

# Biosolids & Sludges

Matching Material and Land  
for Beneficial Use

Katie Beecroft

## Purpose and Technical Framing

- Biosolids and sludges are **heterogeneous products** applied to **heterogeneous environments**
- Risk and benefit are largely determined by **matching product quality to receiving environment**

Moving from “**Can we apply?**” to  
“**What product, where, and why?**”

# Biosolids and Sludge Products: The Spectrum

1

Stabilised biosolids  
(various grades)

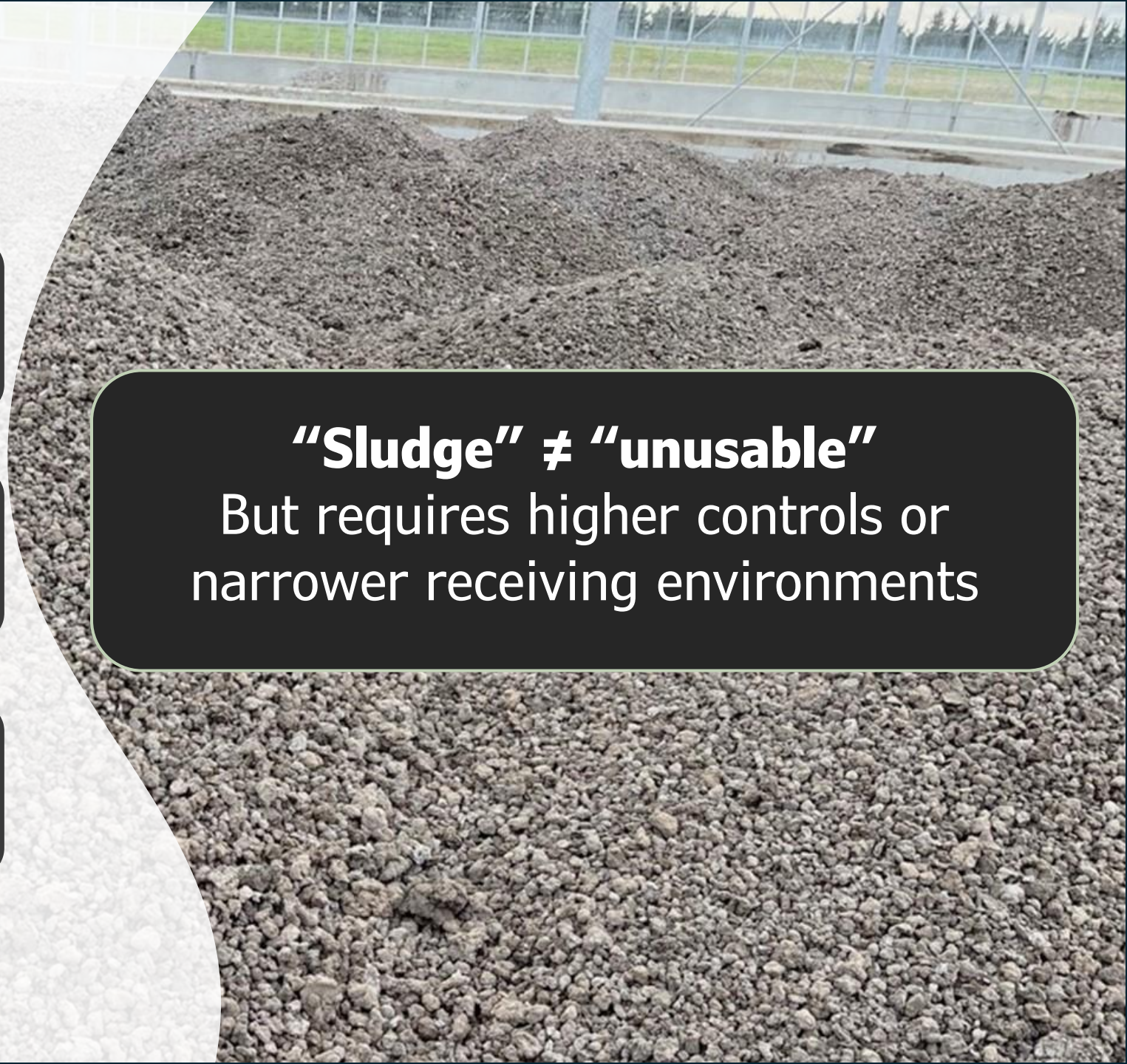
2

Treated but non-compliant  
sludge products (pathogens,  
metals, or stability)

3

Liquid vs dewatered  
products

**“Sludge” ≠ “unusable”**  
But requires higher controls or  
narrower receiving environments



## NZ Regulatory Context (Risk Based)

- Graded and tiered approach under NZ Biosolids Guidelines
- Regional plan rules, RMA (?) consent pathways and WEPS
- Increasing scrutiny on contaminants and cumulative effects

**Regulation supports site specific risk assessment, not one size fits all pathways**

## Tailoring to Soil and Geology



### Key Soil Factors

- Texture, structure, drainage class
- pH, Cation exchange capacity (CEC), Anion Storage (ASC)
- Background nutrients and metal status

Neutral pH high CEC, high ASC, deep soils → greater buffering for metals

Poorly drained or shallow soils → limited suitability for high N or liquid products

Sludge products → only appropriate where pathogen die off, nutrient and contaminant retention, and monitoring can be demonstrated

# Managing Risk



## Hydroclimatic Controls (understand)

- Rainfall intensity and seasonality
- Evapotranspiration balance
- Depth to groundwater and aquifer vulnerability



## Risk Pathways (evaluate)

- N leaching to groundwater
- Particulate and dissolved P to surface water
- Transport of pathogens during storm events



## Product Alignment (mitigate)

- Liquid or low-stability products → dry seasons, low runoff risk
- Sludge products → locations with **large separation distances**, low recharge, and strong attenuation

# Material Handling



## Dry: >85% solids

- Fertiliser spreader or helicopter hopper
- Falls through foliage / established vegetation
- Cultivation not required
- Slow to incorporate and release nutrients



## Spadeable: 15-30% solids

- Muck spreader
- Application at cultivation
- Flat to rolling sites
- Growing season release of nutrients



## Wet: 2-8% solids

- Direct injection, discing
- Apply to growing crop
- Best suited to pasture
- Flat land
- Supply of water as well as rapidly available nutrients

# Land Use, Receptors, and Community Context

## Land Use Compatibility

- Forestry, cropping, pastoral, rehabilitation land
- Harvest timing and withholding periods

## Human and Ecological Receptors

- Proximity to dwellings, wāhi tapu, waterways
- Stock access and food-chain exposure

## Social Licence

- Odour, traffic, visibility
- Sludge applications often require **higher engagement thresholds**



## Case Study: Sludge Application to Dry Land

### Material

- Minimally stabilised WAS, municipal wastewater plant
- Complies with contaminant grades
- Other wastes to be applied

### Landscape Parameters

- Brown Soils
- Semi-arid climate
- Predominantly flat
- Fodder crop and low intensity drystock
- ~ 4 m groundwater depth



## Case Study: Sludge Application to Dry Land

### **Adaptive Management**

- Product characterisation frequency
- Soil and water trend monitoring
- Trigger levels and response actions

### **Operational Controls**

- Setbacks, incorporation, application rates
- Integration with other site activities
- Contractor competence and QA/QC

Site matched products +  
monitoring = **defensible risk  
management**

## Key Conclusions

- Biosolids management success is driven by **contextual fit**
- Lower-grade products are not automatically excluded, but **their use is more restricted and needs higher management controls**
- Technical evidence underpins regulatory approval and social acceptance

### LOOKING AHEAD

- Emerging contaminants and evolving consent conditions
- Increasing need for **bespoke product-site matching frameworks**

L  W E  
Environmental  
I m p a c t



office@lei.co.nz | www.lei.co.nz | 06 359 3099