

Co-operation Canada – Netherlands

Groundwater and soil management



DUTCH DIRT

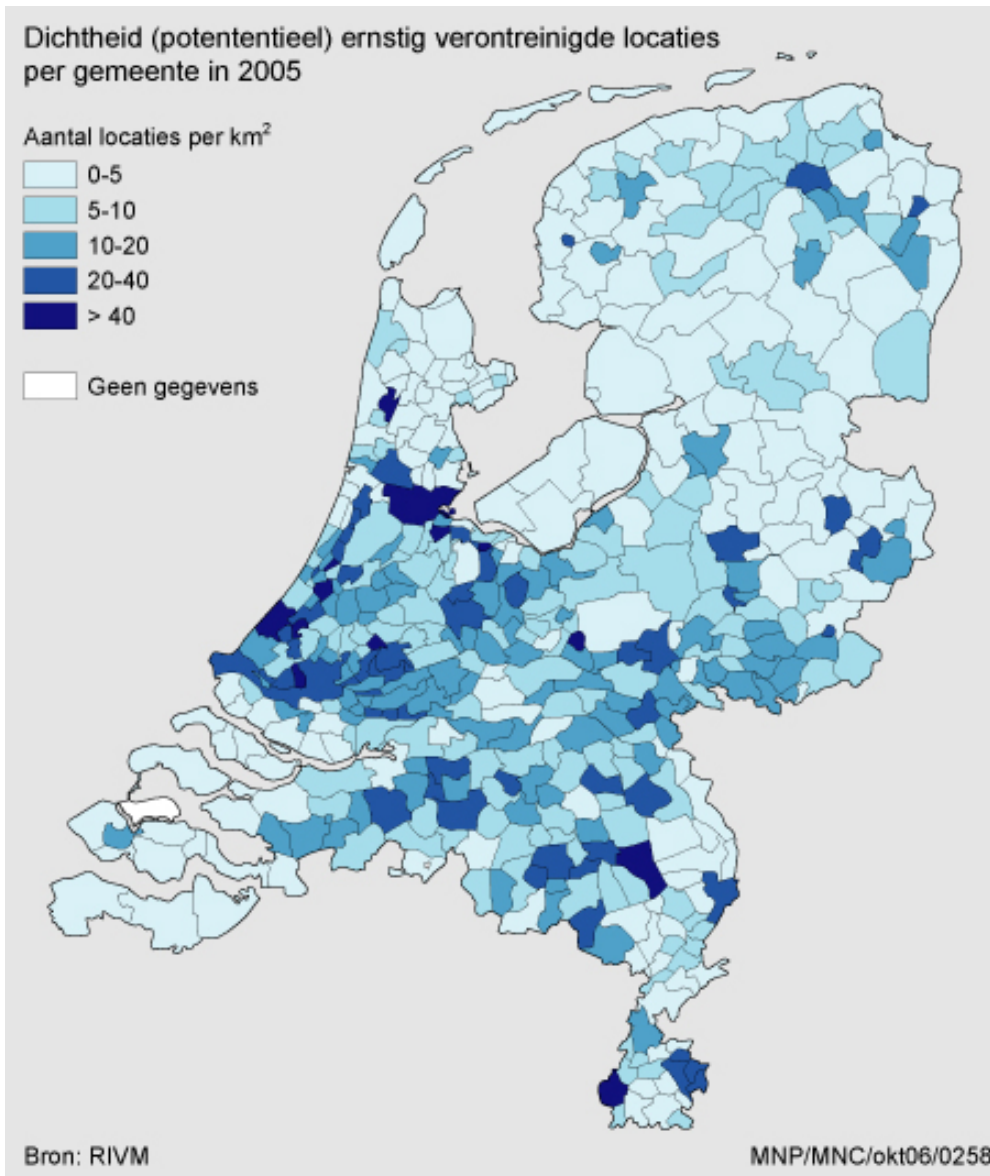
This May, **Hon Lu** joined a business mission on behalf of ReNew Canada to report on a knowledge partnership between Canada and the Netherlands for soil and groundwater technology



“One interesting difference I observed while in Holland was the intense understanding that contaminated soil was not considered a waste.” Marcia Wallace

“The shortage of soil and the limited options for landfilling make soil a valuable resource to the Dutch society”

“Soil in The Netherlands is an opportunity instead of a liability”



- Total Surface: 41.526 km²
- 450.000 sites are suspected of soil pollution
- 58.000 need remediation
- 12.000 urgent remediation (< 2015)

Brief History



<1980

- No soil policy
- No funding
- No awareness

Lekkertkirk 1980



>1980

- 1983 Soil Remediation Law
- 1995 Soil Remediation in Soil Protection Law
- 2005 New Policy in Soil Protection Law
- 2007 New Policy in Soil Protection Law
- 2007 EU Water Framework Directive
- 2008 EU Soil Framework Directive (in prep.)

Why Holland In-situ Program (HIP)?



Growing attention in (sub-)urban brownfields to:

- Provide building space in a densely populated area
- 450.000 contaminated sites, 90% in urban environment

Ministry of Environment adjusted its policy for the soil remediation plan until 2030

- Adopting risk based approach: only the “immediate risk” sites to be remediated
- Risk driven clean-up plan:
 - 15.000 high priority risk sites, in 10 years
 - 60.000 risk carrying sites, in 30 years
- Shallow contamination needs to be remediated;
 - Targets made flexible (land use, costs and risks)
 - Industrial sector oriented programs
 - From 900 to 2000 sites/yr remediated

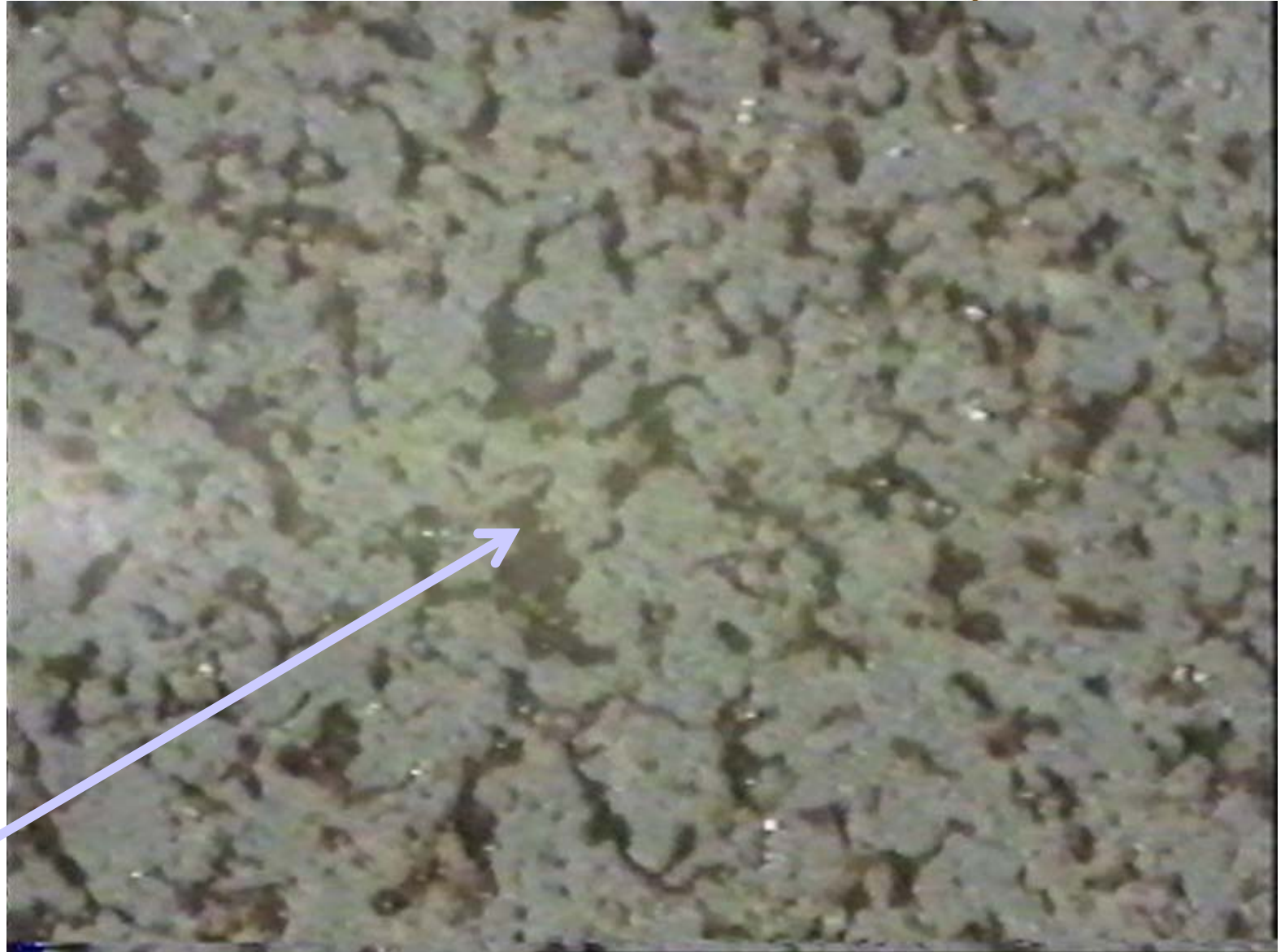
HIP setting

Bottlenecks applying in-situ techniques:

- techniques insufficiently balanced in local geo-hydrological setting
- No standardized approach to remediate common situations
- Mind set of competent authority/regulators lacks confidence in techniques:
 - “Outcome uncertain and risks difficult to manage”
 - Insufficient flexibility to deal with risks and uncertainties
 - Processes (authorisations etc.) with soil remediation too complex (many stakeholders, red tape)
 - Lack of knowledge and experience at daily practice level

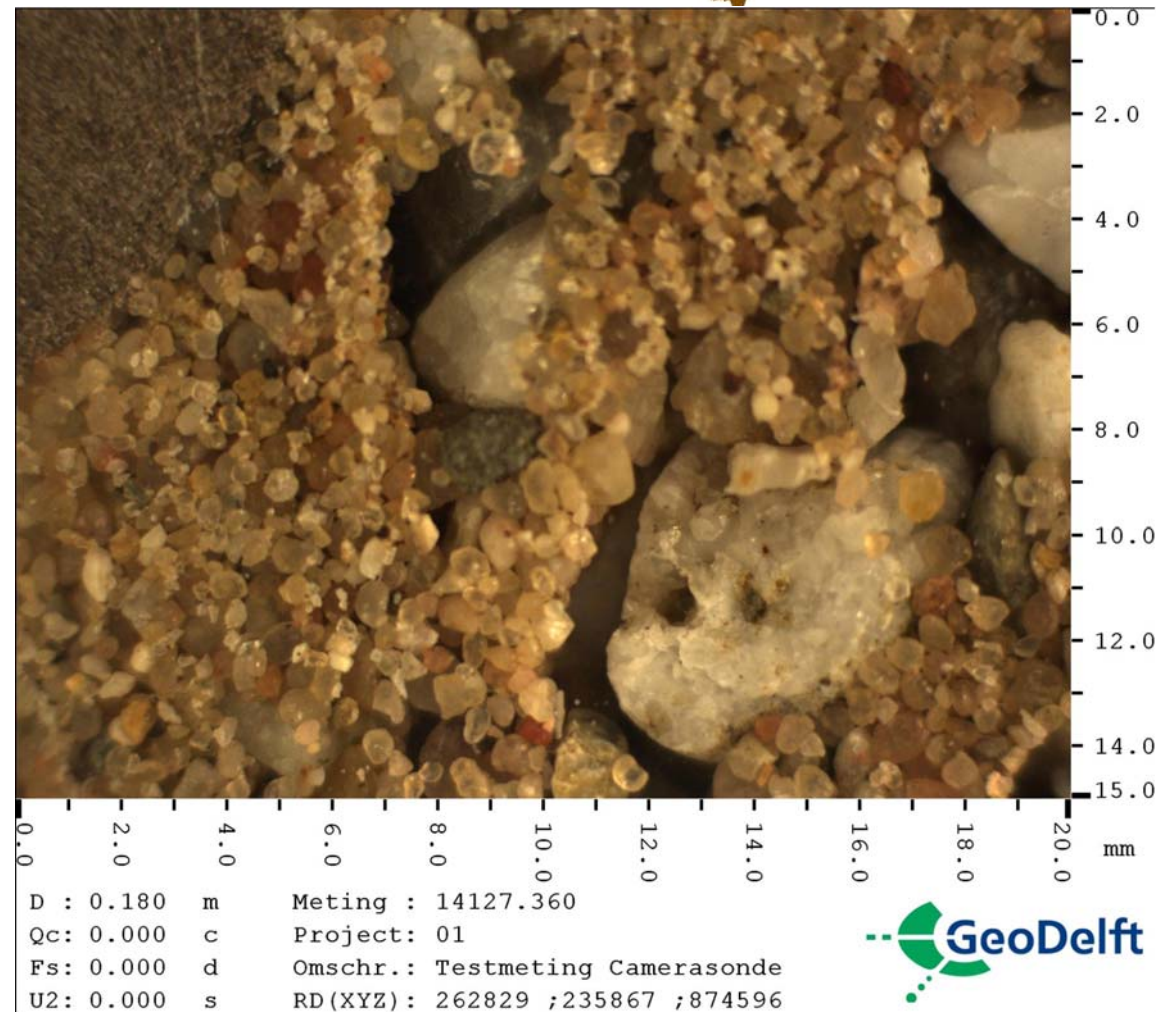
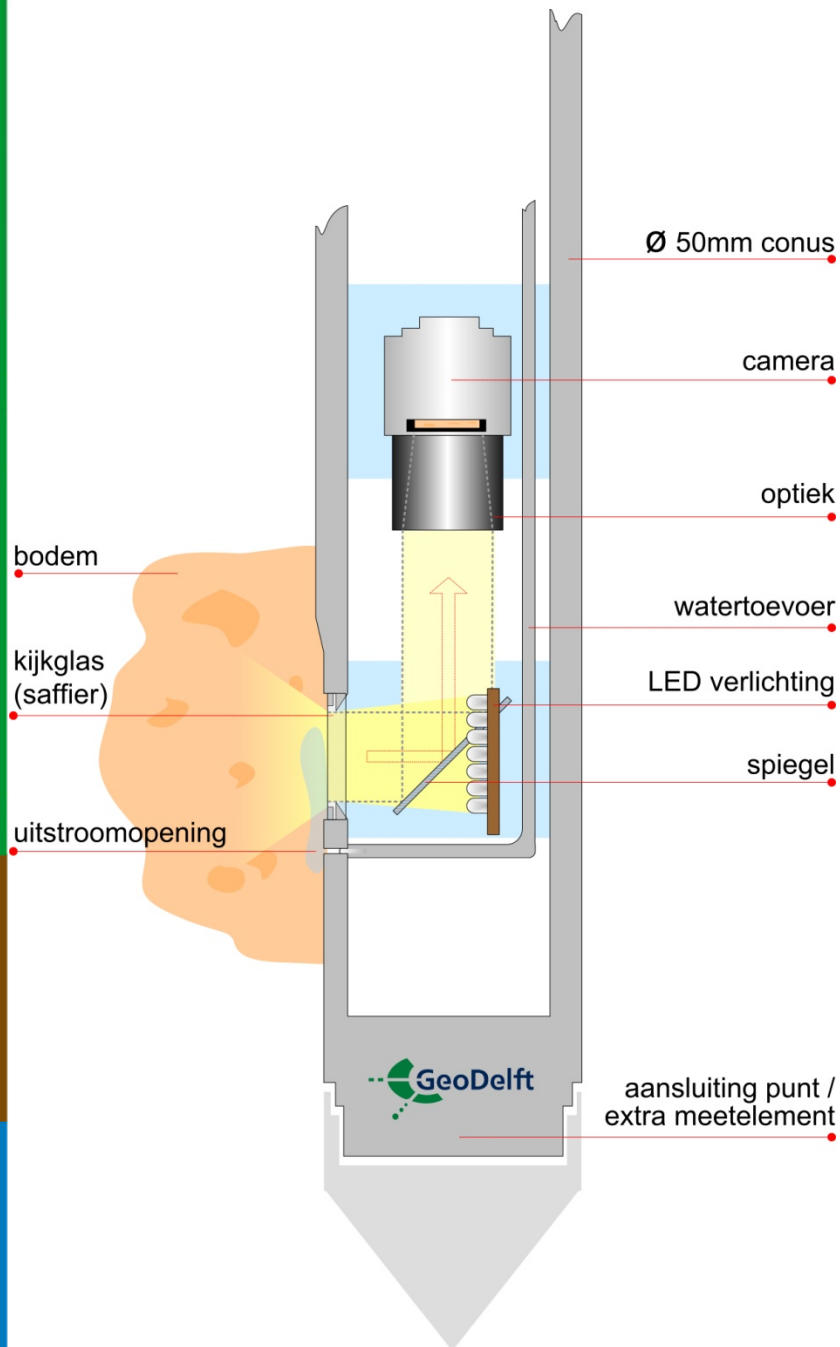
Visual detection of NAPL contamination

NETHERLANDS PARTNERSHIP



creosote

Video cone as tool in communication



Towards reliable and accepted in-situ technologies: the “Holland In Situ Program” project (HIP).

Site Characteristics		Occurrence (% of total)
Contaminant type (C)	C.1 Chlorinated Hydrocarbons	45
	C.2 Aromatics/Oil/MTBE/Cyanide	45
	C.3 Other	10
Geo-hydrology (G)	G.1 Permeable (sandy)	45
	G.2 Layered, permeable and impermeable layers	45
	G.3 Other	10
Built Environment (B)	B.1 Urban	70
	B.2 Industrial	25
	B.3 Other	5

Pilots (1/2) implementation



1. Acoustic Remediation (IV)

- Remediation Technology: Using acoustic energy to mobilize contaminant source.
- Goal: Proof of principle and optimized use of acoustic energy to mobilize DNAPL and LNAPL phases. This would increase the effectiveness of subsequent in-situ remediation and mass flux reduction.
- Contracting Partner: HMVT

2. Innovative Monitoring of Enhanced Natural Attenuation (ENA) (I)

- Remediation Tool: Process monitoring by using chemical and biological analysis
- Goal: To optimize the approaches for detecting and monitoring ENA of chlorinated hydrocarbons using H₂-measurement tools and molecular and stable isotope measurements
- Contracting Partner: NTP

Pilots (2/2) implementation

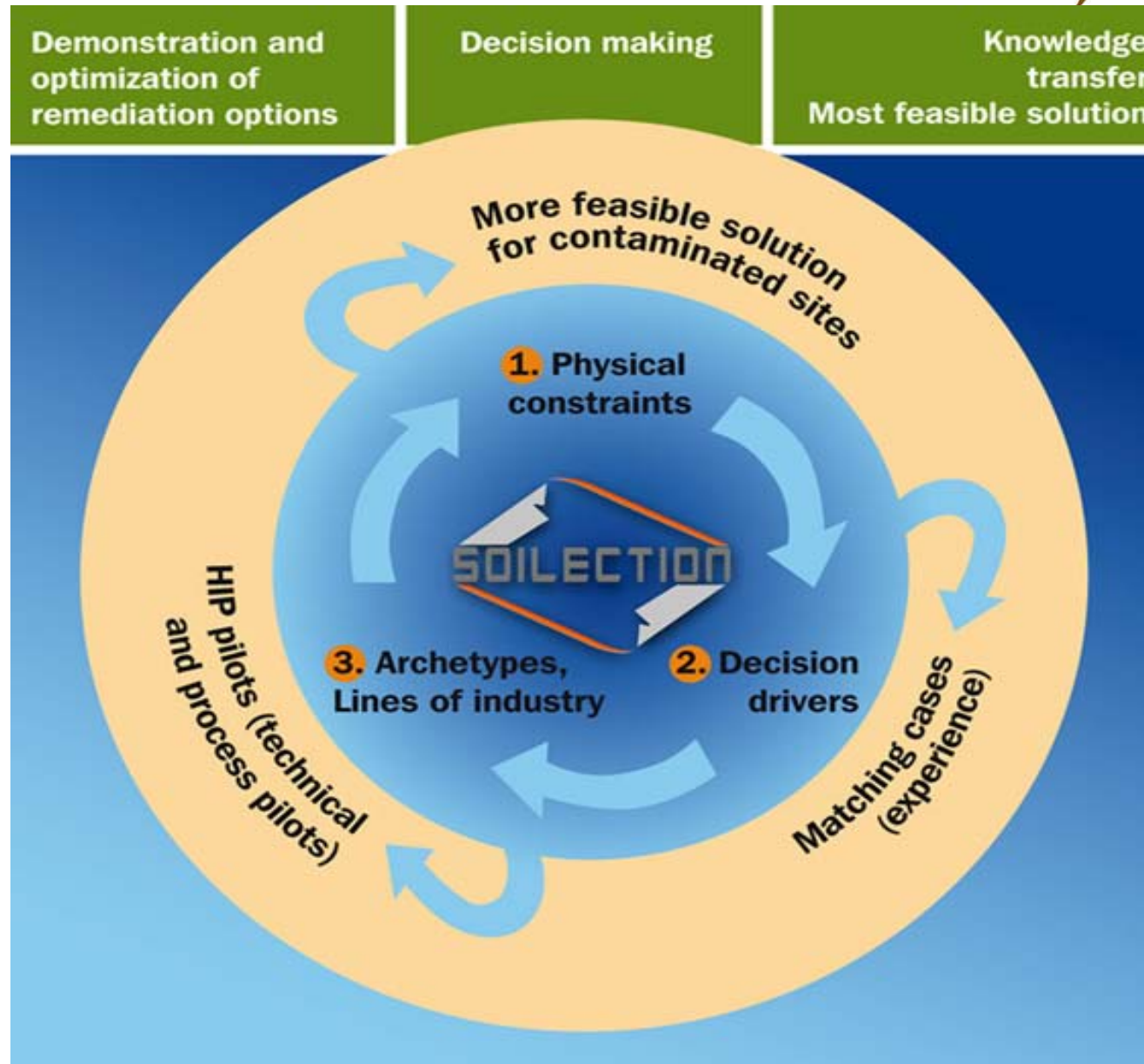
3. Innovative Monitoring and stable end situation for ENA (II)

- Remediation Tool: Process monitoring by using chemical and biological analysis
- Goal: To optimize the approaches for detecting and monitoring ENA of chlorinated hydrocarbons using H2-measurement tools and molecular measurements in a permeable sandy soil.
- Contracting Partner: Biosoil

4. Optimization of ISCO application of Permanganate and Fenton's Reagents (II)

- Remediation Technology: Chemical oxidation of contamination using Fenton's Reagents and Permanganate
- Goal: Increasing the effectiveness of the VOCI remediation by optimizing the application of Fenton's reagents and permanganate based on the spatial assessment of their sediment oxidant demand and contaminant distribution in both soil and groundwater. Carbon isotope analyses are used to monitor the contaminant oxidation process.
- Contracting Partner: SITA Remediation

Soilection making experience accessible

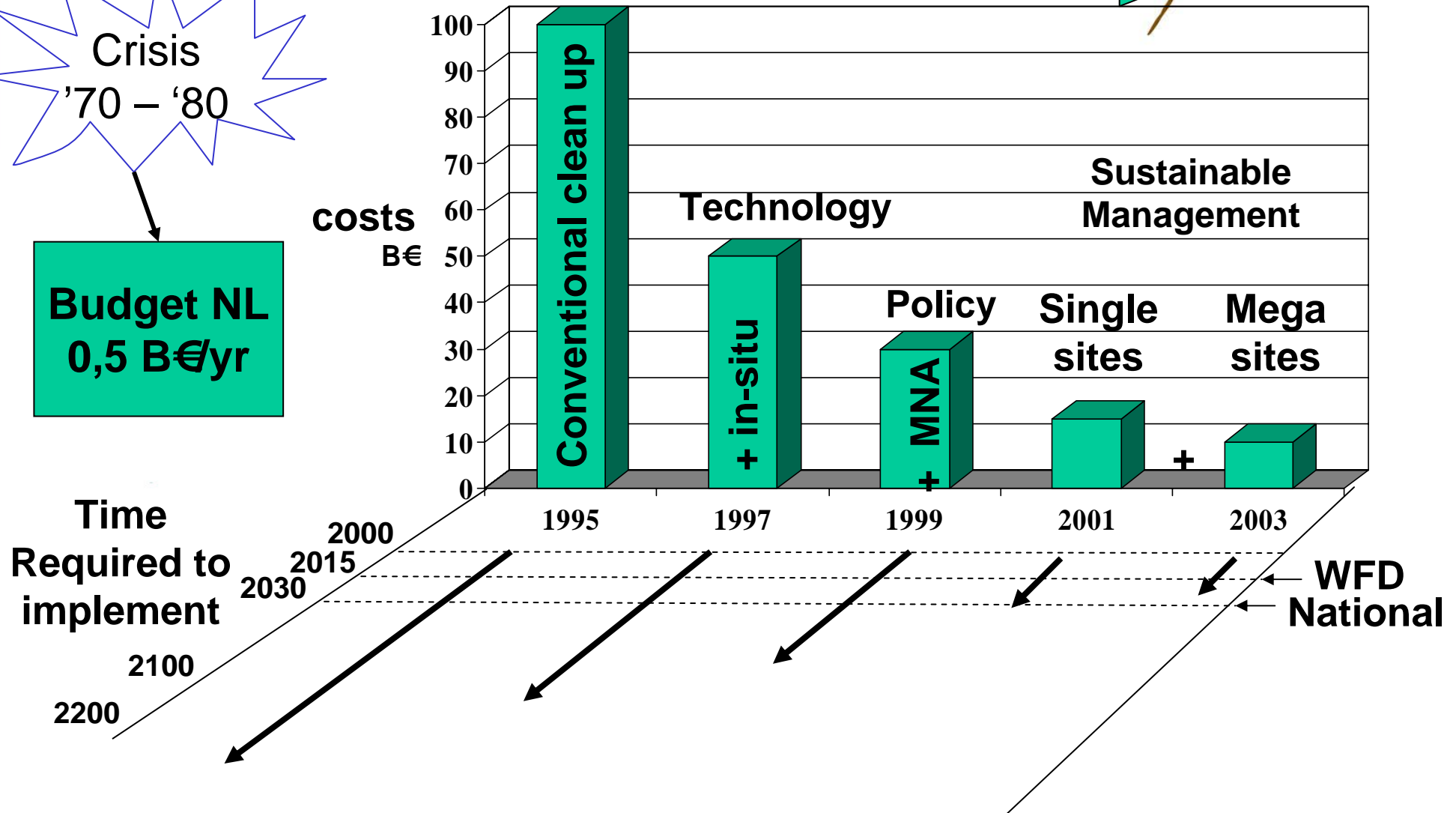


Soil and Groundwater Remediation: More than just technologies

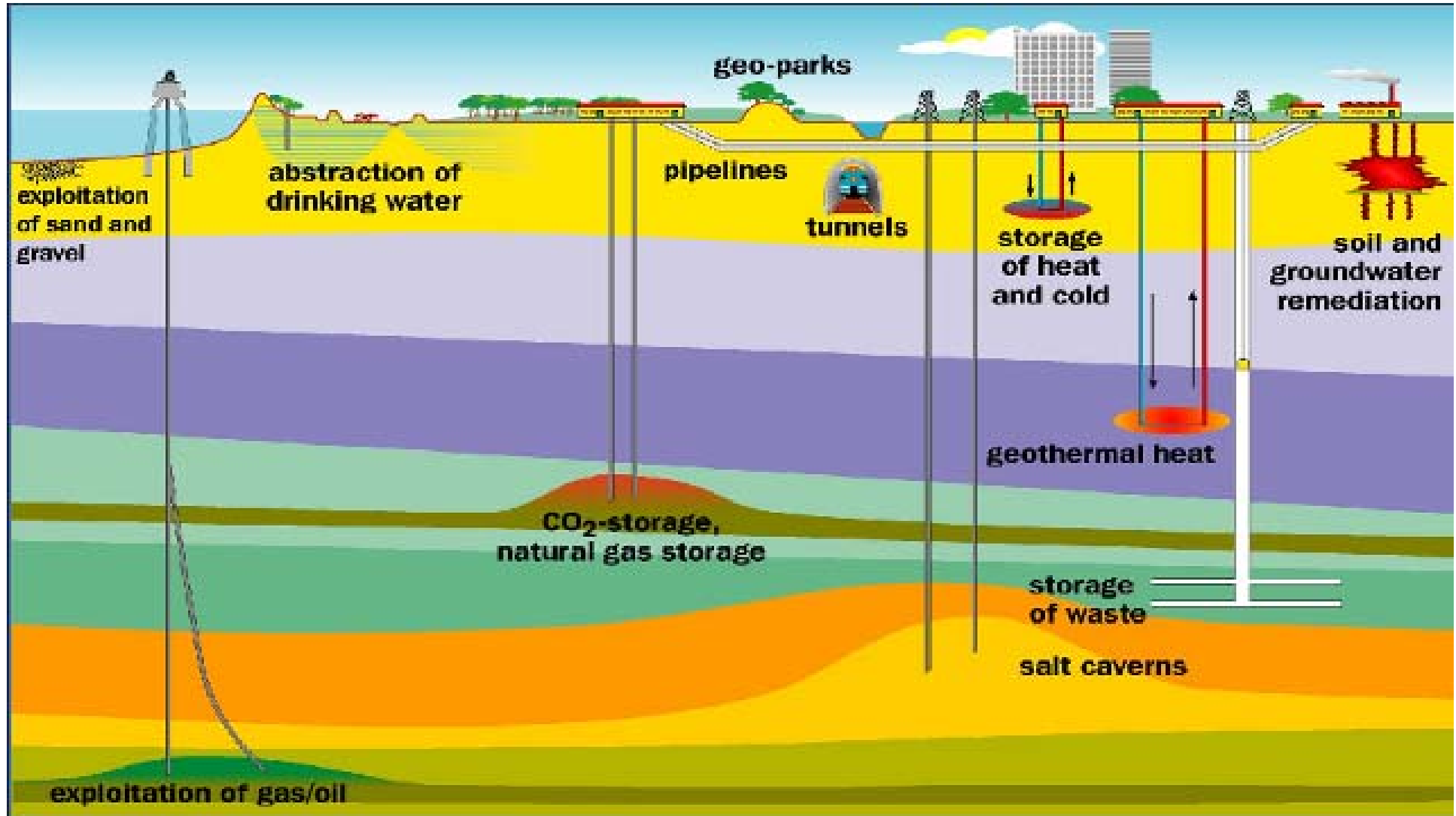
Crisis
'70 – '80

Budget NL
0,5 B€/yr

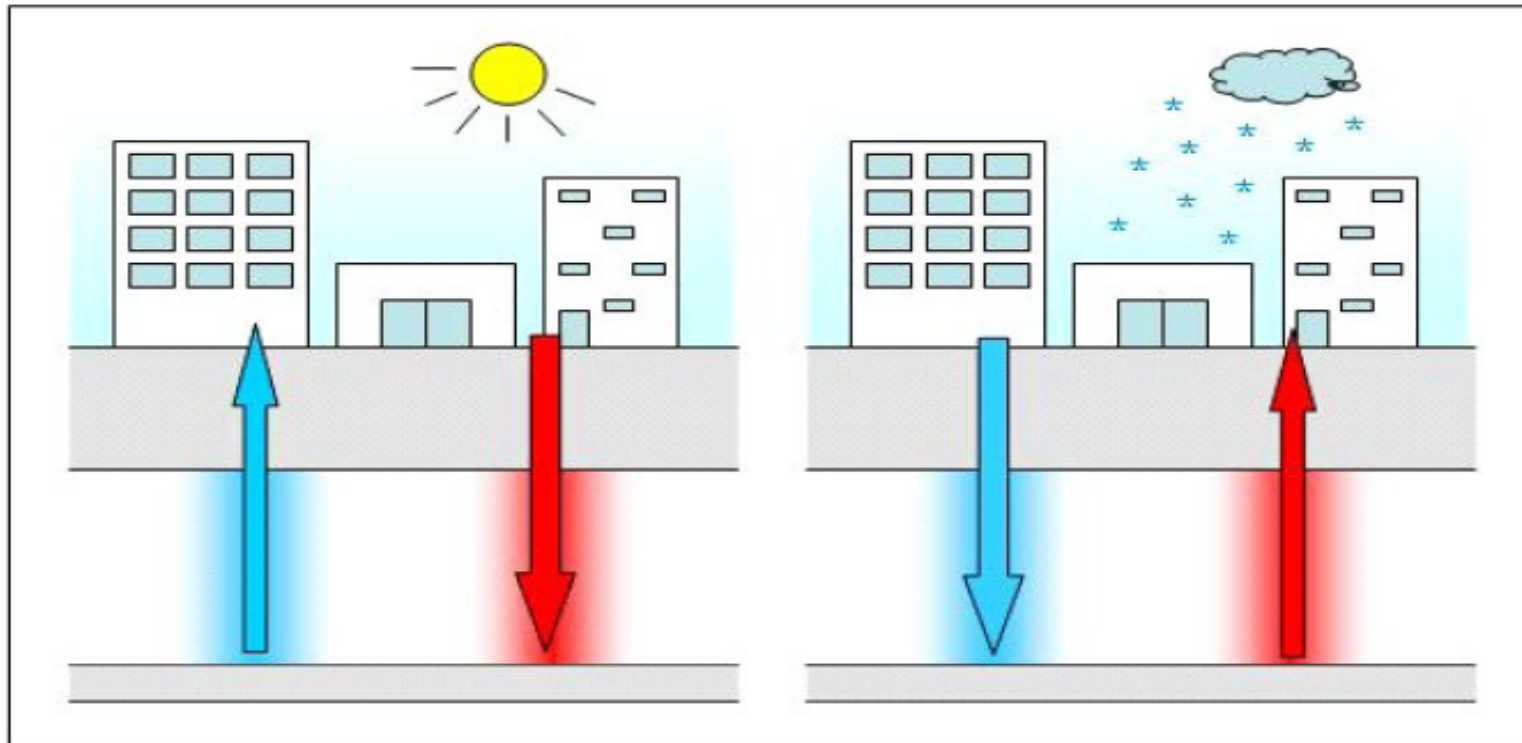
Non-sustainable **Innovation** → Sustainable



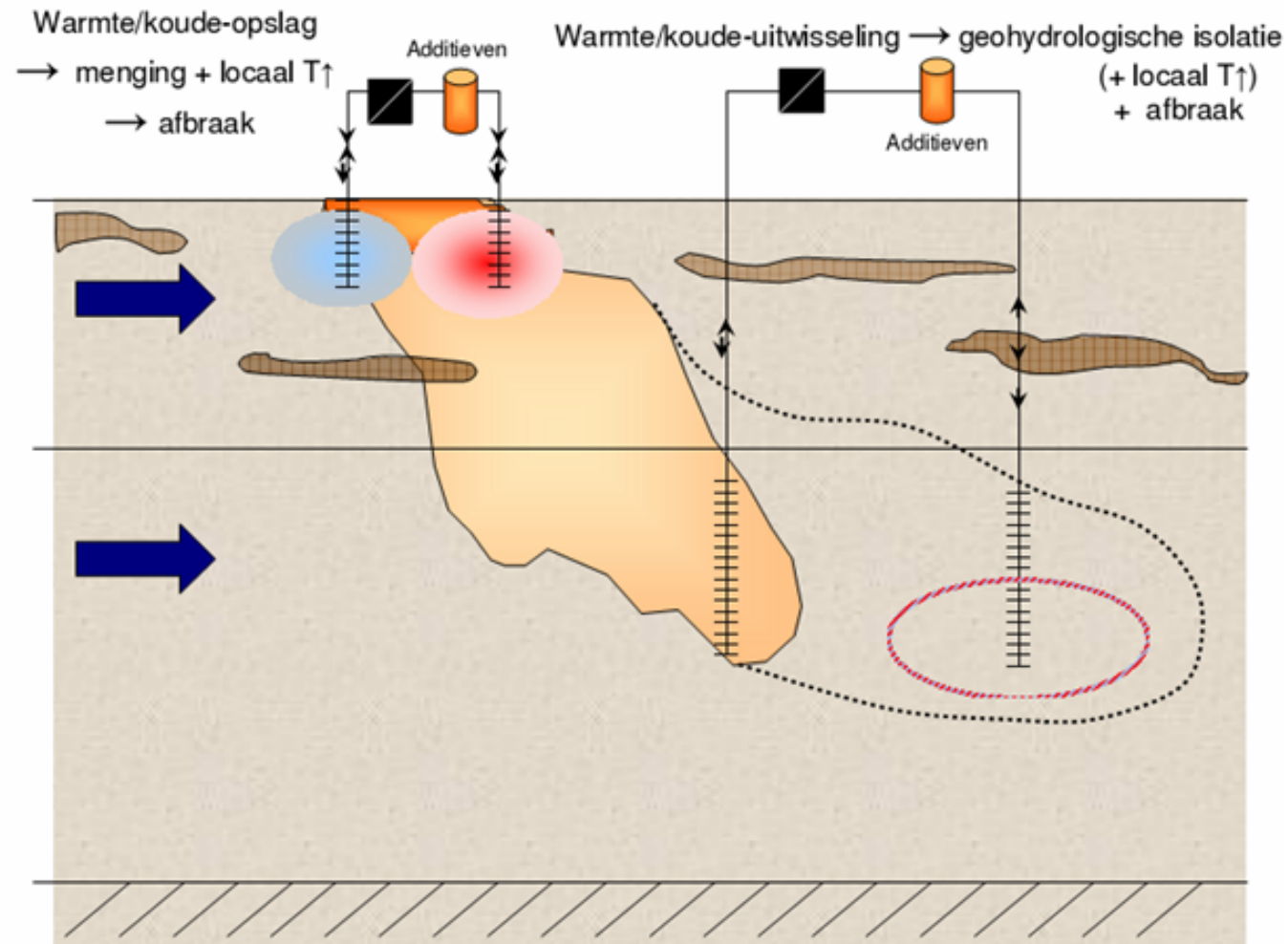
Current Subsurface Activities



Aquifer Thermal Energy Storage (ATES)



Combined ATES and In-situ Remediation



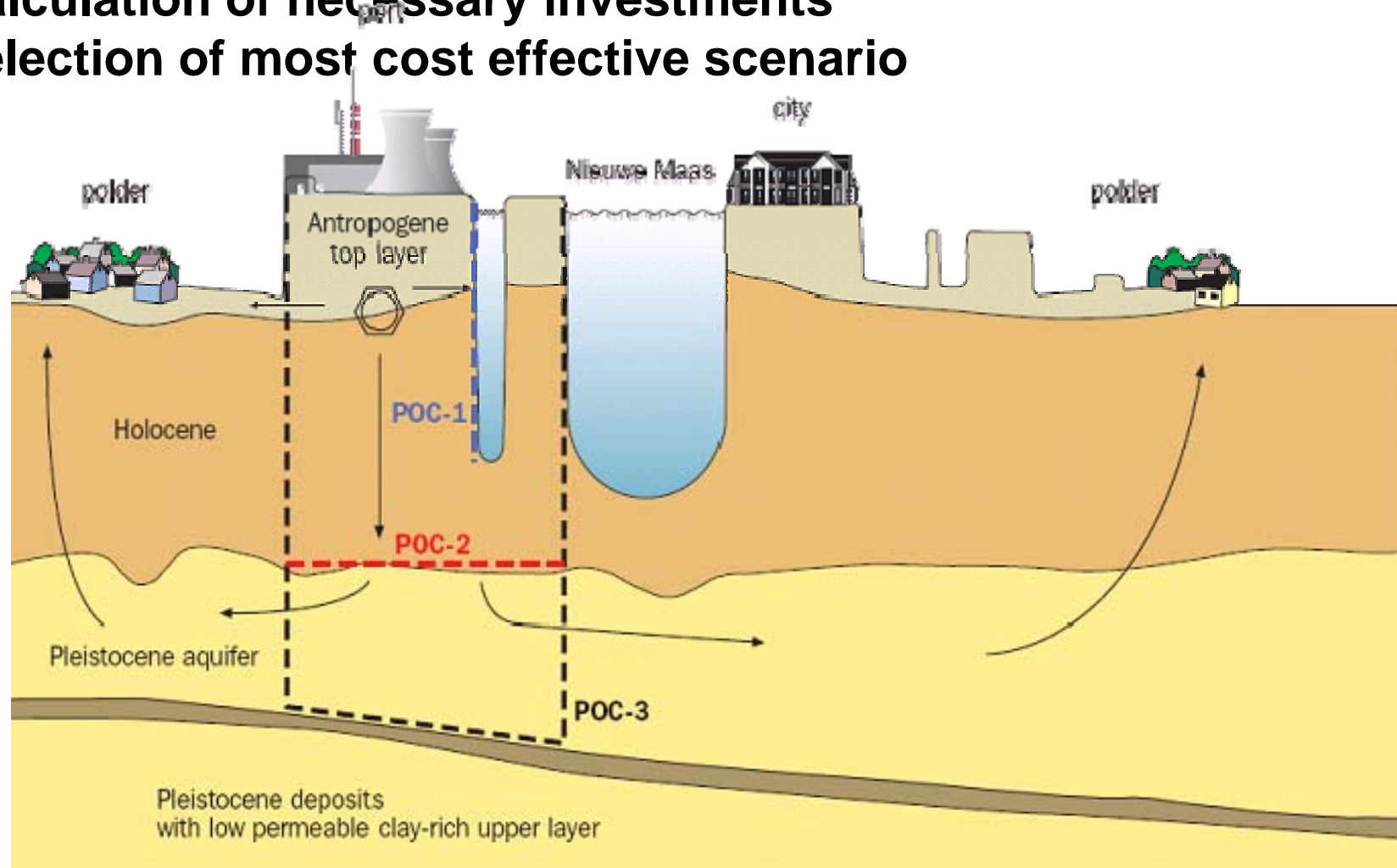
Mega Site Approach –Rotterdam project



More Information on: <http://www.euwelcome.nl/kims/>

Integrated Management Strategy

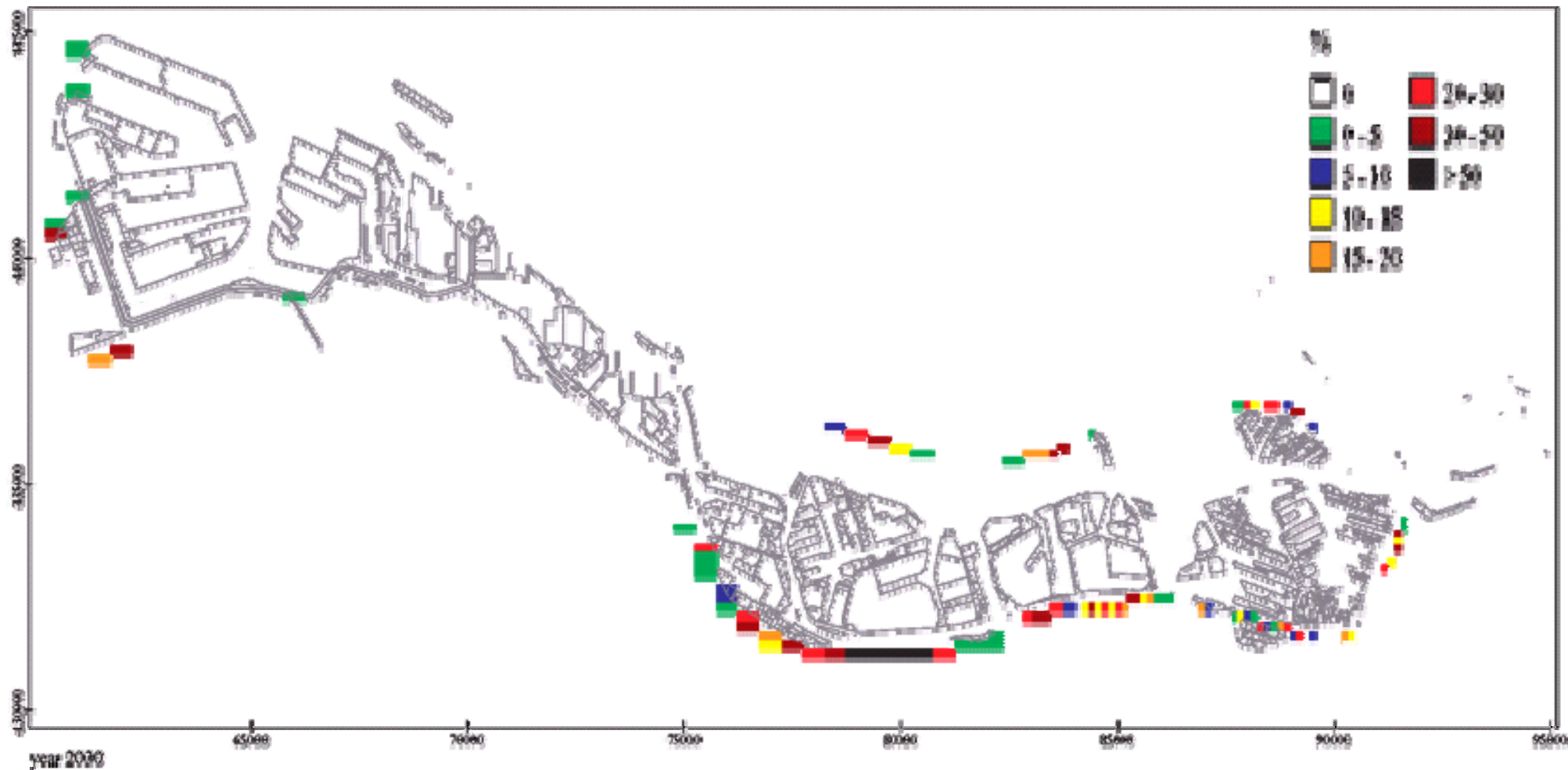
- 1 Identifying Risks (Site Characterization + Risk Assessment)
- 2 Determining the degree of contamination removal required
- 3 Calculation of necessary investments
- 4 Selection of most cost effective scenario



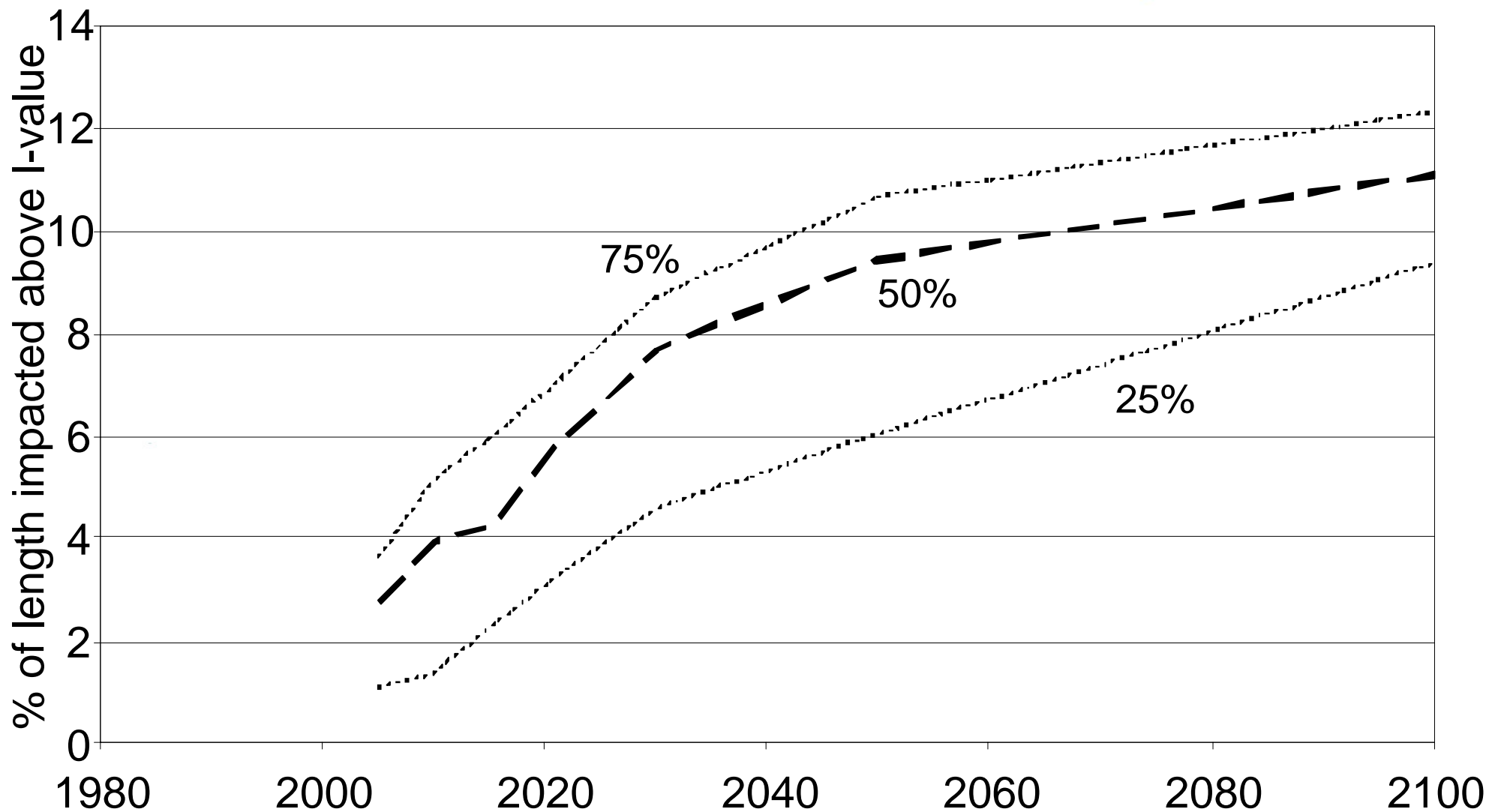


3rd plane of compliance

2030: Chance of exceeding intervention value at 3rd Plane of Compliance



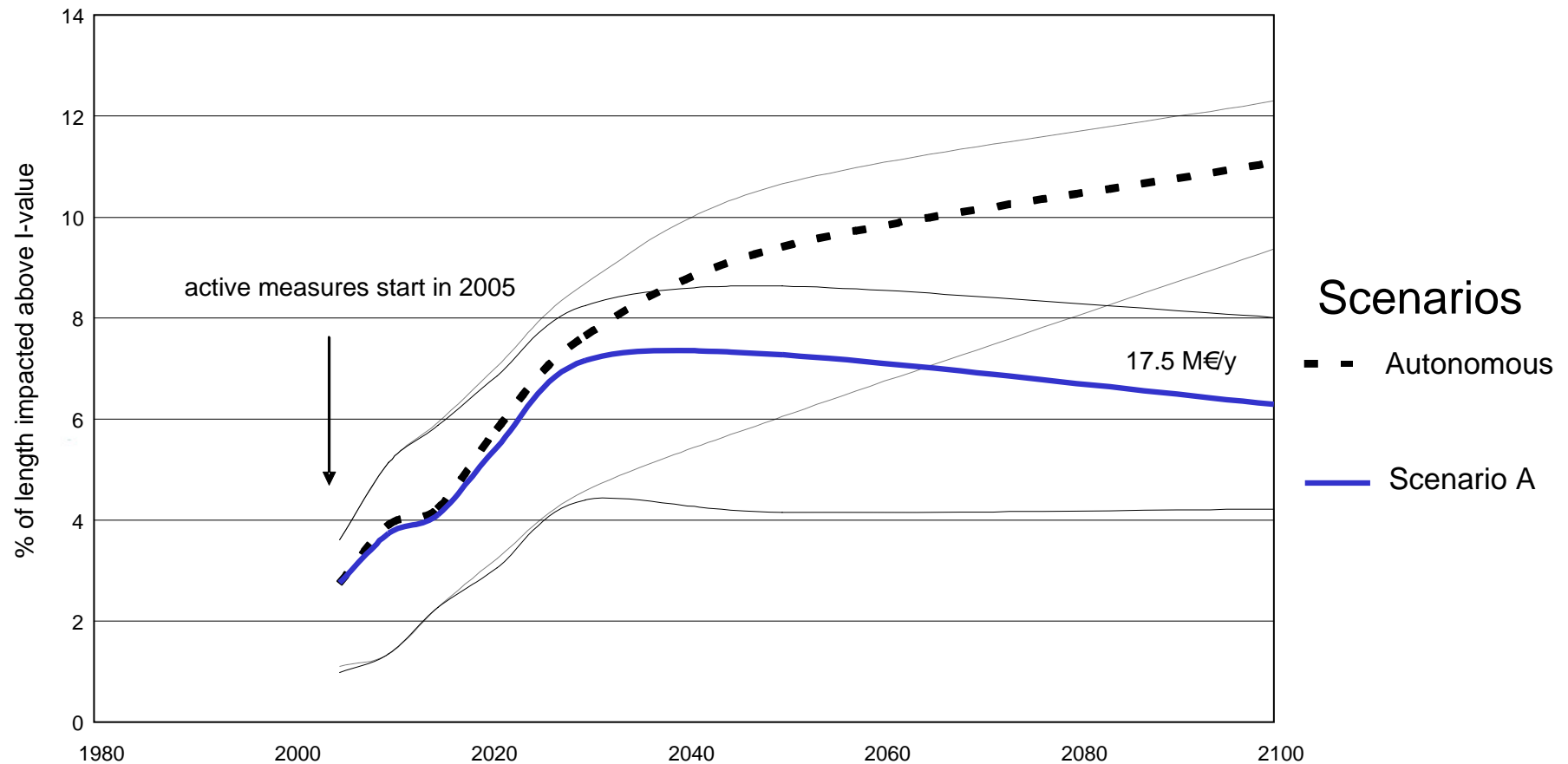
Autonomous scenario (impact on POC 3)



Scenarios for effect of risk management measures (e.g. source removal, NA, Isolation)



Effect of scenario A
(impact on 3rd plane of compliance)

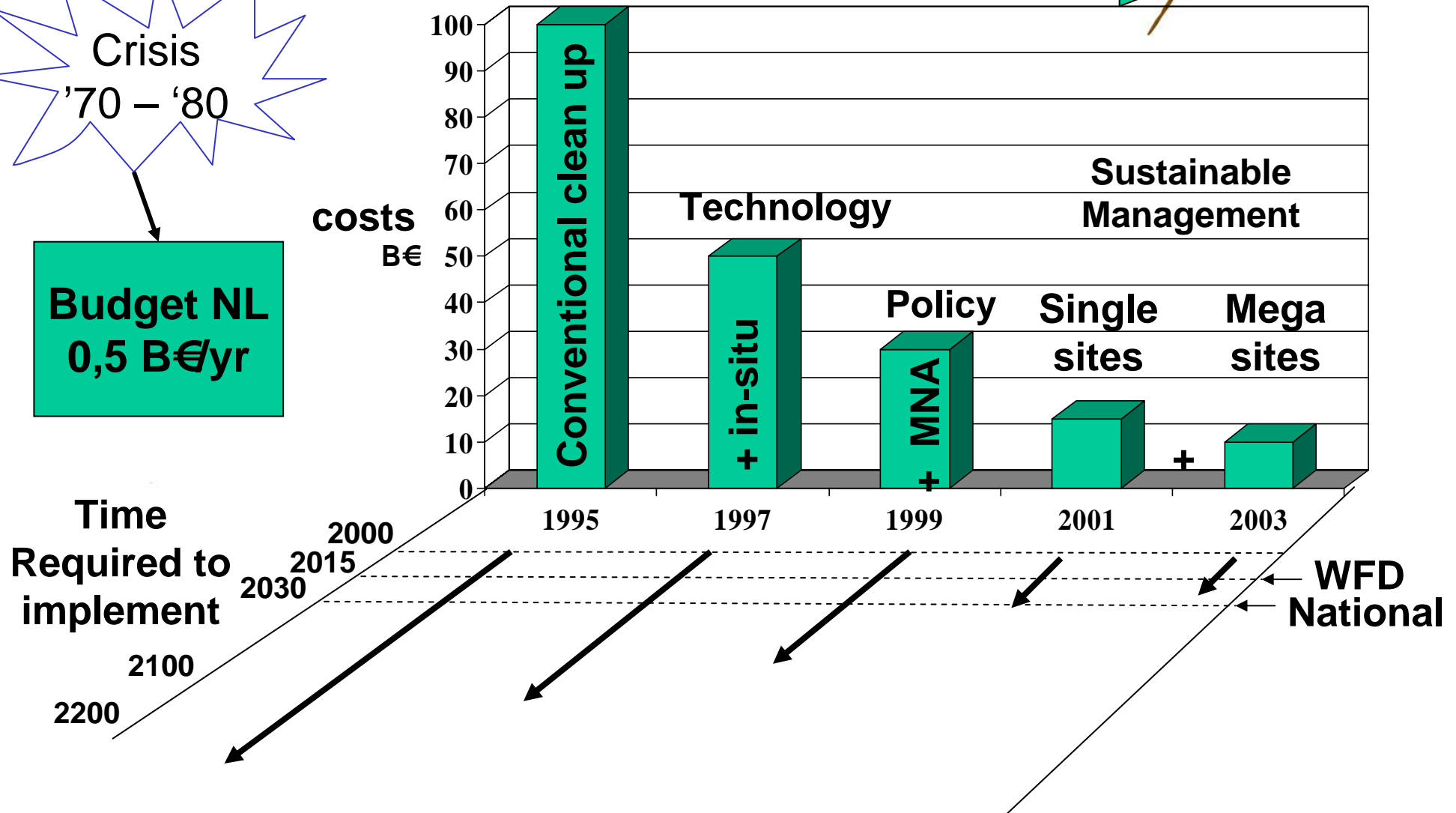


Soil and Groundwater Remediation: More than just technologies

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Netherlands Soil Partnership

Establish a central point for questions and challenges on soil and groundwater issues in the field of:

- Policy
- Law enforcement
- Science
- Implementation

Canadian-Dutch program next 3 years

- Organize public-private knowledge and experience network between both countries
- Connect Canadian and Dutch initiatives (projects, risks toolbox, ...)
- Financial instruments on Canadian and Dutch side
- Mutual international missions feasibility studies towards demonstration projects in four provinces
- Initiate market focussed co-operation in the chain
- Set-up of window of information
- Prepare and implement demonstration projects

Thank you for your attention !

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