting

Large industrial site with source-zone chlorinated solvent impacts

- Former production location of a roof systems factory in Venray
- Industrial activities started around 1950 and were linked to automotive metal construction
- Total site area approximately 8 ha, including about 5 ha of industrial buildings
- Redevelopment potential created the opportunity to rethink the remediation strategy

Parameter	Initial source concentrations in µg/L
	Groundwater
Impacted area/depth	45,000 m³ / 16 m-bgl
PCE	>10% solubility, 5000 to 11,000
TCE	Up to 100,000
cis-DCE	Up to 76,000
VC	Up to 830



Source locations

Why the previous approach was not enough?

Containment controlled migration risk but did not remove the source

Previous approach

- ❑ Hydraulic containment to prevent off-site migration
- ❑ Long-term pump-and-treat system
- ❑ Limited contaminant mass removal
- ❑ Source areas below buildings not actively treated



Deadlock

- ❑ Uncertain duration
- ❑ Uncertain liability
- ❑ Potential lateral spreading within site boundaries
- ❑ Redevelopment remained blocked

The project needed a finite, redevelopment-compatible solution.

Stakeholders and requirements

Different definitions of success had to be integrated into one project structure

Client / developer

Fixed price total package
No more liability exposure

Province of Limburg

From passive control to
proactive remediation

Municipality of Venray

Redevelopment and
employment benefits

GreenSoil

Fixed-price offer while controlling risk

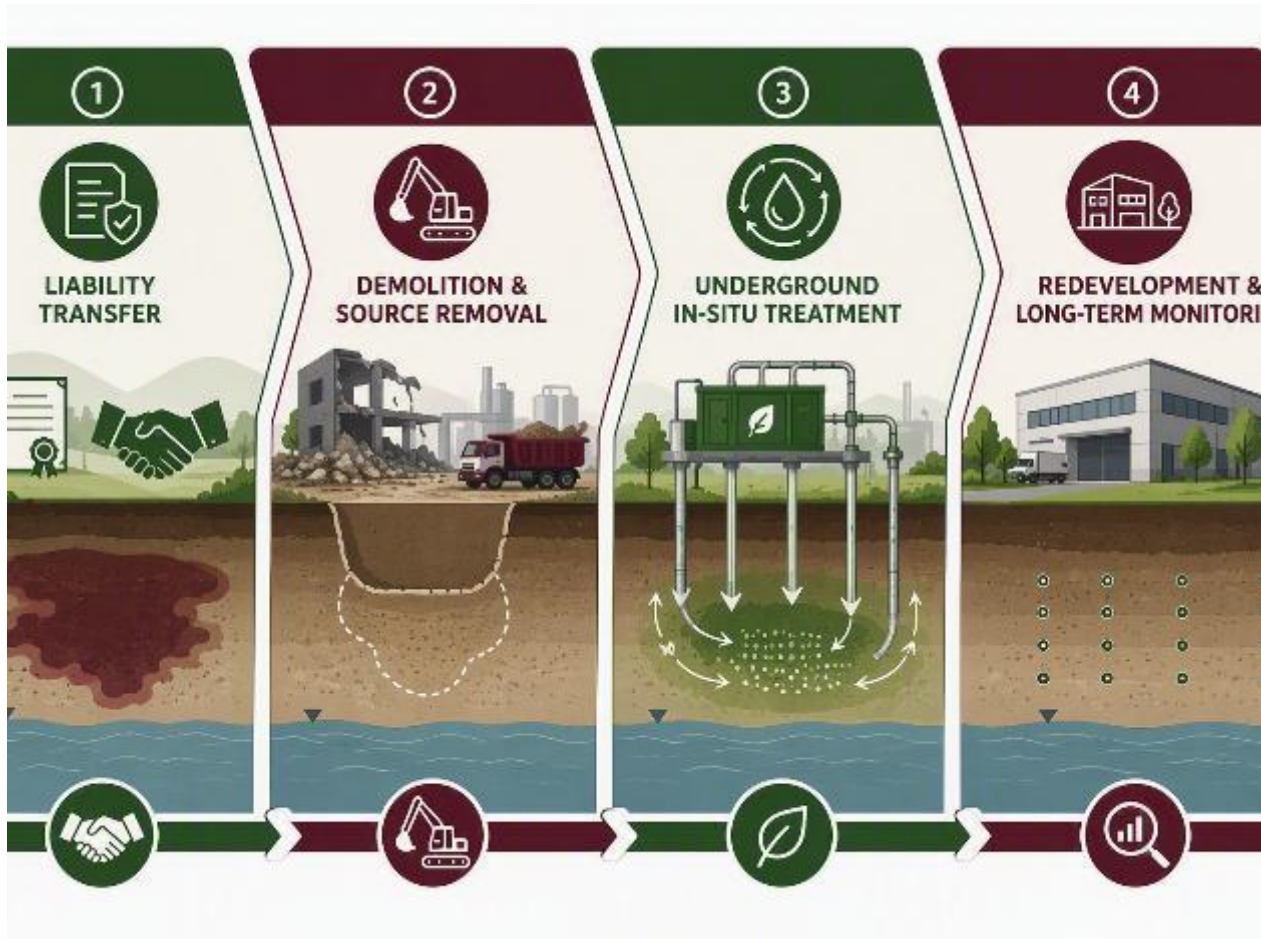
Bodem Beheer Nederland

Monitoring and aftercare role after active
remediation

The technical design had to solve a legal, commercial and redevelopment problem at the same time.

Integrated remediation strategy

The end use defined the remediation approach



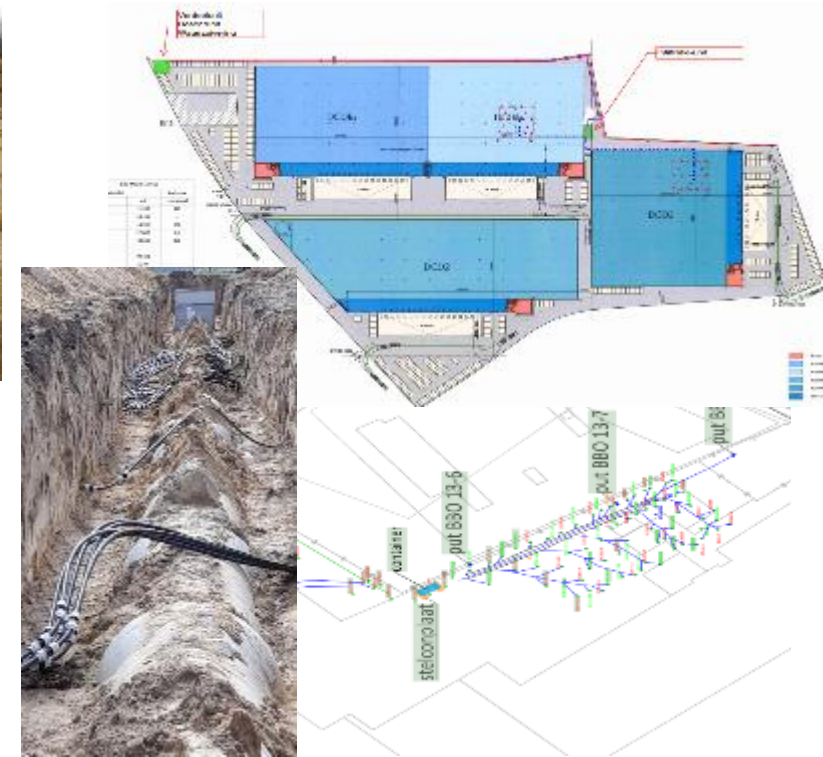
Strategy components

- ❑ GreenSoil assumed full environmental liability under a lump-sum contract
- ❑ Scope integrated demolition, asbestos removal, source removal and groundwater remediation
- ❑ Source areas were excavated to around 4 m-bgl and treated off-site
- ❑ **Underground treatment infrastructure was designed below future development**
- ❑ A bio-barrier was included to control plume migration

Redevelopment was not an afterthought. It was the design driver.

Construction and source removal

Demolition, excavation and underground infrastructure were coordinated with redevelopment



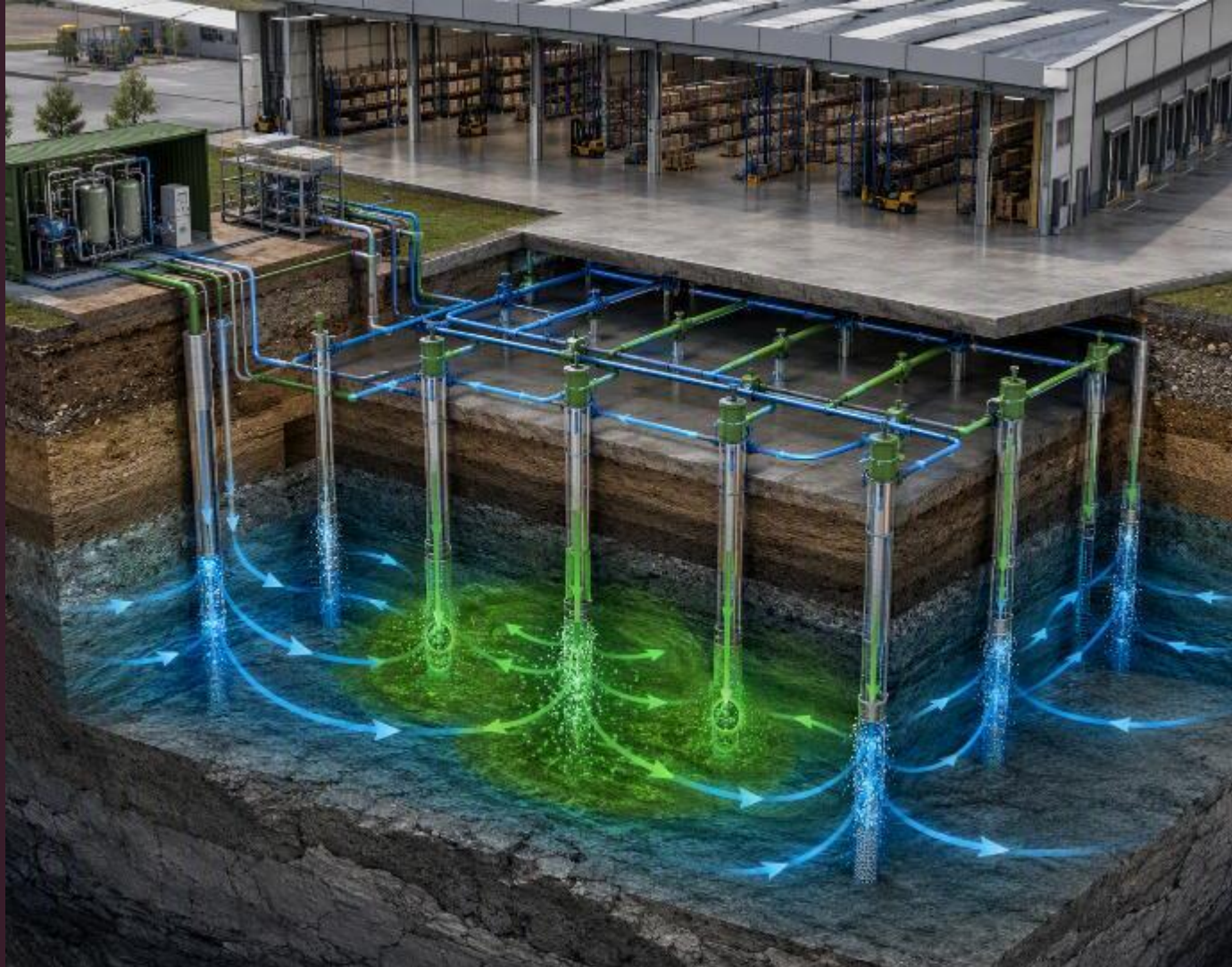
Demolition

Excavation and backfilling

In-situ system integrated
in redevelopment

Underground remediation infrastructure allowed site preparation and redevelopment to proceed while groundwater treatment continued.

Technical concept: an underground in-situ bioreactor



How the treatment works

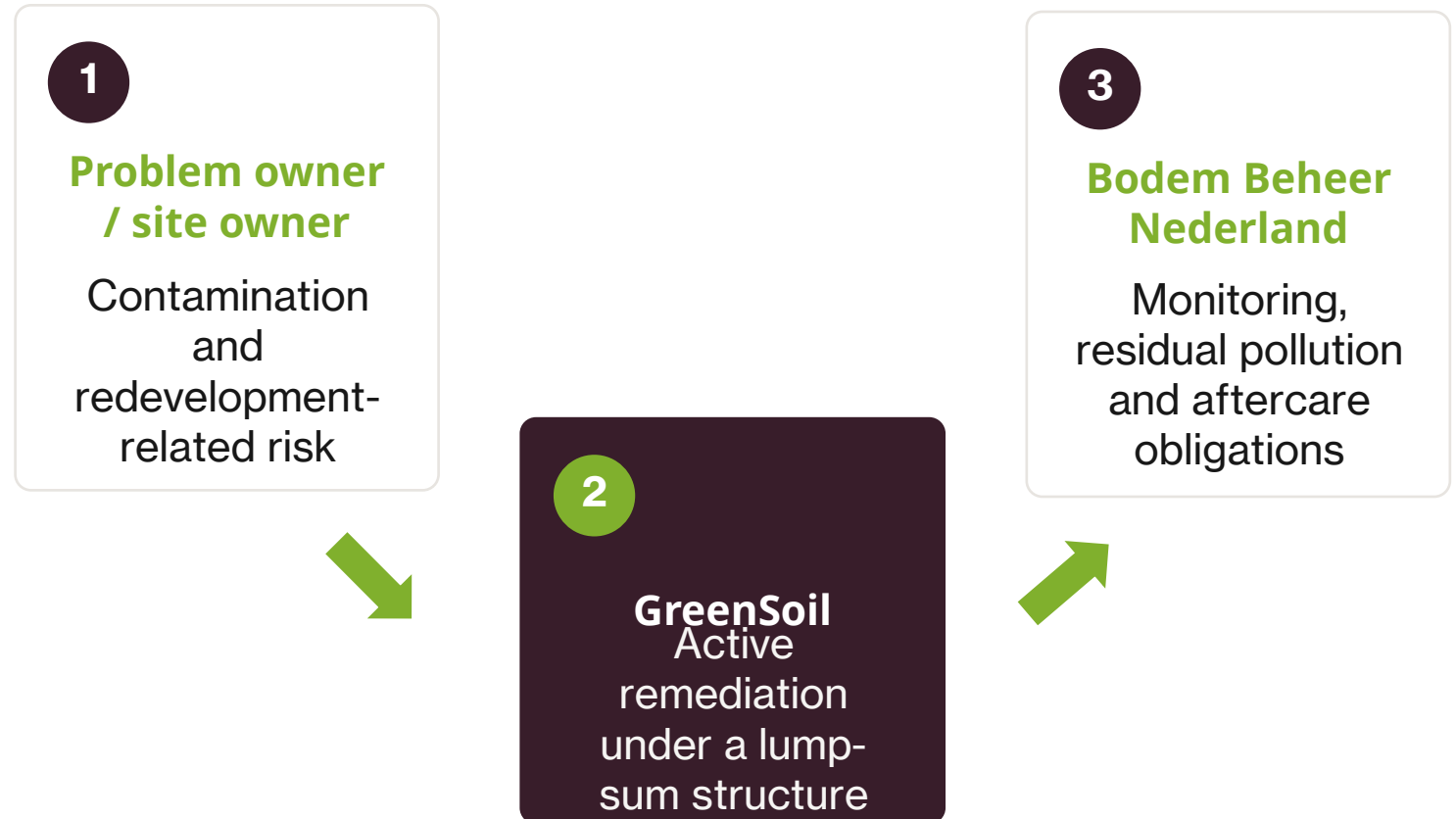
- ❑ Extraction and injection filters recirculate groundwater
- ❑ **Extracted water is amended with Dehalo GS™ carbon substrate**
- ❑ Amended water is reinjected to stimulate anaerobic reductive dichlorination (ERD)
- ❑ Nutrients, trace elements and vitamins support biological activity
- ❑ A boundary bio-barrier helps control plume migration

Practical result: treatment below a redeveloped site

Recirculation filters, Dehalo GS™ and enhanced anaerobic biodegradation

Liability and aftercare structure

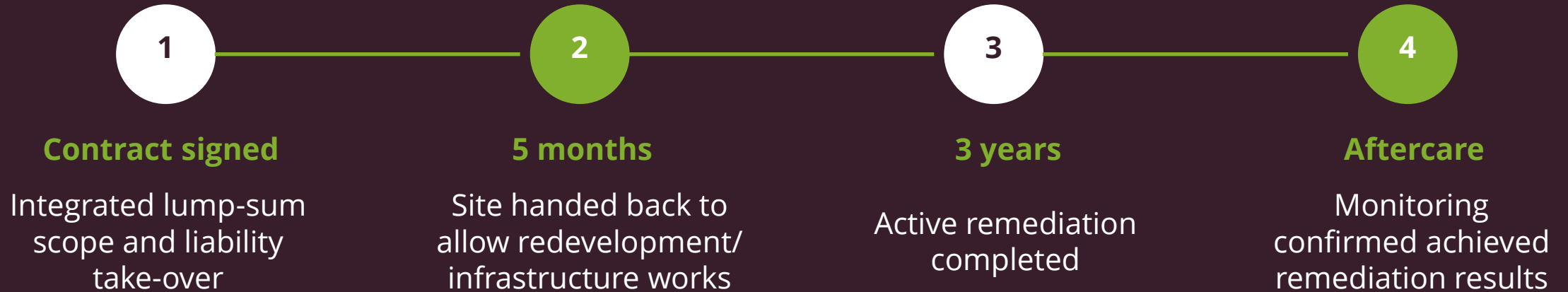
Residual risk was made manageable through a staged responsibility pathway



The remediation result achieved by GreenSoil became the starting situation for long-term monitoring and aftercare.

Results

Rapid site handover, active remediation and long-term risk control



The project transformed a stalled contaminated site into a redevelopable brownfield asset while maintaining long-term risk control.

Key performance figures

Parameter	Initial Source concentrations	source-zone target concentrations (<1% solubility criteria)	Final concentrations	Reduction %
PCE	>10% solubility, 5000 to 11,000 µg/L	1,500 µg/L	0.2- 0.7 µg/L in source-zone verification wells	>99.98%
TCE	Up to 100,000 µg/L	11,000 µg/L	0.9- 41 µg/L	>99.96%
cis-DCE	Up to 76,000 µg/L	8,000 µg/L	16- 77 µg/L	>99.96%
VC	Up to 830 µg/L	11,000 µg/L	30- 61 µg/L	92.7 to 96.4%

The Venray project successfully met its remediation objectives, achieved all source-zone target concentrations (<1% solubility criteria), and was recommended for closure by the independent verifier on December 2025.

Key lessons learned

- ❑ End use must be considered early when selecting a remediation strategy
- ❑ Source removal, in-situ treatment and plume control can be combined in one phased design
- ❑ Redevelopment can move forward without waiting for groundwater remediation to be completed
- ❑ Liability transfer can unlock sites that are technically and commercially stalled
- ❑ The best remediation design is often the one that solves the client's risk problem, not only the contaminant problem



Questions



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