



Manaaki Whenua  
Landcare Research

# Safeguarding the life-supporting capacity of soil

KI WENUA – LANDCARE RESEARCH





# Outline

- Overview of managing soil contaminants in NZ
- Developing Ecological soil guideline values (Eco-SGVs)
  - Trace elements
- Applications of Eco-SGVs
- Natural geochemically mineralised areas
- 'Surplus soils'

# Managing soil contaminants in NZ



Consenting processes

"Discharge shall not create a contaminated site"

Soil disposal- clean fill, managed fill

Waste disposal to land guidelines - WAC

Organic materials guidelines

Preventing soil contamination

**Protection of soil quality**

**Contaminated land management**

NES for soil contaminants to protect human health

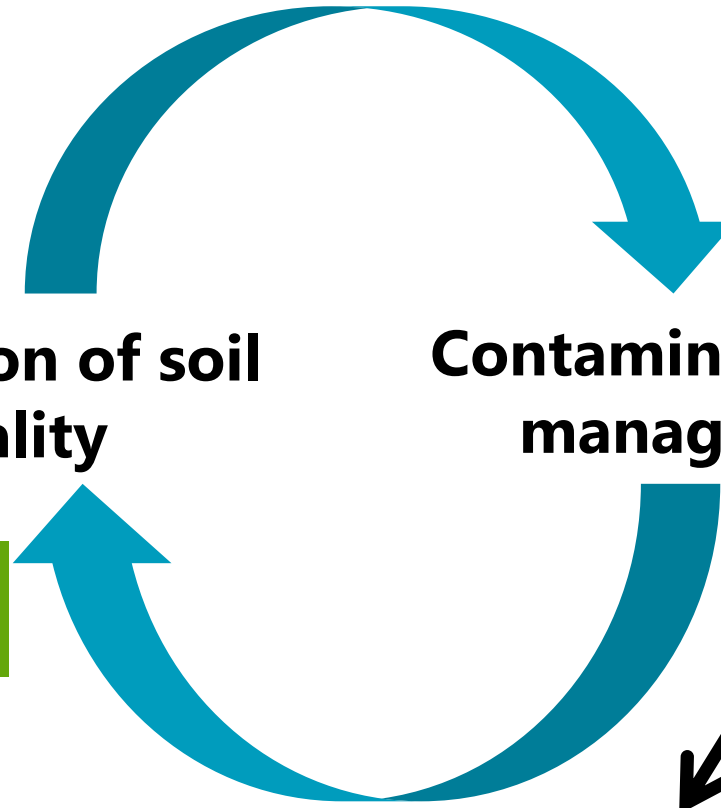
CLMG series

TFMS - Cd

Soil quality monitoring – SOE reporting

Identifying level of effect

Remedial or management activities



# Managing soil contaminants in NZ



Consenting processes

"Discharge shall not create a contaminated site"

Soil disposal- clean fill, managed fill

Waste disposal to land guidelines - WAC

Organic materials guidelines

Prevent contamination

**Missing gap: soil guideline values to protect ecological receptors**

Guidelines for soil contaminants to protect human health

CLMG series

TFMS - Cd

Soil quality monitoring - SOE reporting

level of effect

Remedial or management activities



# What are Eco-SGVs?

- Soil guideline values developed to protect terrestrial ecological receptors (soil microbes, invertebrates, plants, wildlife and livestock) from negative contaminant effects



- They provide a useful means to **initially** assess potential environmental impact /trigger further risk assessment



# What's been done?

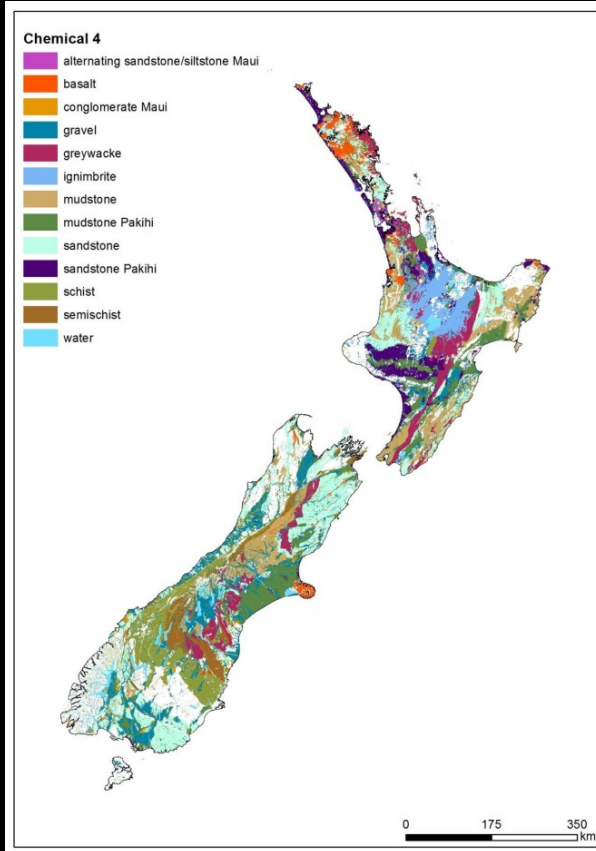
- Developed through tools project 2014-2016 (LMF, LMG, WCLF)
  - SGVs for 11 priority contaminants (9 inorganic, 3 organic)
  - Identified next steps
    - Technical review
    - Development of legislative framework
- International guidance released 2017, technical peer review 2018 → technical update in 2019
- 2022 Medium Advice Grant
  - Focus on context for application & integrating te ao Maori



# Very brief overview of the derivation method!



- “Added risk” approach for naturally occurring substances (trace elements) i.e.
  - $\text{Eco-SGV} = \text{background} + \text{added concentration}$



- National assessment 2015
- Updated analyses 2022 – collaborative with GNS





# Trace elements.....

- Some are essential elements (micro-nutrients)
  - E.g. Cu, Zn, Co, Mo, B
- Some are intentionally applied/used
  - Micronutrient fertilisers, pesticides - AsPb, Cu, Zn, Pb in petrol.....
- Some are present as contaminants in other products/activities
  - Cd, F, U in phosphate fertilisers, Pb-based paint, inappropriate disposal of waste eg electroplating wastes, waste application to land
- Some are naturally elevated eg in certain geologies = geochemically mineralised areas

## Eco-SGVs developed for.....

Arsenic (As)  
Boron (B)  
Copper (Cu)  
Cadmium (Cd)  
Chromium (Cr)  
Fluoride (F) - provisional  
Lead (Pb)  
Zinc (Zn)

## Organic contaminants

Dichlorodiphenyltrichloroethane  
(DDT)  
Total petroleum hydrocarbon (TPH)  
Polycyclic aromatic hydrocarbons  
(PAH)



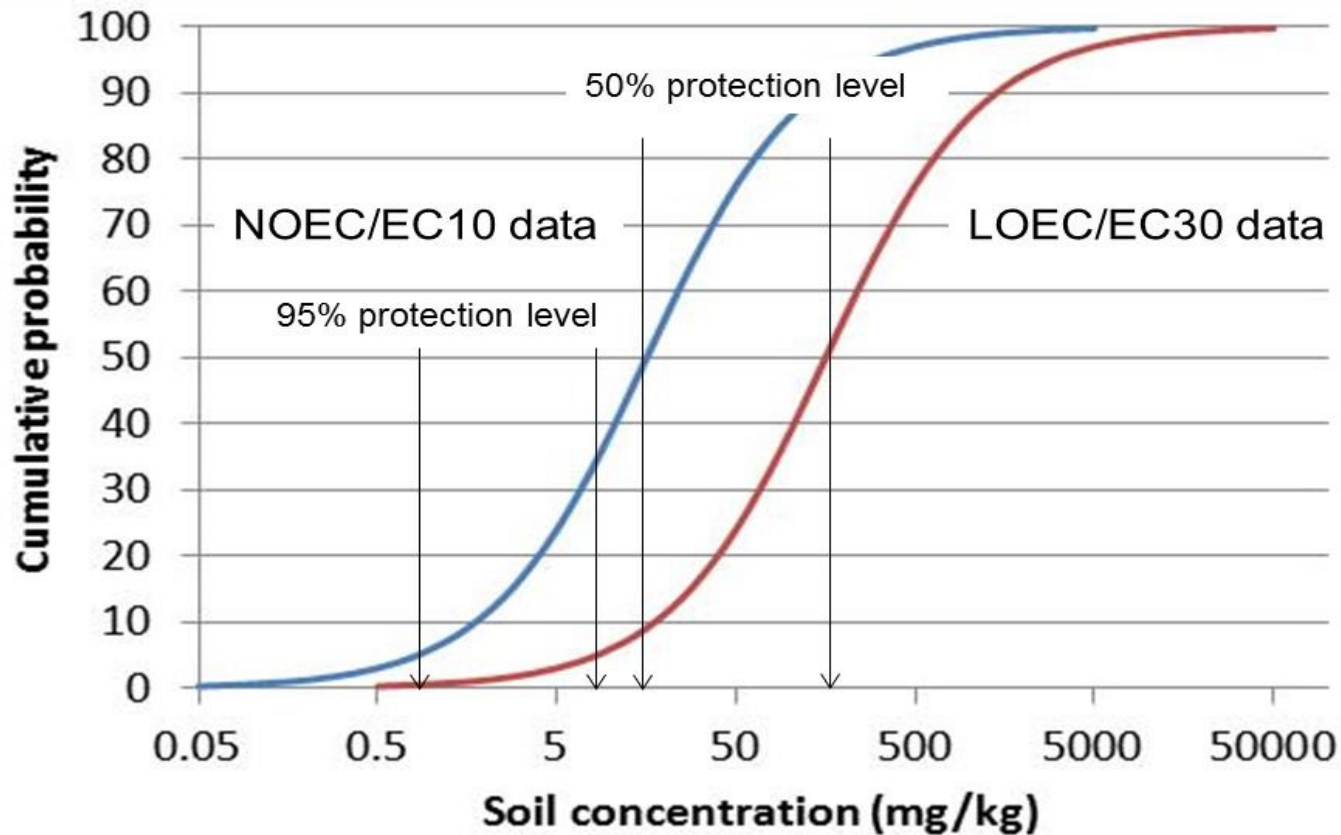


## Eco-SGV approach...

- “Added risk” approach for naturally occurring substances  
i.e.
  - $\text{Eco-SGV} = \text{background} + \text{added concentration}$
- Toxicity data selection from literature
- Accounting for ageing/leaching
- Developed for reference soil/s (influences bioavailability)
  - Sensitive, typical, tolerant (Cu and Zn only)
- Species-sensitivity distribution if sufficient data (statistics)
  - BurliOZ 2 software
  - Originally based on different levels of protection for different land-uses



# Eco-SGV approach...



**Problem: not widely used as lack of national direction/consensus on application**



# Next steps to facilitate uptake/use

- Envirolink Medium Advice Grant – completed June 2022, MDC
  - Focus on context for application & integrating te ao Māori
  - Māori, central & local govt, & enduser workshops
- Tools project – commenced July 2022 (WCLF, LMF)
  - Detailed policy/reg assessment of implementation of ecological soil guideline values and sustainable management of 'surplus' soils
- Advisory group formed and intended to carry-through for both projects
  - comprised of representatives MfE, MPI, DoC, Regional, Unitary and District Councils, Wasteminz Contaminated land SIG, and Maori representatives



# Māori and central and local government workshop

- What are the desired outcomes from the use of Eco-SGVs?
- How could Eco-SGVs be used?
- What actions should be triggered as a result of non-compliance?
- And what should constitute non-compliance with Eco-SGV?
- Are the proposed land use categories (and associated levels of protection) appropriate? (are there potential additions eg. Māori customary use)
  - is any differentiation on the basis of land use appropriate?
- How should background soil concentrations be used?

# Te Ao Māori

- Important to understand Māori cultural values and key concepts in soil and land management to help set criteria to be culturally acceptable and meet Māori aspirations and needs.
- Cultural issue:
  - the potential mixing of soils (contaminated soils with uncontaminated soils, or soils from two different geographic areas with different whakapapa)
- Impacts on cultural values
  - papa kāinga (Māori communities, settlements and housing),
  - food harvest areas (e.g., maara kai and mahinga kai)
  - culturally important and significant sites (e.g., marae).
- A key application: use cultural values and ecological soil guidelines to improve the management/rehabilitation of soils in culturally important areas





# Fit with current and future legislation

- Current legislation (ie RMA, Regional Plans etc)
  - Guidance document to inform usage under existing regime
  - Identifying opportunities to connect with future legislation
- Future policy and legislation
  - Natural and Built Environment Act/National Planning Framework
  - Strategic Planning act
  - [National policy statement on highly productive land]
  - Environmental Reporting Act changes
- ...moving feast but there will be limits to protect human health and the ecological integrity of the natural environment (or both):
  - “the minimum biophysical state of the natural environment or of a specified part of that environment” or
  - “the maximum amount of harm or stress that may be permitted on the natural environment or on a specified part of that environment”





# Revised Application of Eco-SGVs

Value name (% protection)	Protection of soil quality	Contaminated land management
Target limit value (95%)	<p>Regional council <b>State of the Environment monitoring</b></p> <p><b>Discharge consent limits</b>, including for <b>application of wastes*</b> (e.g. biosolids, cleanfill, managed fill) <b>to land</b> and compost/mulch products</p> <p><i>Iwi/hapū/Māori achieve soil health goals, reflecting cultural values</i></p>	<p>Potential remediation targets (<b>except</b> Cu, Zn)</p> <p><i>Te ao Māori aspirations are met for achieving or maintaining mauri</i></p>
Site investigation trigger (80%)	NA	<p>‘Soft’ trigger level for site investigation, - Identification of contaminated land, where HH is not driver</p> <ul style="list-style-type: none"><li>- leading to identification for mitigation options (e.g. where source can be reduced, active management to reduce concs (Cu, Zn), includes assessment of offsite risks</li><li>- <i>May assist Māori in co-management plans</i></li></ul>
Limit (60%)	NA	<p>‘Hard’ trigger level for site investigation, greater expectation of ‘action’ to improve environment</p>



# Protecting soil quality

- 'Awareness-raising'
  - Regional council SOE monitoring
  - Production land\*
  - Special non-regulatory use - e.g. maara kai, mahinga kai, community gardens – need combined HH and Eco-SGVs (& food consumption)
- Compliance & consenting
  - Discharge limits
  - Landfill waste acceptance criteria
    - Classes 3-5, 95<sup>th</sup> percentile vs Eco-SGV
- Soil replacement (organic products)

Contaminant	Soil target* (mg/kg)
As	20 [17]
B - HWS	7
Cd	1.5 <sup>1</sup> [0.8]
Cr	190
Cu	100
Pb	280 [160]
Zn	170

\*Lowest median background, 'typical' soil, 95% protection

<sup>1</sup> Additional consideration for compliance with food standards

Italics = HH values

\* See Cadmium fact sheets developed by Cadmium Management Group (MPI & industry websites)



# Contaminated land management guidance

- Do not over-ride human health values (also developed combined values for NES land-uses)
- Propose using same triggers as NES e.g. land disturbance, and CLMG#5 guidelines
  - **Key gap (including under existing regime)** is management of contaminated sites that don't undergo land use change
- Key changes/differences (**updates required**)
  - requirement to consider onsite ecological receptors (soil microbes, plants, soil invertebrates) during PSI and DSI
  - same Eco-SGVs apply across all land uses (cf HH SCS)
  - Exclusion for commercial sealed/impervious soil e.g. compacted roadways
- Tools project – policy regulatory review & developing framework for implementation



# Proposed actions in event of non-compliance

Value name	Information source	Action in event of non-compliance
Target value (95%)	DSI	Nothing other than potentially information to land manager about improving soil quality. Can be <b>potential remediation targets</b> (except for Cu and Zn)
Site investigation trigger – ‘soft’ action level	DSI	Site investigation report includes <b>assessment of options for mitigating risk eg reducing any ongoing inputs of eg Cu, Zn, as well as assessment of potential offsite risks</b> . Advice on actions to remediate/reduce contaminant concs/mitigate risk to land-owner/ manager.  Potential value to <b>identify contaminated land</b> for all land uses except commercial/industrial
Limit value – ‘hard’ action level	DSI, further investigation/ risk assessment	The intent is that non-compliance at this level gives rise to <b>greater requirement to further assess risk/effect from contaminants including offsite risks, and risk mitigation</b> – the incentive for risk assessment over ‘dig and dump’ is that demonstration of no effect/no risk can provide the basis for no further action (and therefore reduced cost).  Potential value to <b>identify contaminated land</b> for commercial/industrial land.



# Key areas for further guidance/consideration



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## Exploring the implementation of ecological soil guideline values for soil contaminants

Envirolink Grant: 2214-MLDC162

Prepared for: Marlborough District Council

June 2022

- Use of background soil concentrations
  - When should it be relevant to adjust Eco-SGVs?
  - Regional vs national determination of background soils
  - **Identification of mineralised areas**
- Evaluation of 95<sup>th</sup> percentile background vs EcoSGV (based on median background concentration)
  - Particularly relevant for cleanfill criteria
- Guidance around sampling/consideration of ecological receptors for contaminated site investigations (Tools project)



# Knowledge gap – naturally mineralised areas



- Specific areas have **naturally elevated** trace elements – location unknown
- How do TE **flow** from these areas into terrestrial and aquatic environments?
- Differentiating human and ecological risk of **natural vs anthropogenic** elevation
- Cultural connection
- Critical to inform **management** of potentially toxic elements in soil





# Tools project

- Policy and regulatory aspects in the implementation of Eco-SGVs
  - Detailed policy and regulatory review - current and future policy/legislation
  - A framework for implementation of Eco-SGVs
- Sustainable management of “surplus soils” to achieve better overall environmental outcomes
  - Understanding the drivers, working towards better solutions
  - End output is a guide to assist in decision-making (and draws in te ao Maori)
  - First activity – ‘interested parties’ workshop to brainstorm factors leading to the generation of ‘surplus soils’ and barriers to reuse



# Surplus soils definition – work in progress

- Soils are those that have been disturbed (and extracted) through natural (e.g. land-slips) and anthropogenic activities (e.g. land development, utilities installation) but are unable to be used or kept onsite, or are excess to requirements  
[note excludes quarries]





# Surplus soils workshop

**Developer drivers** – avoidance of legacy risk, building preferences, lack of storage space, lack of incentives/disincentives

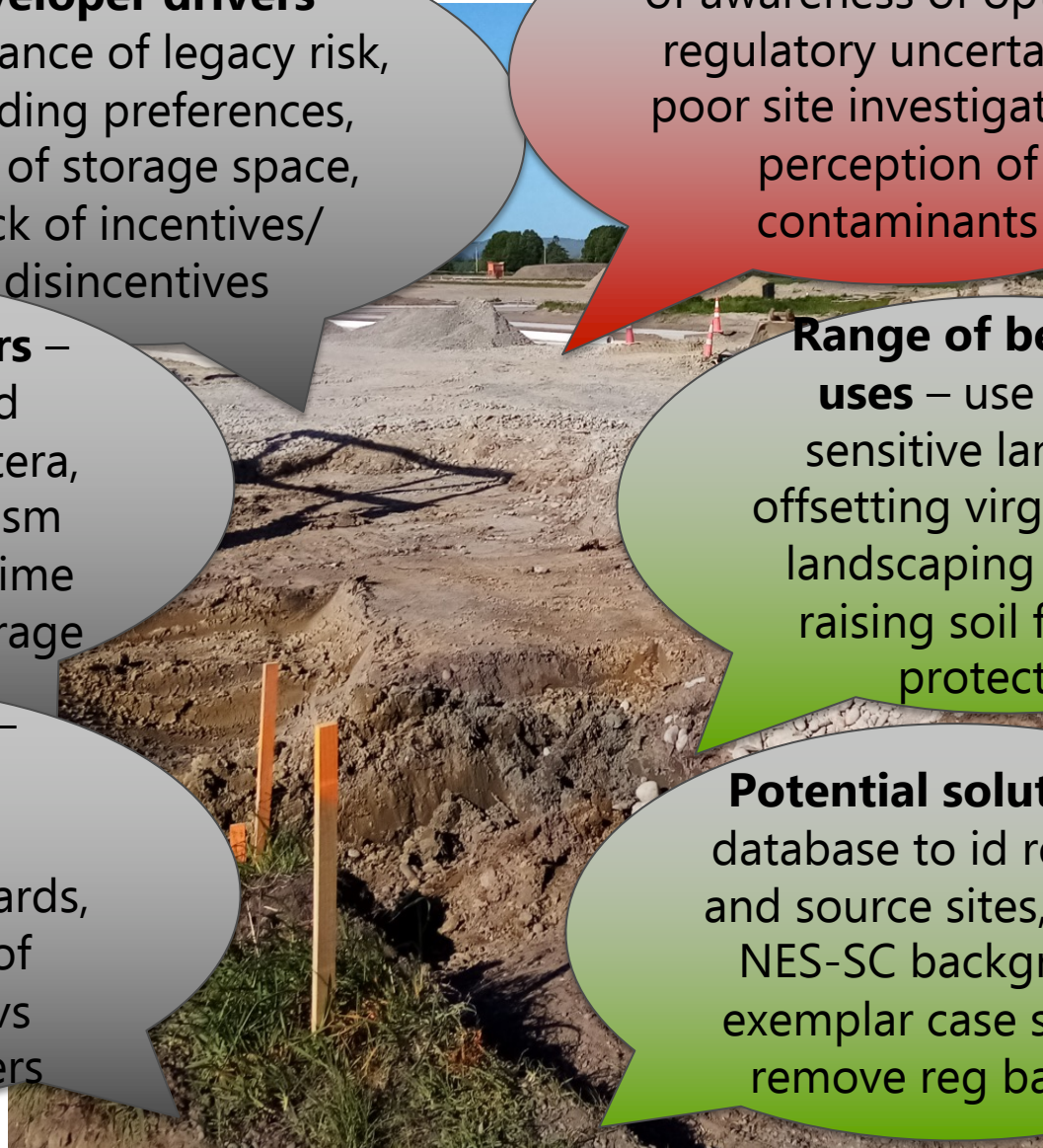
**Barriers to reuse** – lack of awareness of options, regulatory uncertainty, poor site investigations, perception of contaminants

**Regulatory drivers** – NES background concs/clean-fill criteria, council conservatism and/or expertise, time for consent for storage

**Range of beneficial uses** – use in less-sensitive land-uses, offsetting virgin soil use, landscaping features, raising soil for flood protection

**Other drivers** – Geotechnical requirements, engineering standards, differing levels of scrutiny public vs private developers

**Potential solutions** – database to id receptor and source sites, amend NES-SC background, exemplar case studies, remove reg barriers





# Surplus soils workshop

**Developer driven**  
avoidance of  
building  
lack of  
lack

**Barriers to reuse** – lack of awareness of options, regulatory uncertainty, poor site investigations, poor perception of contaminants

**Regulatory driven**  
NES background  
concs/clean-fill  
council consent  
and/or expertise  
for consent for

**Other drivers**  
Geotechnical  
requirements  
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differing levels of  
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private developers

## Next steps

- Identify key issues to be tackled within tools project, pathways for other issues
- Characteristics of soil for different beneficial re-use
  - Identify case study examples
  - Develop guidance
    - Workshops

**Range of beneficial uses** – use in less-sensitive land-uses, avoiding virgin soil use, landscaping features, using soil for flood protection

**Potential solutions** – base to id receptor source sites, amend NES-SC background, exemplar case studies, remove reg barriers



# Invitation!

- Feel free to get in touch if you are interested
  - in being involved in future workshops on
    - on the implementation of Eco-SGVs
    - Management of surplus soils
  - Further discussions on challenges and opportunities associated with ecosystems and potentially toxic elements from naturally mineralised areas



A landscape photograph showing a mountain valley. In the foreground, there are large, dark grey rocks and tall, brownish-green grasses. A path or road is visible, winding through the valley. The middle ground features rolling hills and mountains covered in sparse vegetation. The sky is filled with large, white and grey clouds. The overall scene is a natural, outdoor setting.

Any questions?

Old Ghost Road, West Coast