The 5 Fundamentals of Successful Rehabilitation of Disturbed Lands

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Overview

- Introduction to DURA Veg – PGG Wrightson Turf
- Overview of “The 5 Fundamentals”
  - Understand Your Substrate
  - Pick the Right Plant Species
  - Select the Correct Erosion Control Material
  - Ensure Proper Installation
  - Follow-up Inspection and Maintenance
- Successful Case Histories
- Q & A

DURA Veg™
Sustainable revegetation

PGG Wrightson Turf is part of PGG Wrightson Seeds LTD, Australasia's largest proprietary seed business.

DuraVeg™ sustainable revegetation from PGG Wrightson Turf delivers a complete range of revegetation, rehabilitation, soil stabilisation, dust and erosion control solutions across the full range of environmental conditions that Australasia can deliver.

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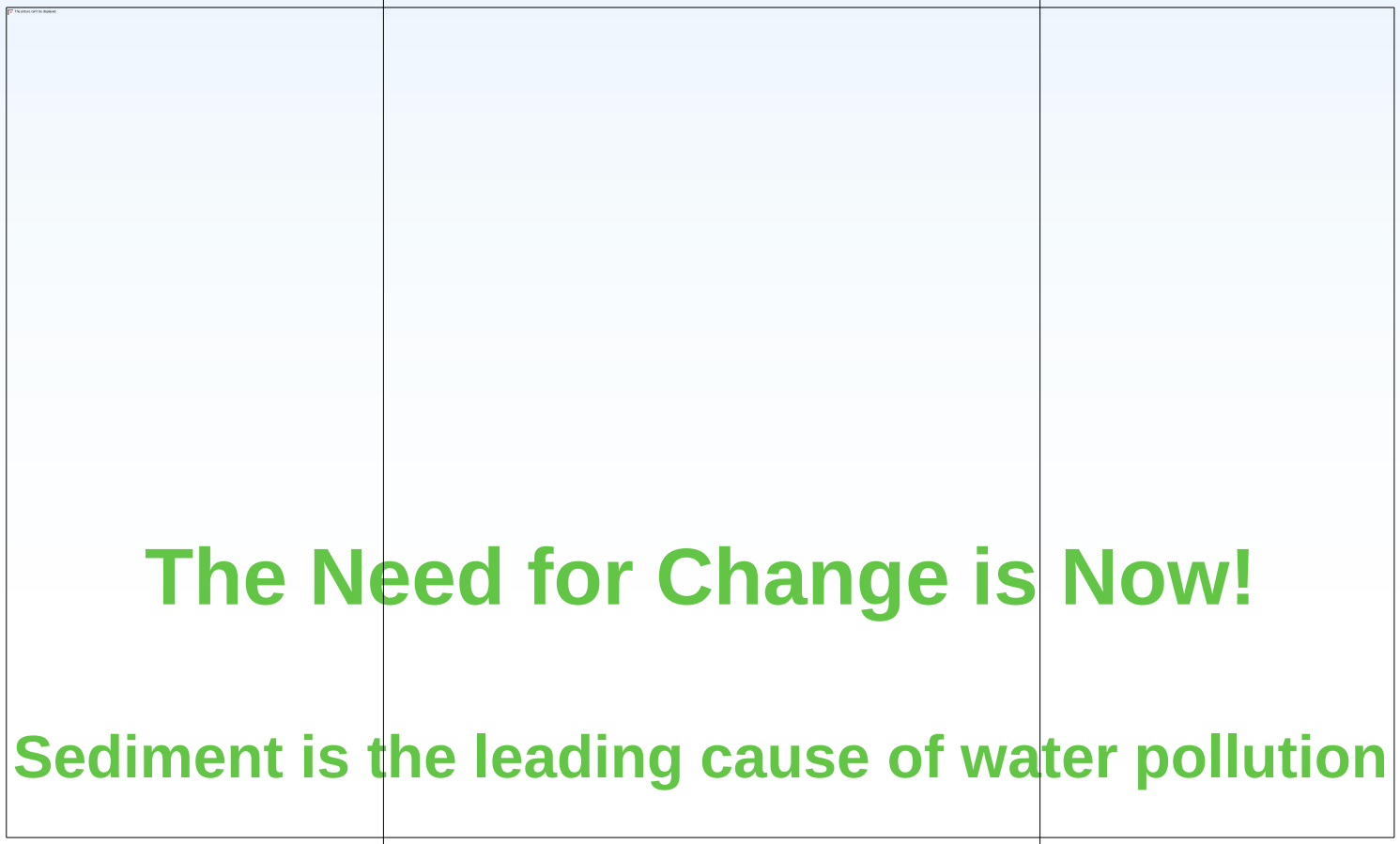

The Need for Change is Now!

Sediment is the leading cause of water pollution

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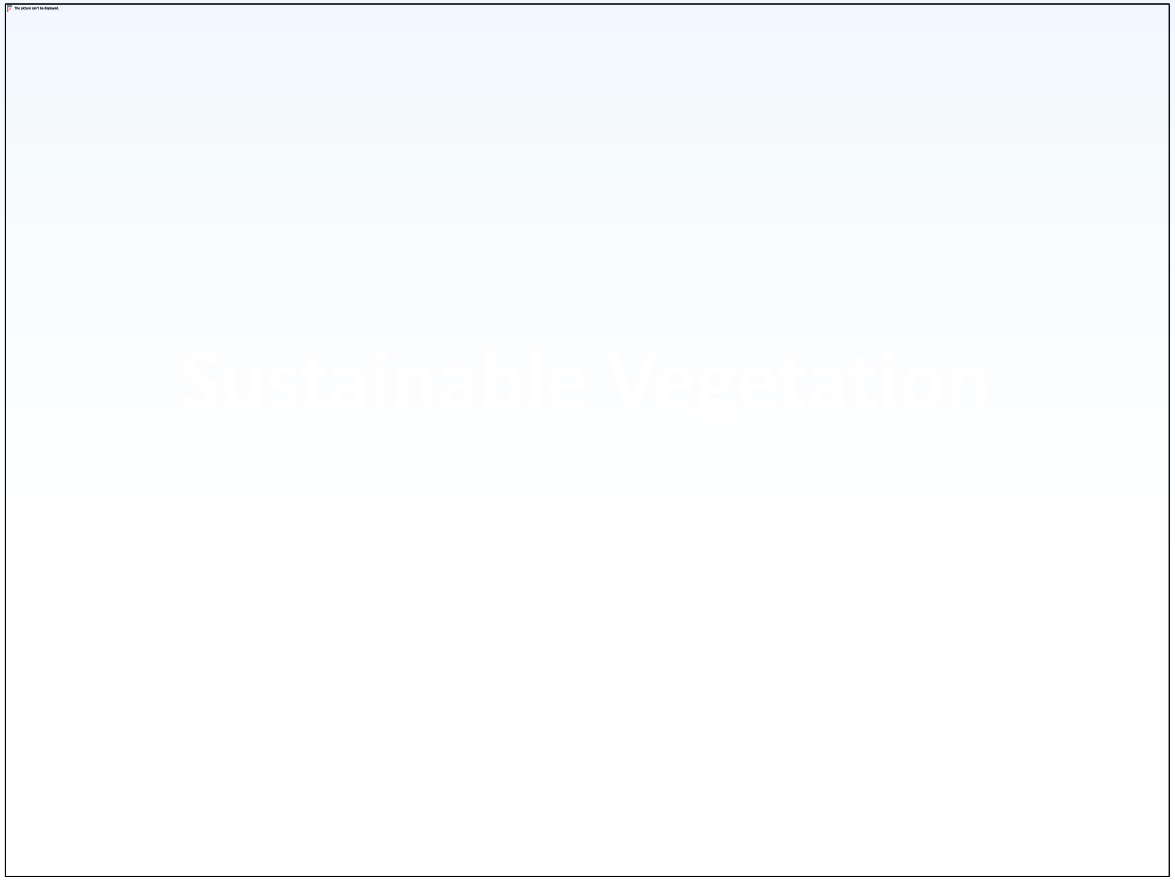
What is the most cost-effective form of erosion control?



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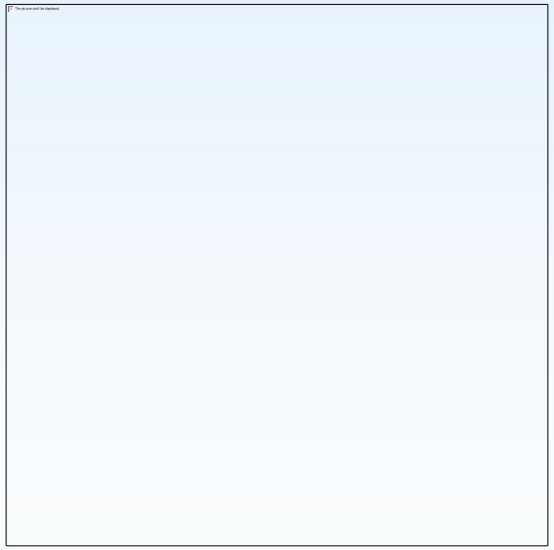
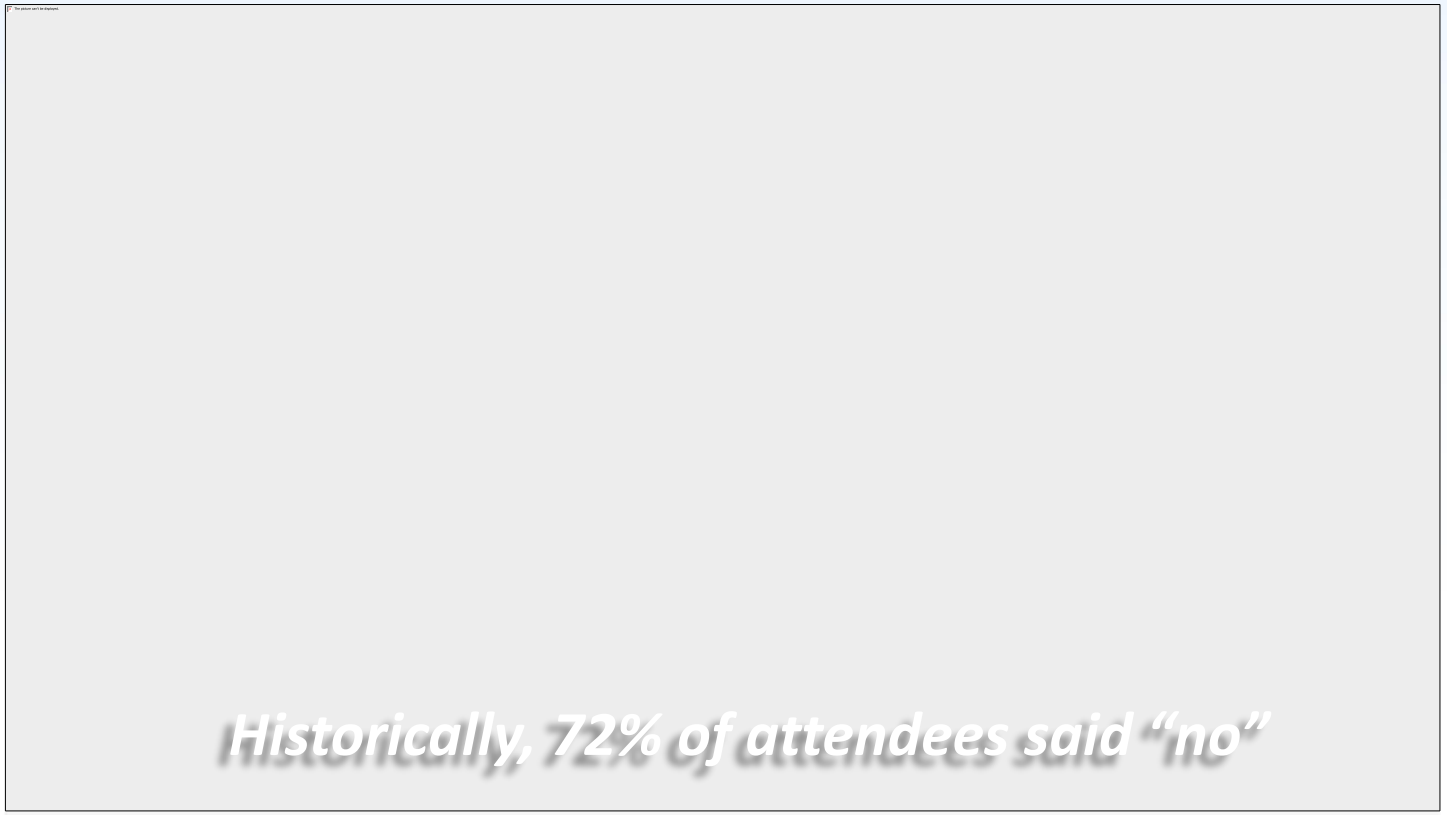


Create Optimal Soil Conditions

Fundamental #1

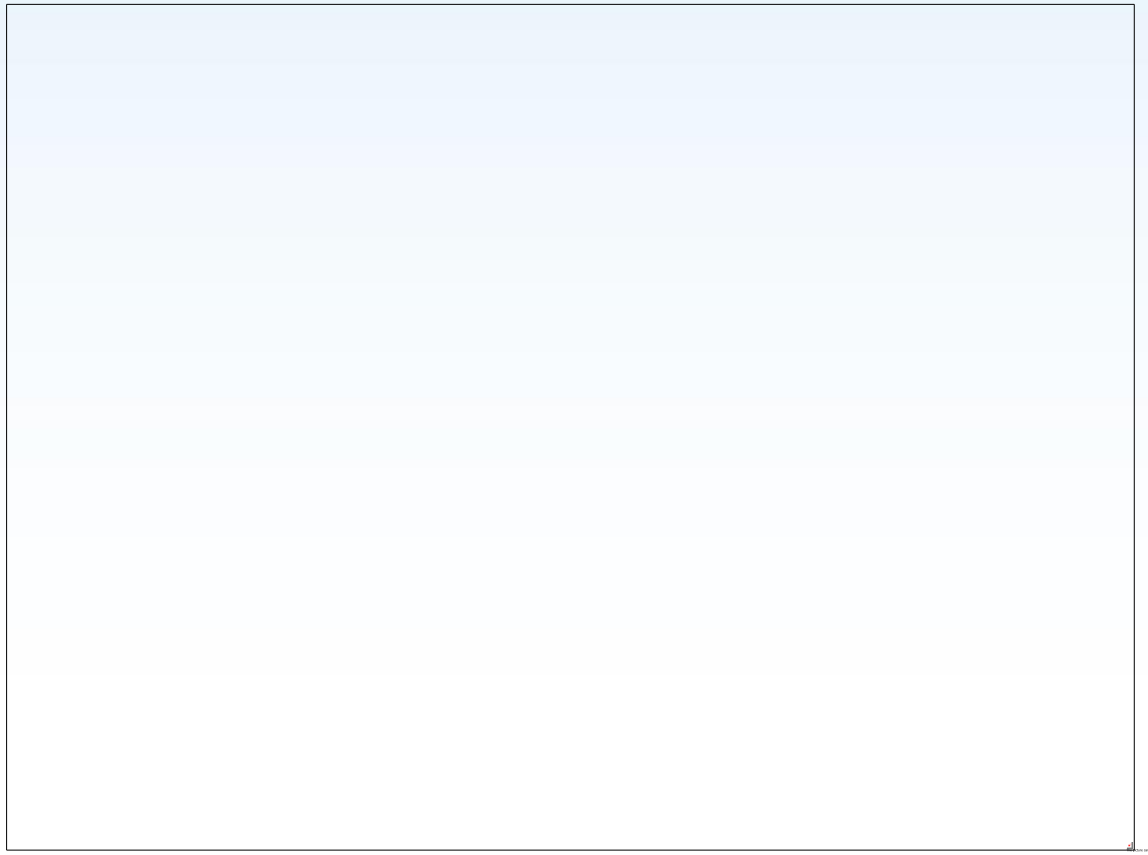
Do you routinely conduct soil testing for agronomic potential when designing or installing a project?

- ❑ Yes
- ❑ No



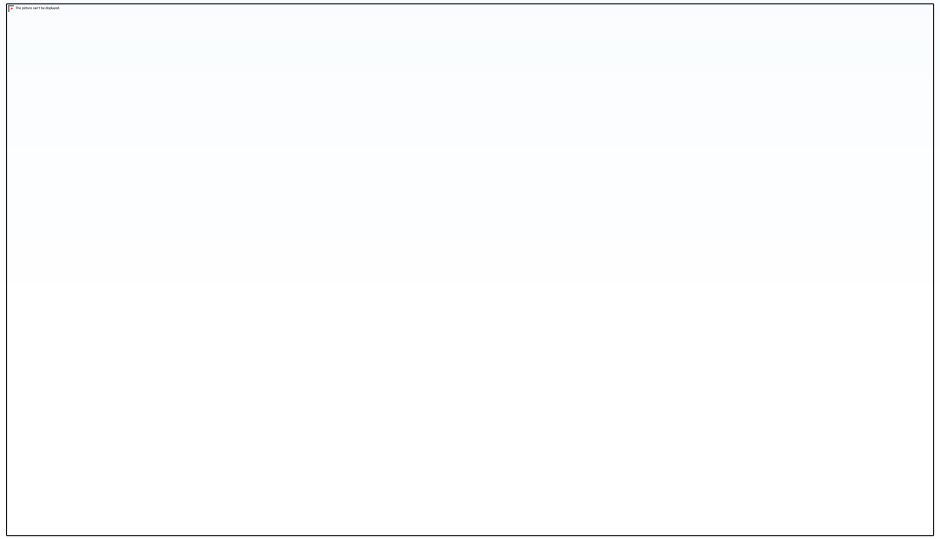
Create Optimal Soil Conditions

- Evaluate soil fertility
- Provide a basis for amendment recommendations
- Help ensure appropriate plant species selection
- Predict probability of desired outcome



Start with a soil test

- Texture/Type – sand, silt, or clay?
- pH – to determine soil acidity or alkalinity
- % Organic Matter and Organic Acids
- Phosphorus and Potassium (P, K)
- Cation Exchange Capacity (CEC)
- Sodium Adsorption Ratio (SAR)
- Excess metals and salts



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PLANT NUTRIENT AVAILABILITY

SOIL ACIDITY

4.0	10%	-90%
4.5	29%	-71%
5.0	46%	-54%
5.5	67%	-33%
6.0	80%	-20%
6.3	100%	0%
7.3	100%	0%
8.0	80%	-20%
8.5	67%	-33%
9.0	46%	-54%
9.5	29%	-71%
10.0	10%	-90%

SOIL ALKALINITY

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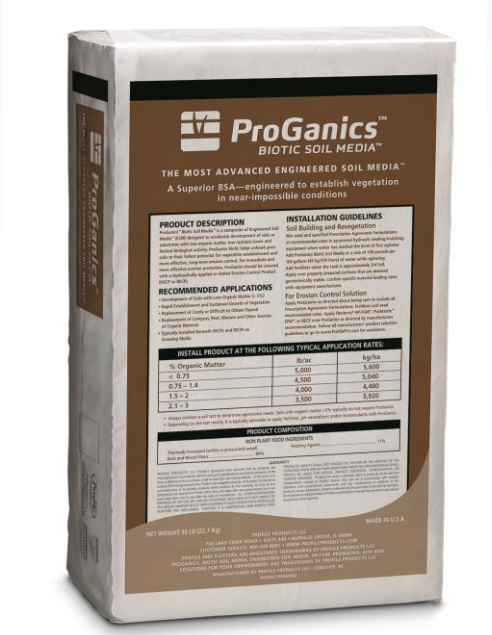
Agronomic Amendments

- Fertilisers
- Soil Neutralizers
- Growth Stimulators and Enhancers
- Biotic Soil Media



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ProGanics™
BIOTIC SOIL MEDIA™

Topsoil replacement option

- Low organic matter
- Topsoil placement impractical
- Needed to assist vegetation establishment

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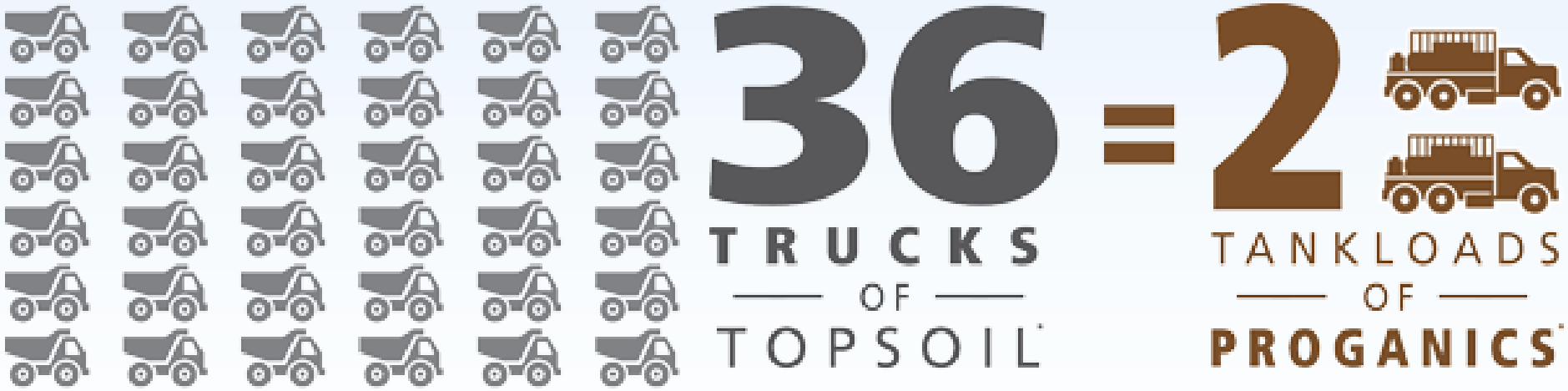

- 36 trucks is the amount needed to cover 0.4 hectares with 10 cm of topsoil (based on 11.5 cubic metre capacity dump truck).

** 2 tankloads is based on a 3,000-gallon capacity hydroseeder equipped with gear or positive displacement pump. ProGanics is applied at 3,900-5,600 kg/ha.
1815 kg of ProGanics provides the same amount of organic and soil building components per 4000m2 as 36 loads of rich topsoil. *Separation layer will be required on highly deficient soils.*

ProGanics Composition Benefits

- **Renewable Thermally Refined® Bark and Wood Fibers** –phyto-sanitized fibers to provide maximum soil coverage without weed seeds and pathogens

- **Biochar** – Nutrient and water holding benefits

- **Cross-linked Biopolymers** – high-loading, fast mixing and excellent shoot-ability due to increased water-holding capacity, viscosity and bond strength of the media matrix

- **Seaweed Extract, Humic Acid and Endo Mycorrhizae** — grows vegetation quickly and has been proven under demanding conditions in a wide variety of environments

Warkworth – NZ

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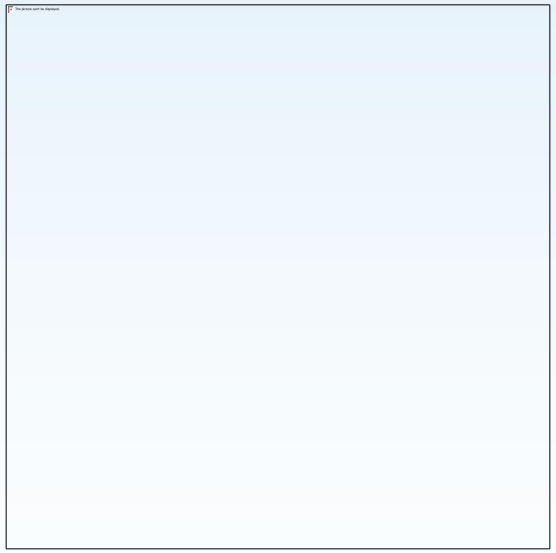
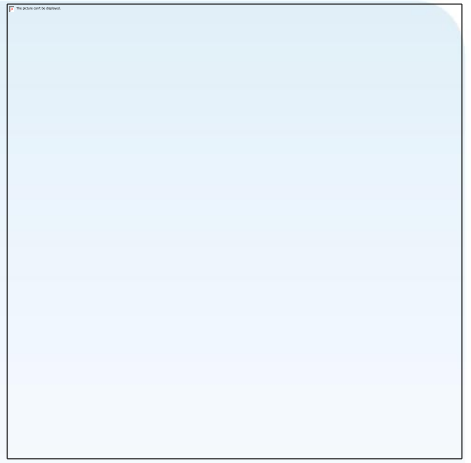


Pick the Right Plant Species

Fundamental #2

Fundamental #2

Pick the Right Plant Species



- Site location?
- Site characteristics – such as elevation, topography, aspect, climatic conditions
- Soil characteristics from soil tests?
- Desired plant materials
- Permanent or temporary vegetation?
- When will the installation occur - seasonality?
- What is the intended application?
- Maintenance activities – irrigation, mowing, supplemental amendments or grazing?

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Common Seed Selection Mistakes

- Mix not adapted to site conditions
- Mix not balanced to develop species diversity
- Too much seed in the mix
- Too much cover crop in the mix
- Seed mix “out of season”

Ecology

- Scars eventually repair naturally through succession.
- Rapid establishing species appear first.
- Replaced by long term species.
- Permanent species are those best adapted to the conditions.

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Specify quality seed

- Need to specify quality.
- Quality is value for money.

Certified seed

- Certified seed is genuine and meets purity standards.
- Only named cultivars can be certified e.g. “Certified Samson perennial ryegrass.”
- Seed over two years old needs germination certificate <12 months old.
- Specify certified seed <3 years old.

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Uncertified seed

- Common or variety not specified (VNS).
- No guarantee of authenticity.
- No standards of purity, may contain weeds
- No standards of germination.
- All uncertified seed needs a purity test and germination test <12 months old.
- Specify seed <3years old.

Nelson Fire Reclamation

Benefits of EcoTain *Plantago lanceolata*

- Wide ecological adaptation
- Fibrous root system
- Reduce the leaching of nitrate through soils through the reduction in the soil populations of ammonium oxidising bacteria
- High uptake of heavy metals through the roots into the plant compared to traditional ryegrass and white clover
- From spot loads, reductions of up to 89% have been reported.

Benefits of Jackal
Festuca arundinacea

- Rapid establishment rate
- Large root system
- Contains AR601 endophyte
- Bird deterrence
- Insect feeding deterrence

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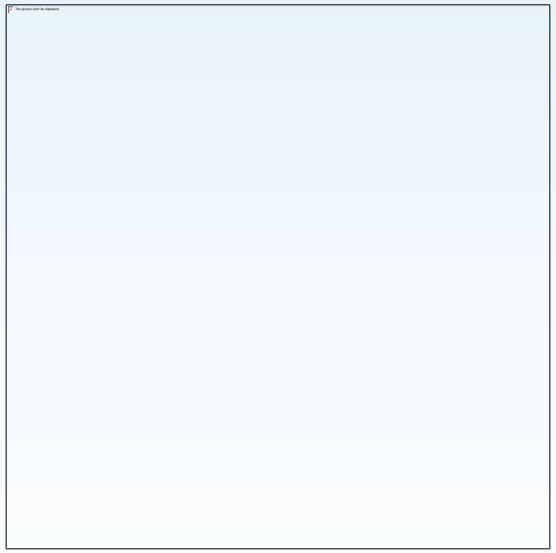


Select Right Erosion Control Material

Fundamental #3

Fundamental #3

Select Right Erosion Control Material

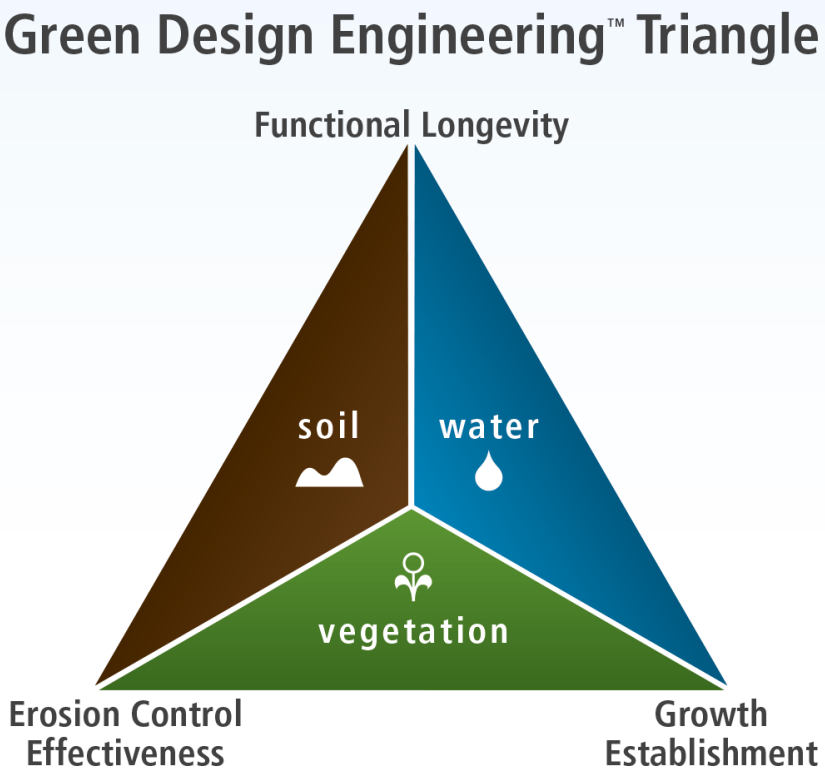
Establishing vegetation requires balancing

NATURAL VARIABLES

and

PRODUCT ATTRIBUTES

to create the best environment for growth and establishment



Hydroseeding System Performance Pyramid

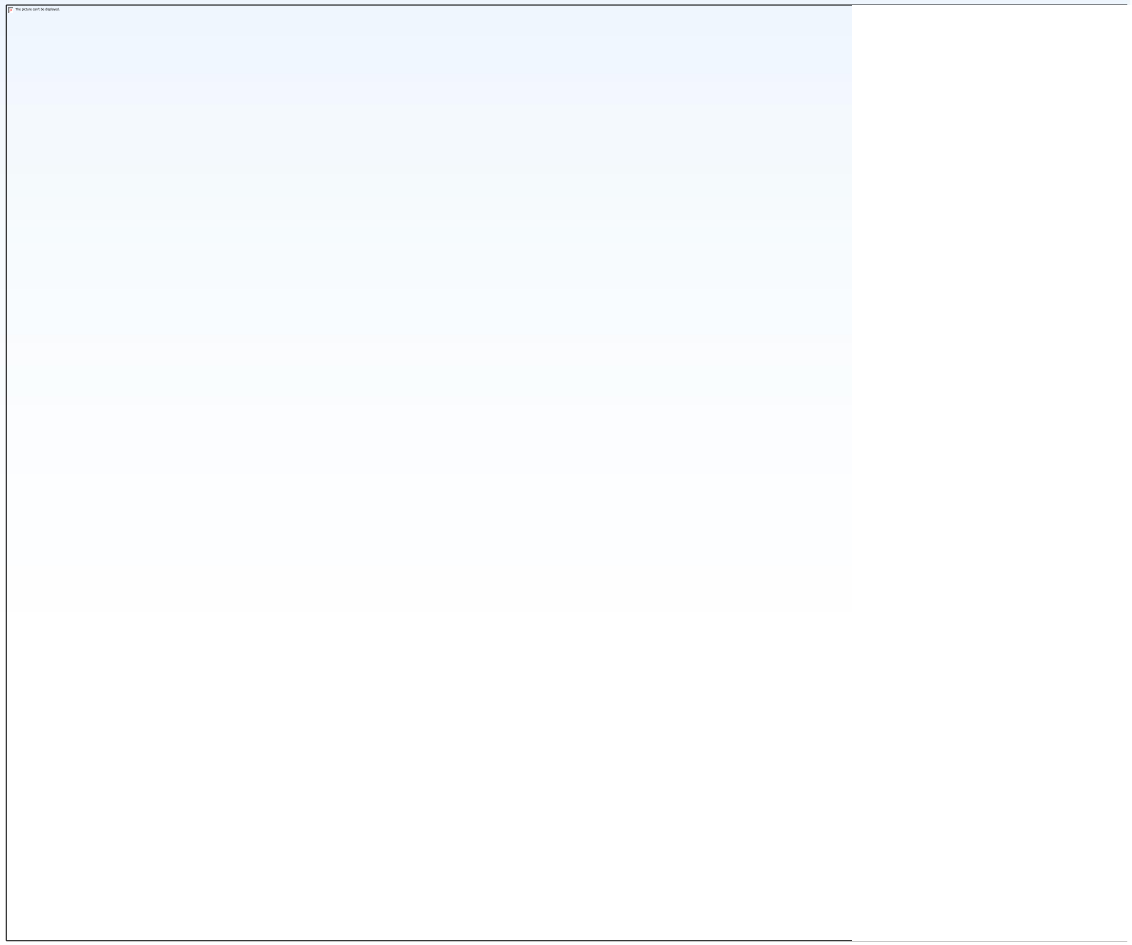
Turf Reinforcement Mats (TRMs)

Hydraulic Erosion Control Products (HECPs)

- Flexible Growth Medium (FGM)
- Bonded Fiber Matrix (BFM)

Hydraulic Mulches & Accessories (HMs)

- Basic hydraulic mulch products



Basic Hydraulic Mulches

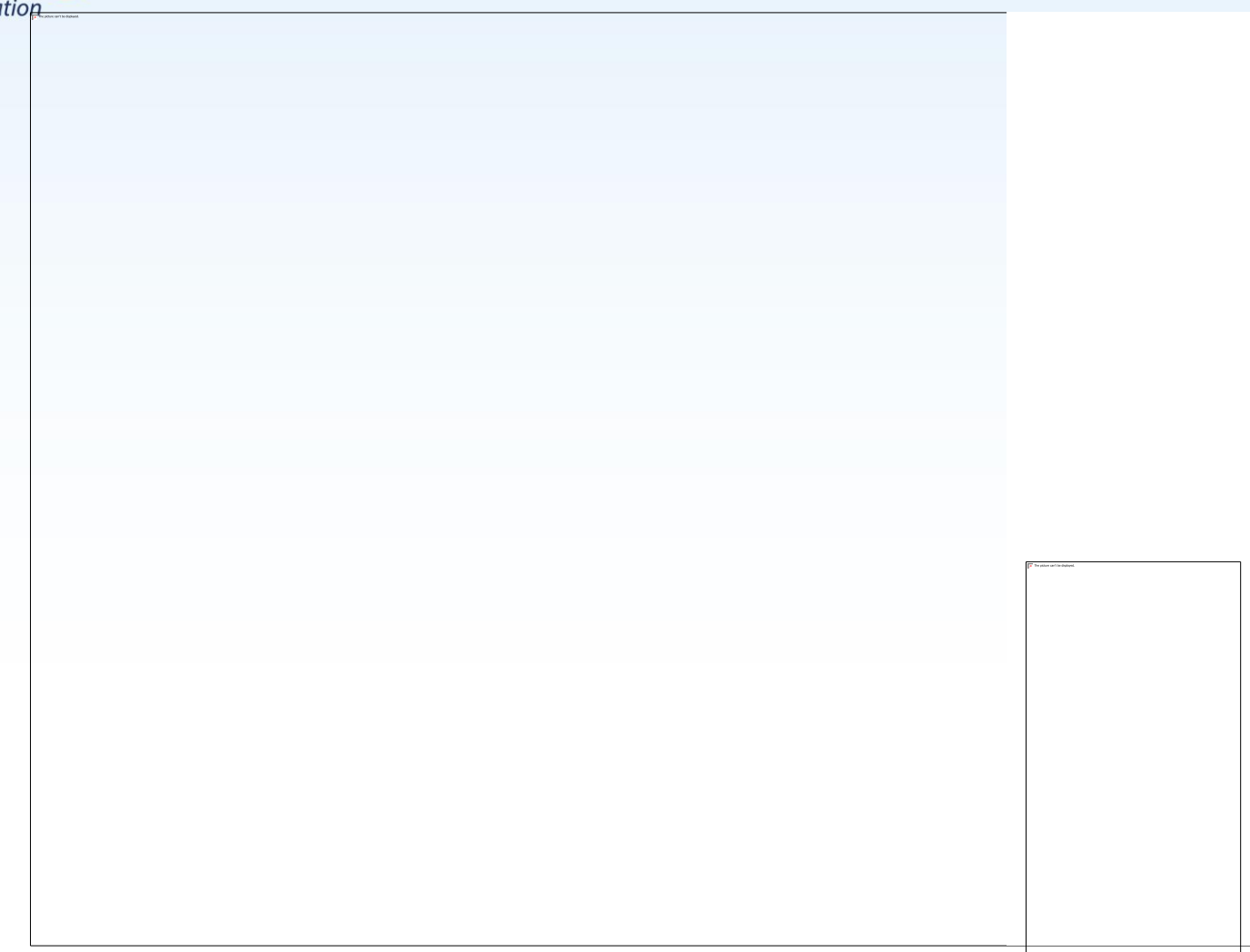
- Wood Fiber Mulches
- Blended Mulches
- Cellulose Mulches
- Pellet Mulches
- Cane Fiber Mulches
- Straw Mulches

Thermally-Refined Wood Fiber has 50% more water retention

Raw material: wood chips

Thermally Refined wood fiber is made by subjecting wood chips to moisture, heat and pressure before separating the wood chips into more fibrous material with greater surface area. This process allows the wood fiber to hold up to 50% more water than atmospherically refined wood fiber – a critical factor in seed germination.

Hydraulic-Mulch 2000



Hydro mulch 2000

Wood fibre mulch for flat or 1:4 slopes.

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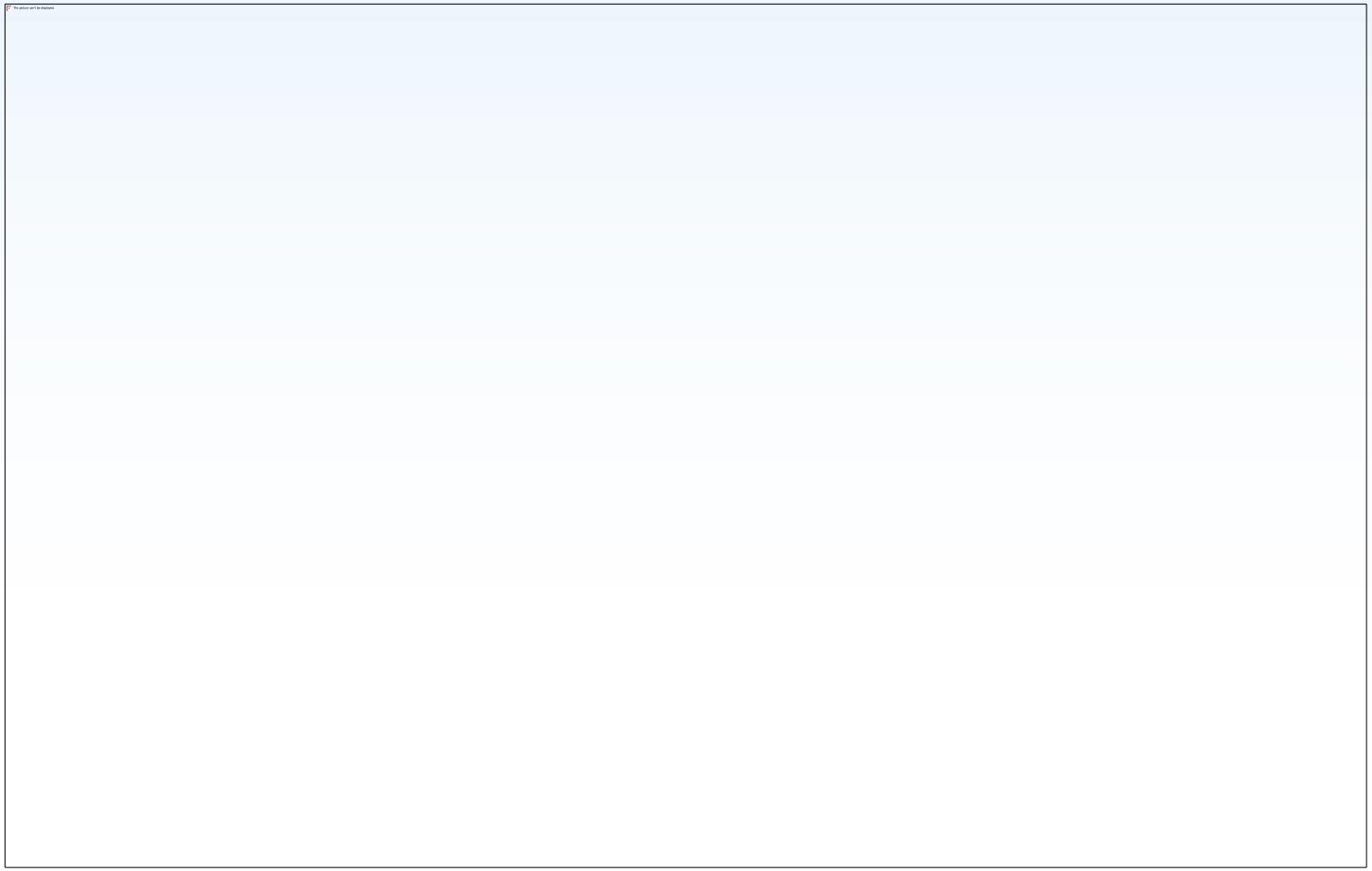
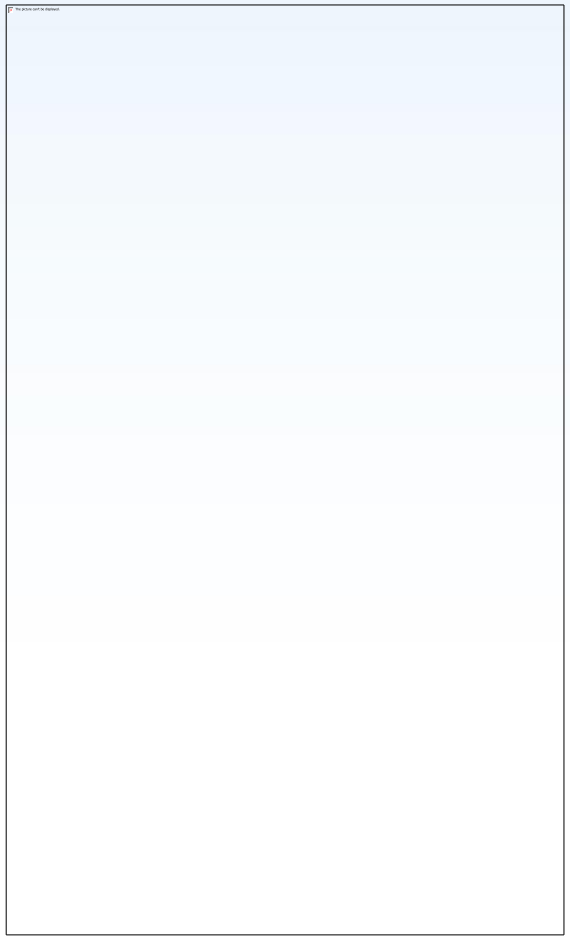
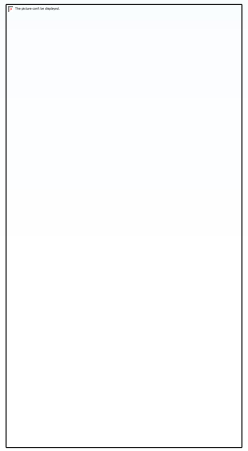


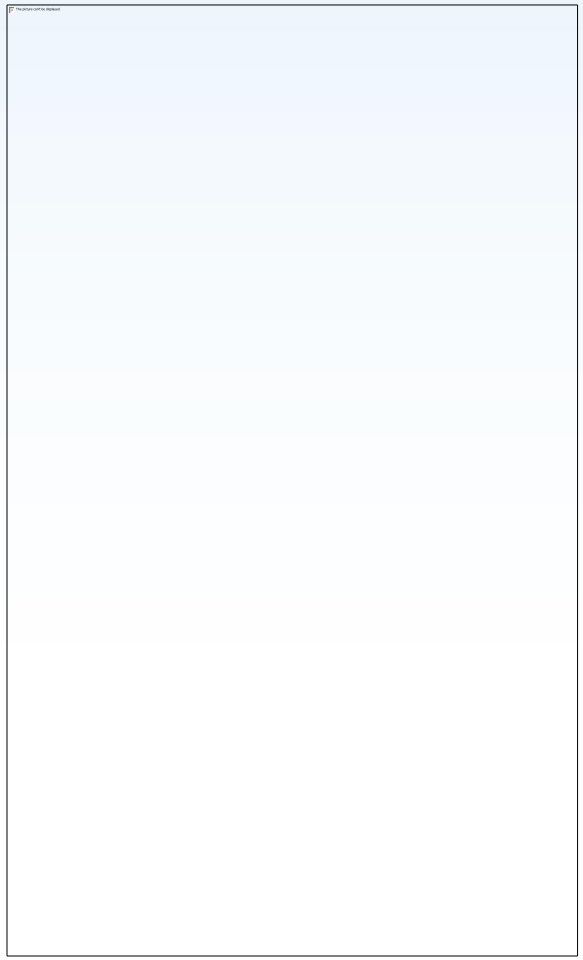
Higher engineered solutions such as Flexterra HP-FGM on steeper gradients and longer slopes

Tekapo NZ

HM 2000







Flexterra HP-FGM

Flexterra HP-FGM

Hydraulic Erosion Control Product (HECP)

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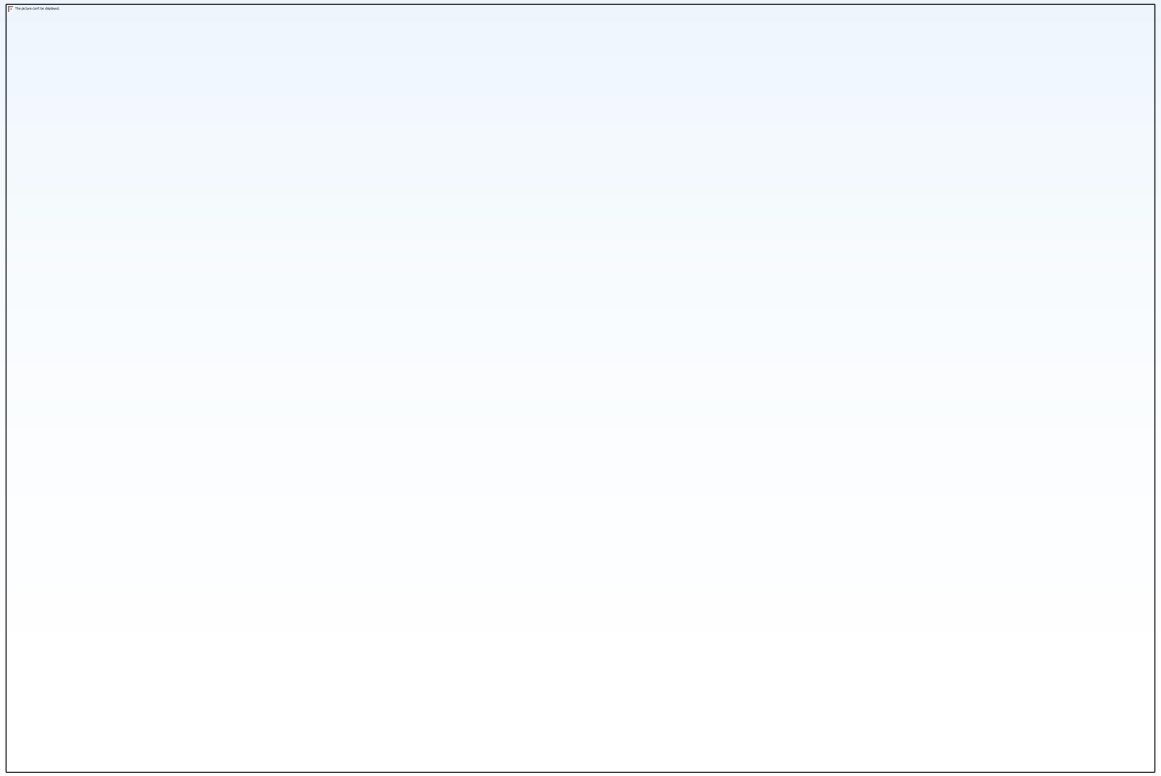
Flexible Growth Medium (FGM)

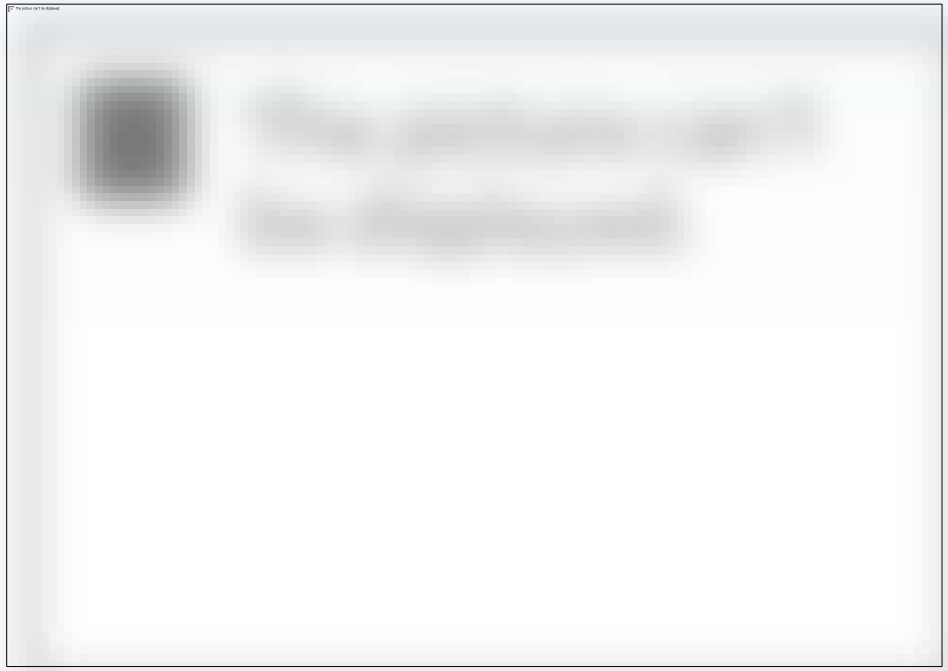


- **> 99% Erosion Control Effectiveness**
  - C-Factor < 0.01
  - No cure time – effective upon application
- **Superior Vegetative Establishment**
  - 1700% water holding capacity
  - 800% Growth Improvement factor
- **Functional Longevity** of 12-18 months
- 100% non-toxic according to EPA 2021.0 and 100% biodegradable according to ASTM D5338

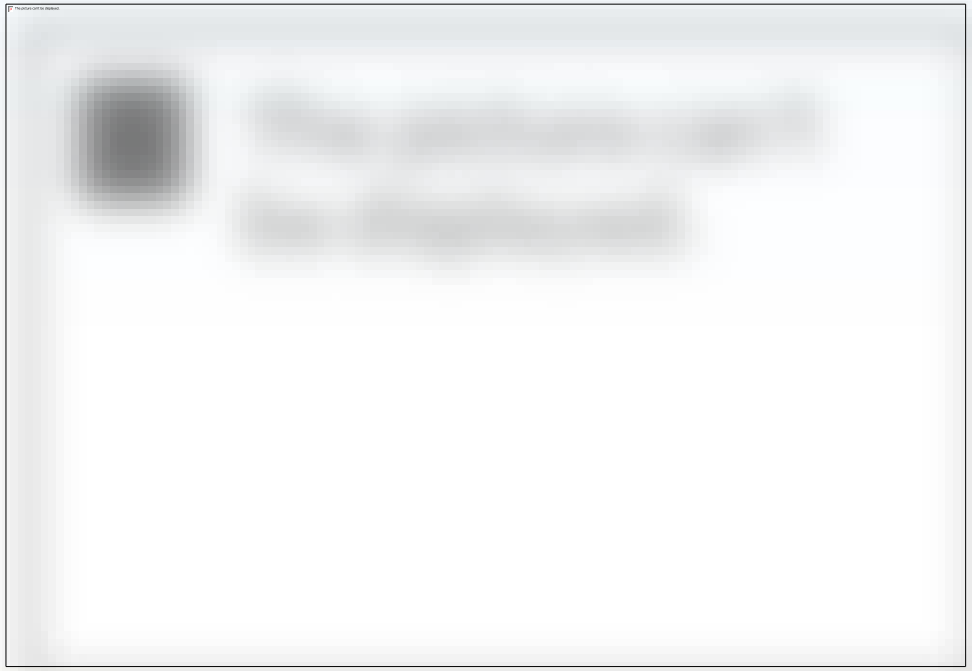
The “C” Factor

The lower the ”C” Factor (Cover Factor) an erosion control medium has better control of soil loss

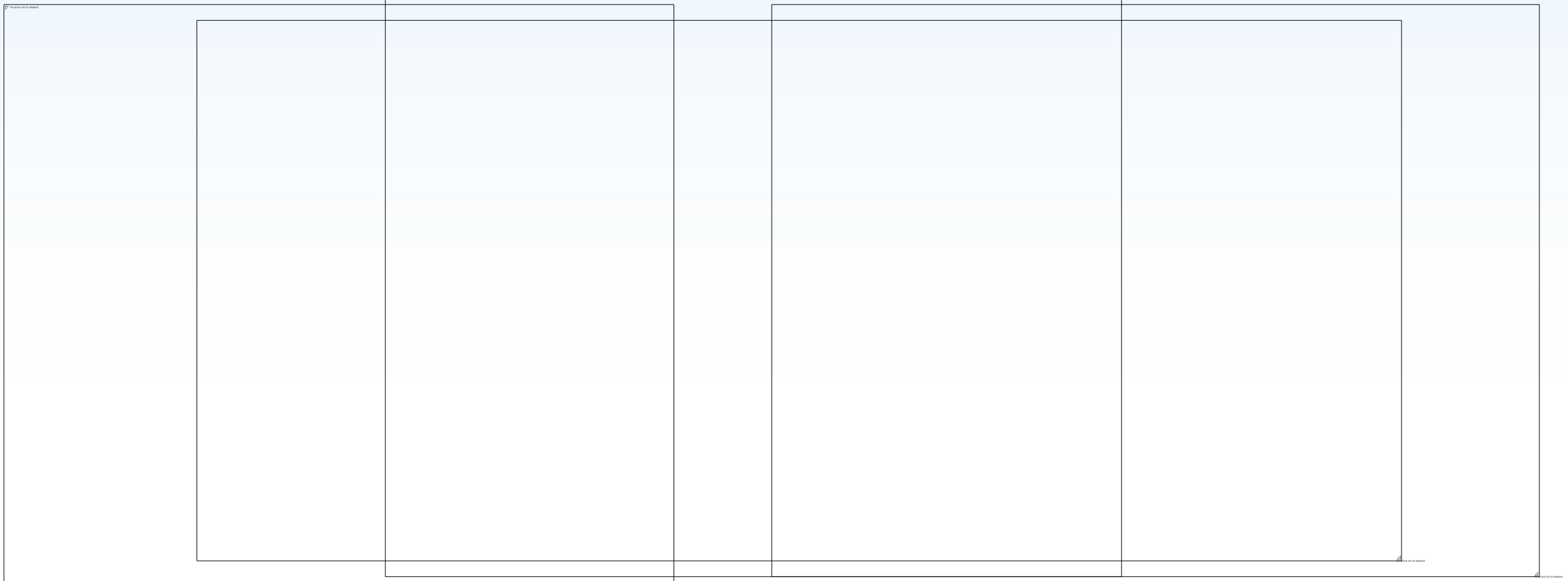
High “C” Factor



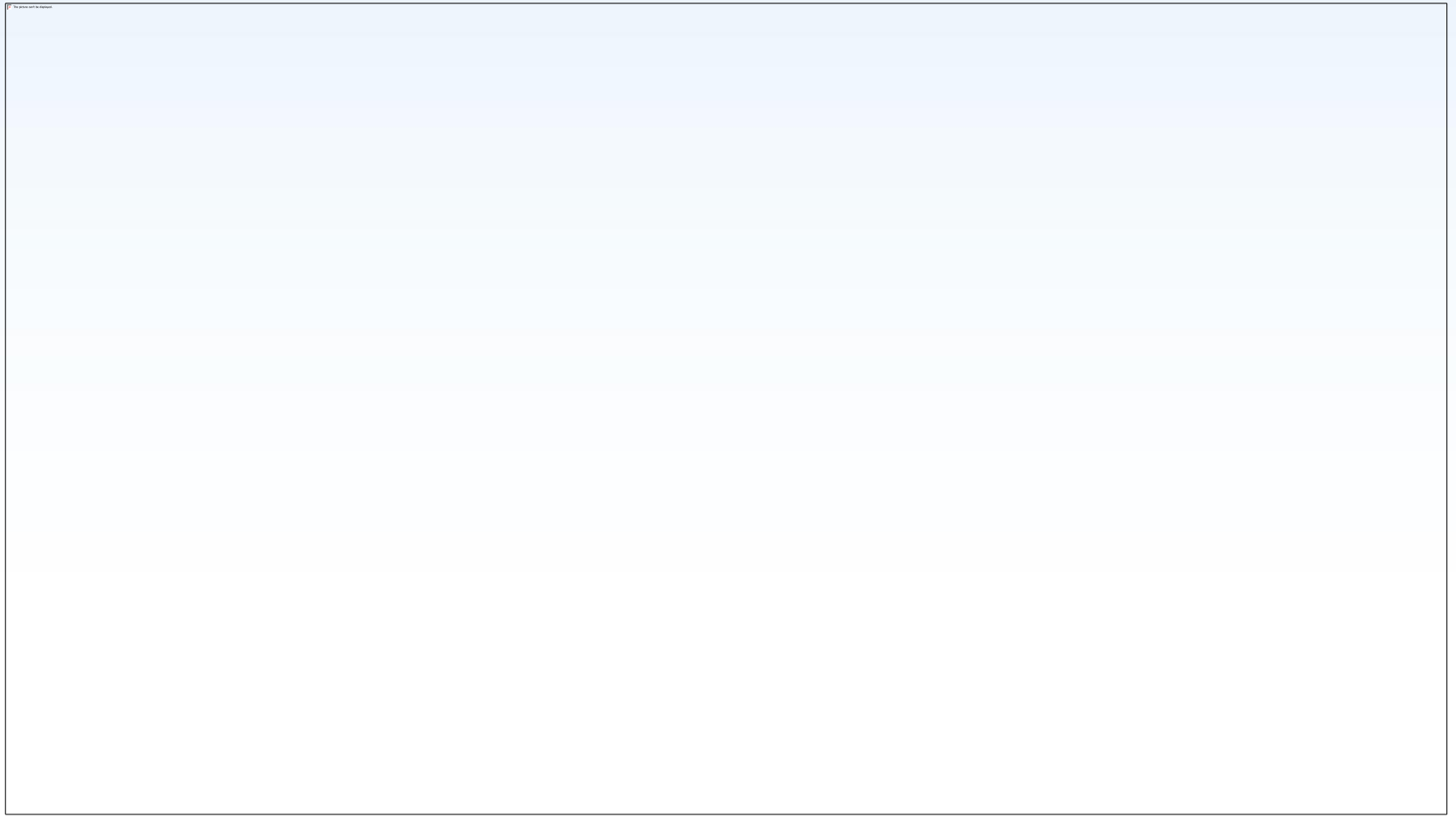
Low “C” Factor



Which BMP to use?

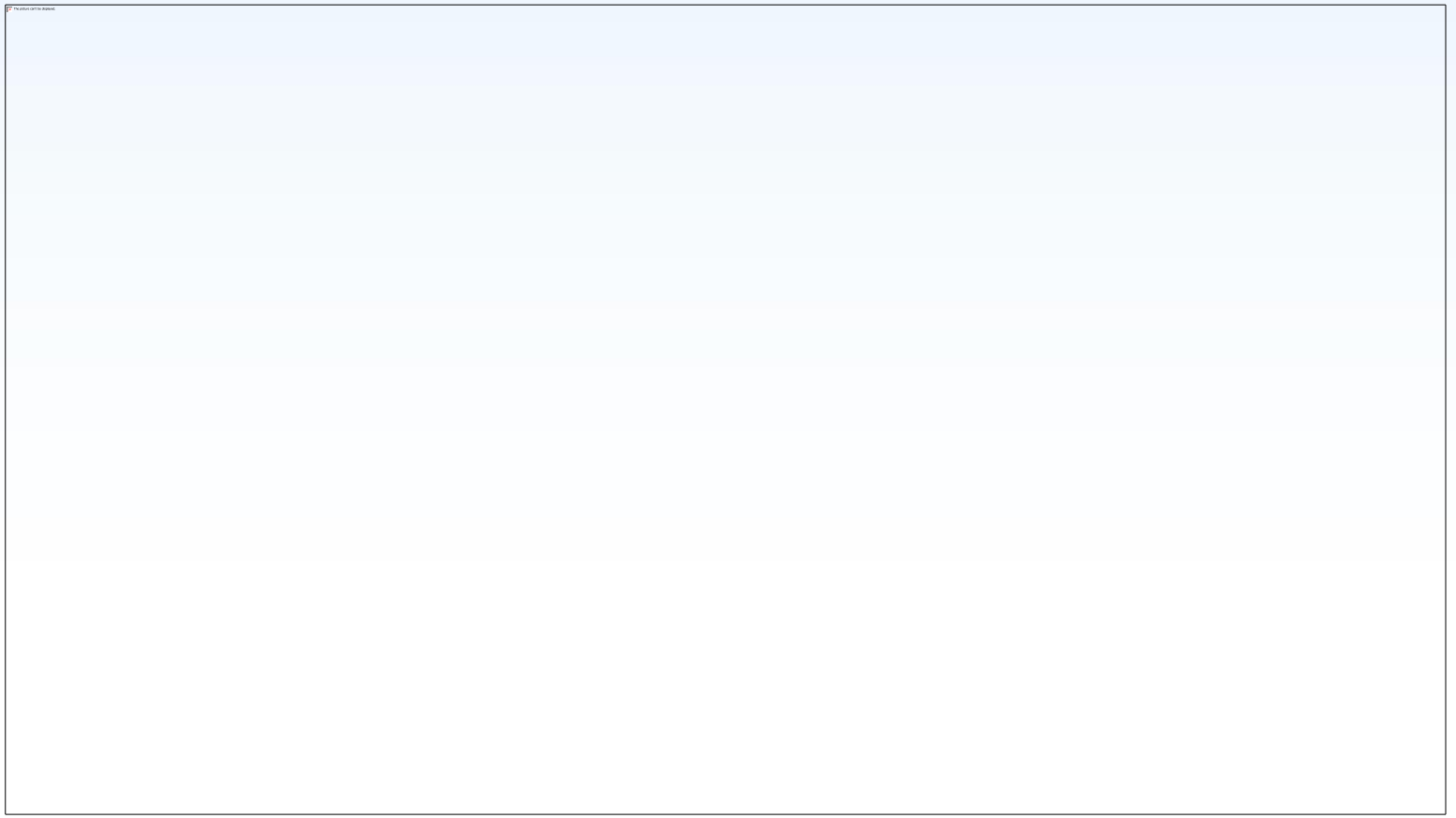


Flexterra HP-FGM application



Christchurch,
New Zealand

Kaikoura rail remediation using ProGanics and Flexterra



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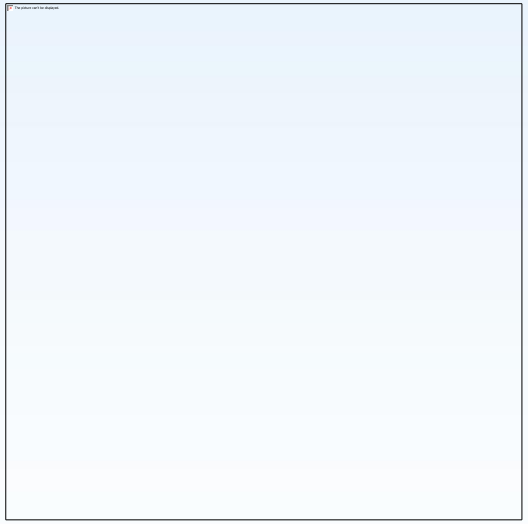


Ensure Proper Installation

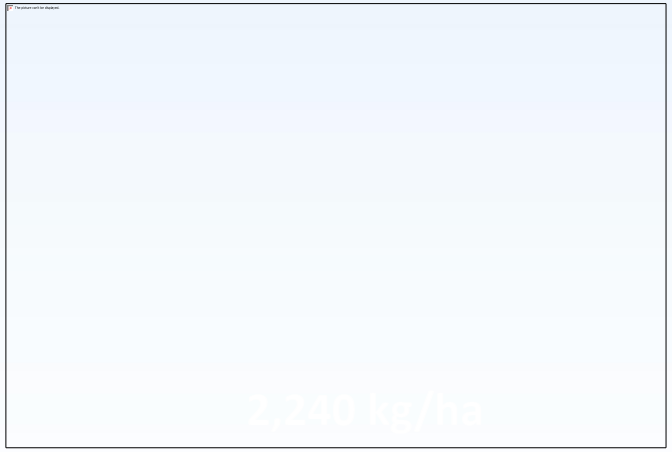
Fundamental #4

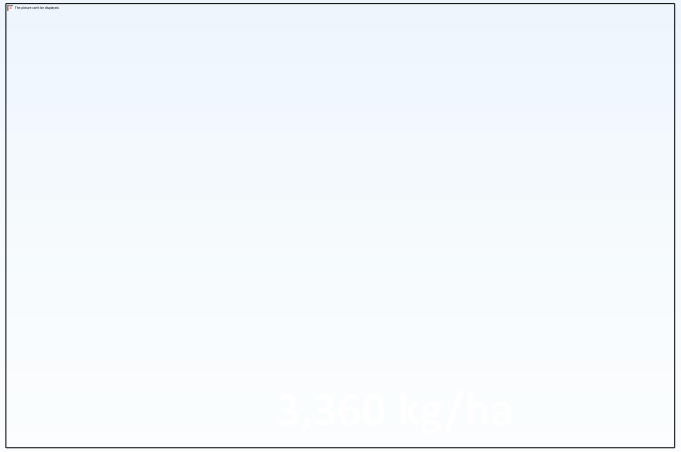
Fundamental #4

Ensure Proper Installation

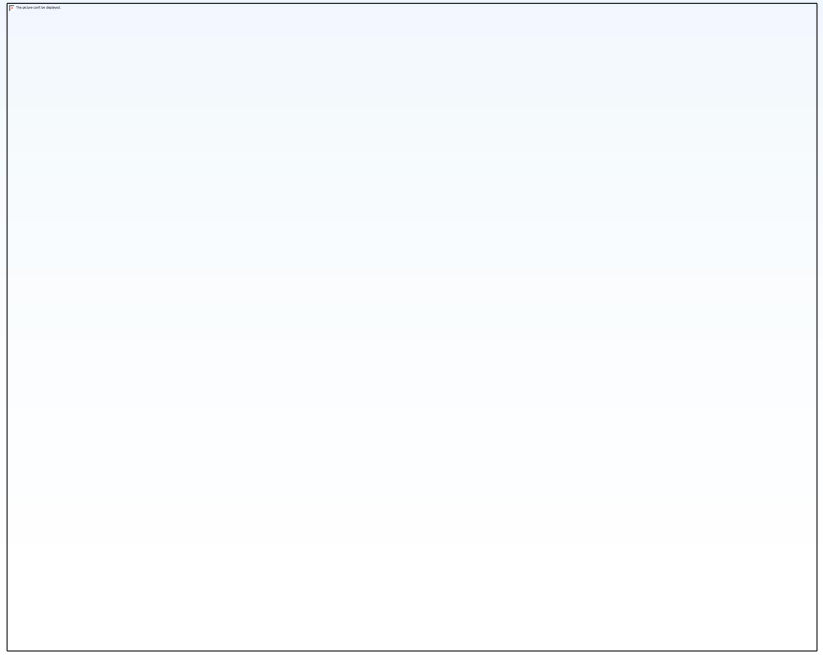
- Comprehensive and detailed construction specifications with plans/drawings
- Complete installation guidelines
- Tools or calculators to facilitate mixing ratios and/or application rates for both agronomic amendments and erosion/sediment control products
- Experience…preferably site-specific experience!

HECP Mixing and Application Guidelines

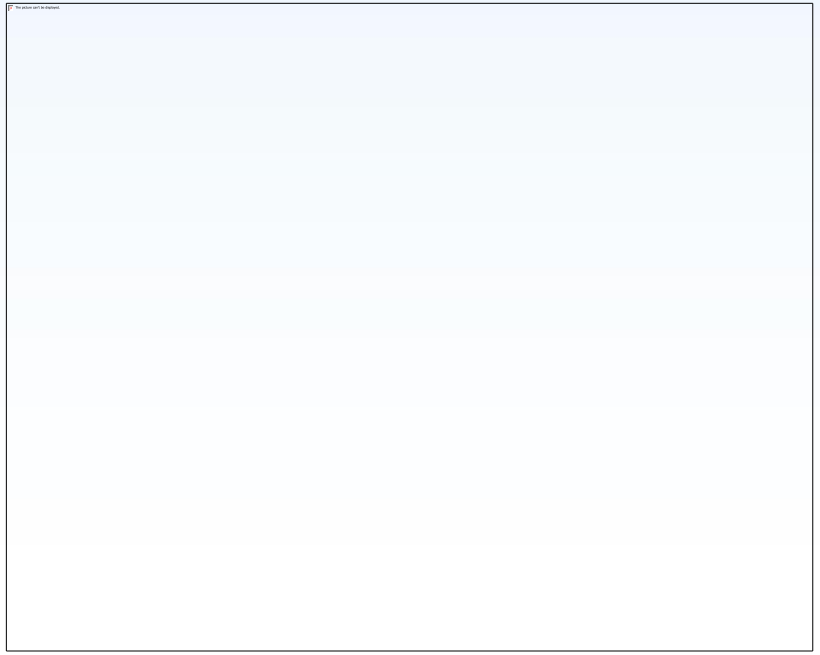




HECP Mixing and Application Guidelines



Proper application and good coverage



Improper application and poor coverage

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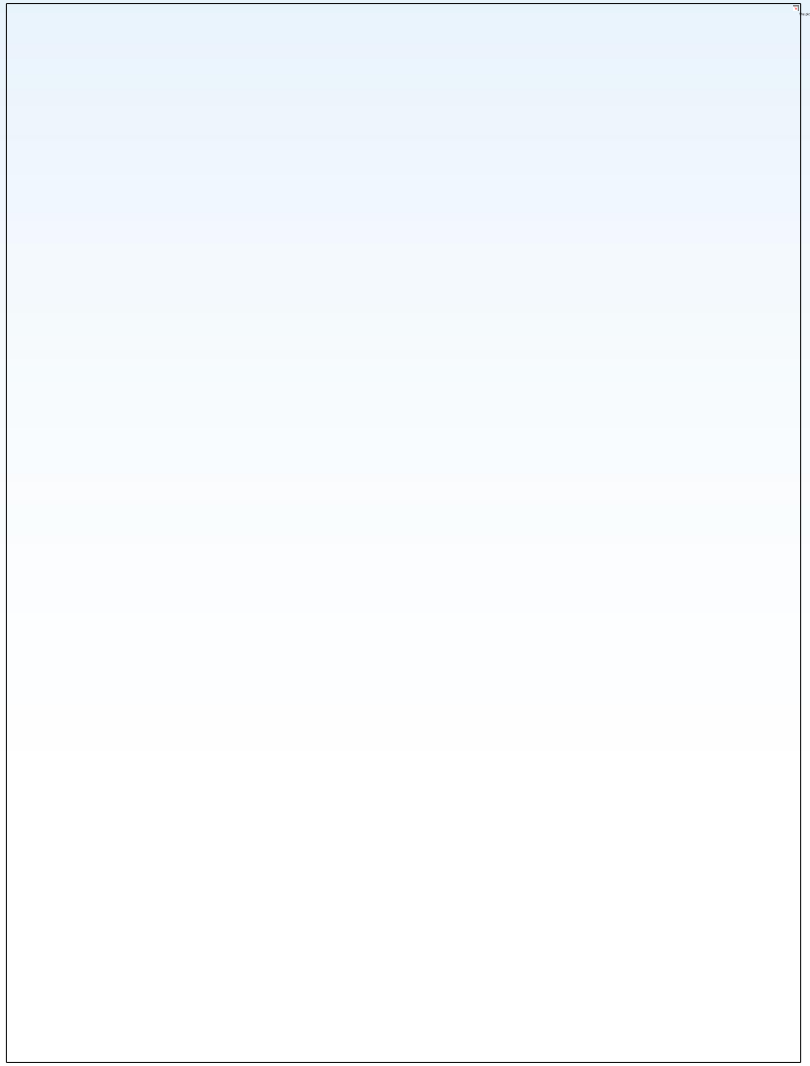

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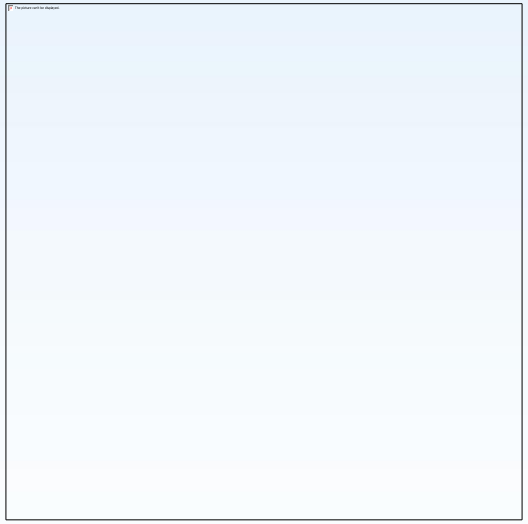
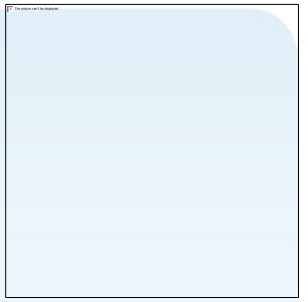


Follow-Up Inspection and Maintenance Practices

Fundamental #5

Fundamental #5

Follow-Up Inspection and Maintenance Practices



- Inspection by qualified professionals whose expectations are consistent with installer as well as owner and regulatory entity(s)
- Initial inspections to insure installations are in accordance with plans/specs with material quantities and activities fully documented
- Subsequent inspections conducted at pre-determined time intervals and maintenance activities conducted after each significant precipitation or other potentially damaging weather event

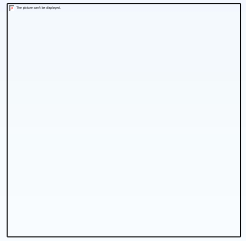
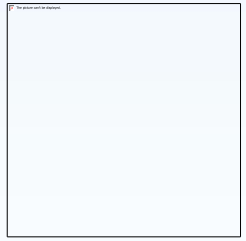
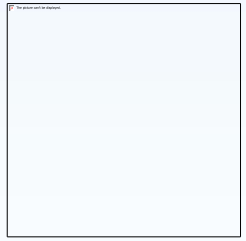
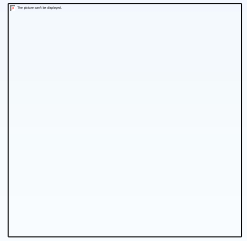
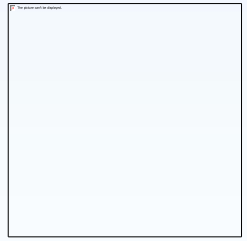
In Conclusion

The Five Fundamentals

1. Understand Your Substrate – test the soil or substrate
2. Species Selection – pick plant materials compatible with project goals
3. Erosion Control Practices – select the most effective control measures
4. Proper Installation – ensure guidelines and specifications are followed
5. Inspection and Maintenance – coordinate plan to ensure success

Fundamentals must be integrated into a working process that entails proper planning and execution

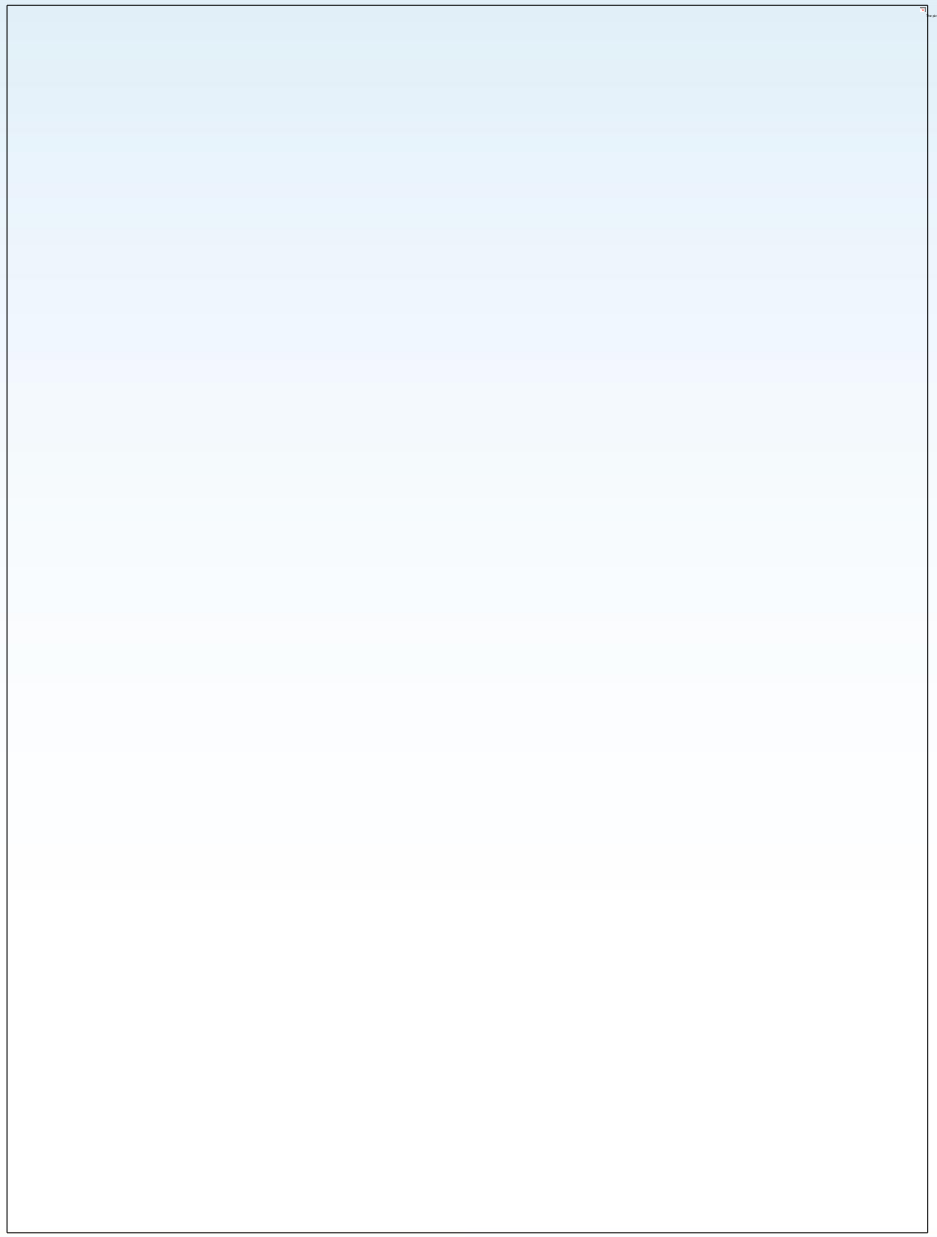
Case Studies

Nelson/Tasman Fires

- 2300ha of damage (25km radius)
- 3000 people evacuated
- Prescriptive seed blend applied by two fixed wing aircraft
- Application of GRT EnviroBinder to 95 hectares

Warkworth - NZ



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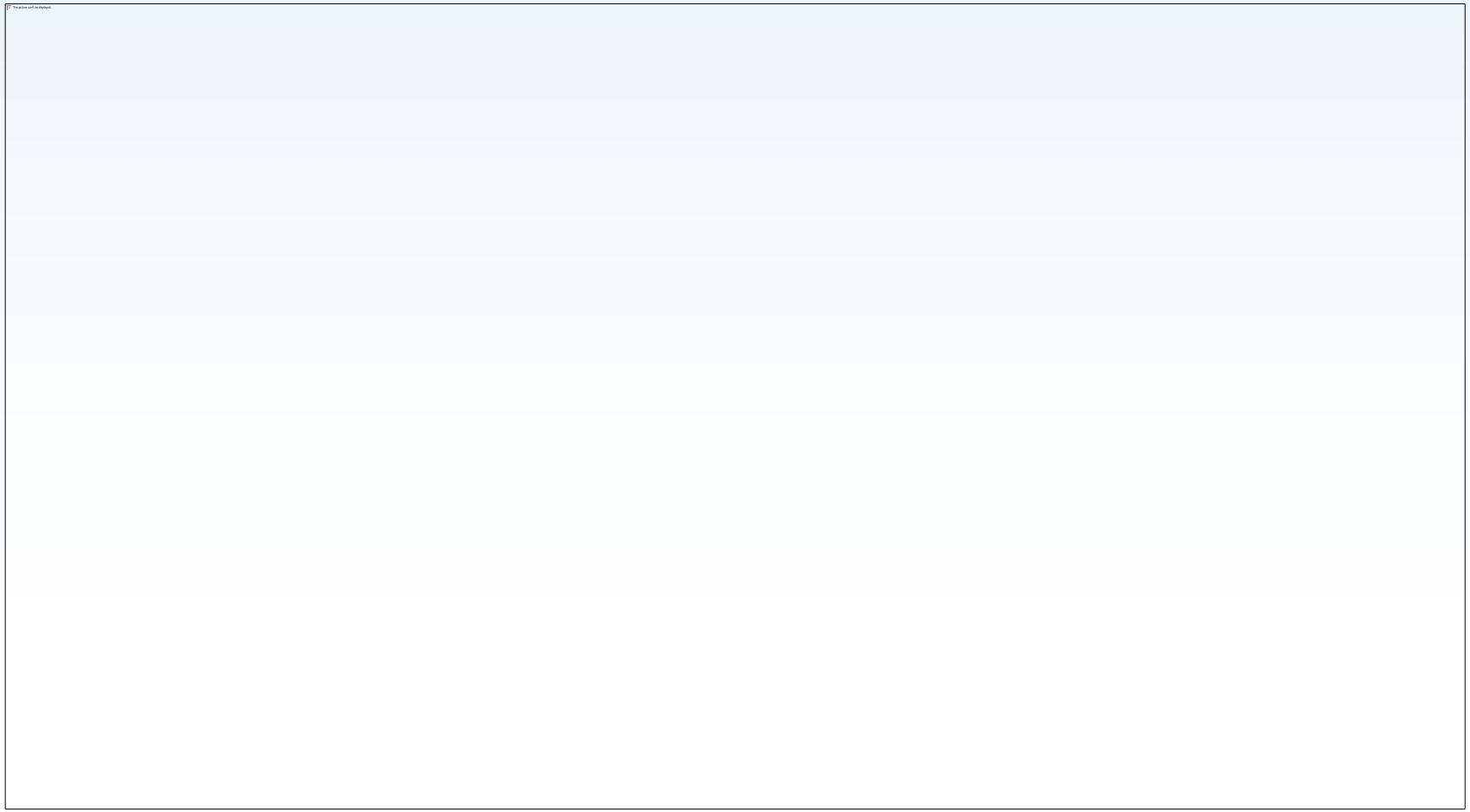


Prescription:

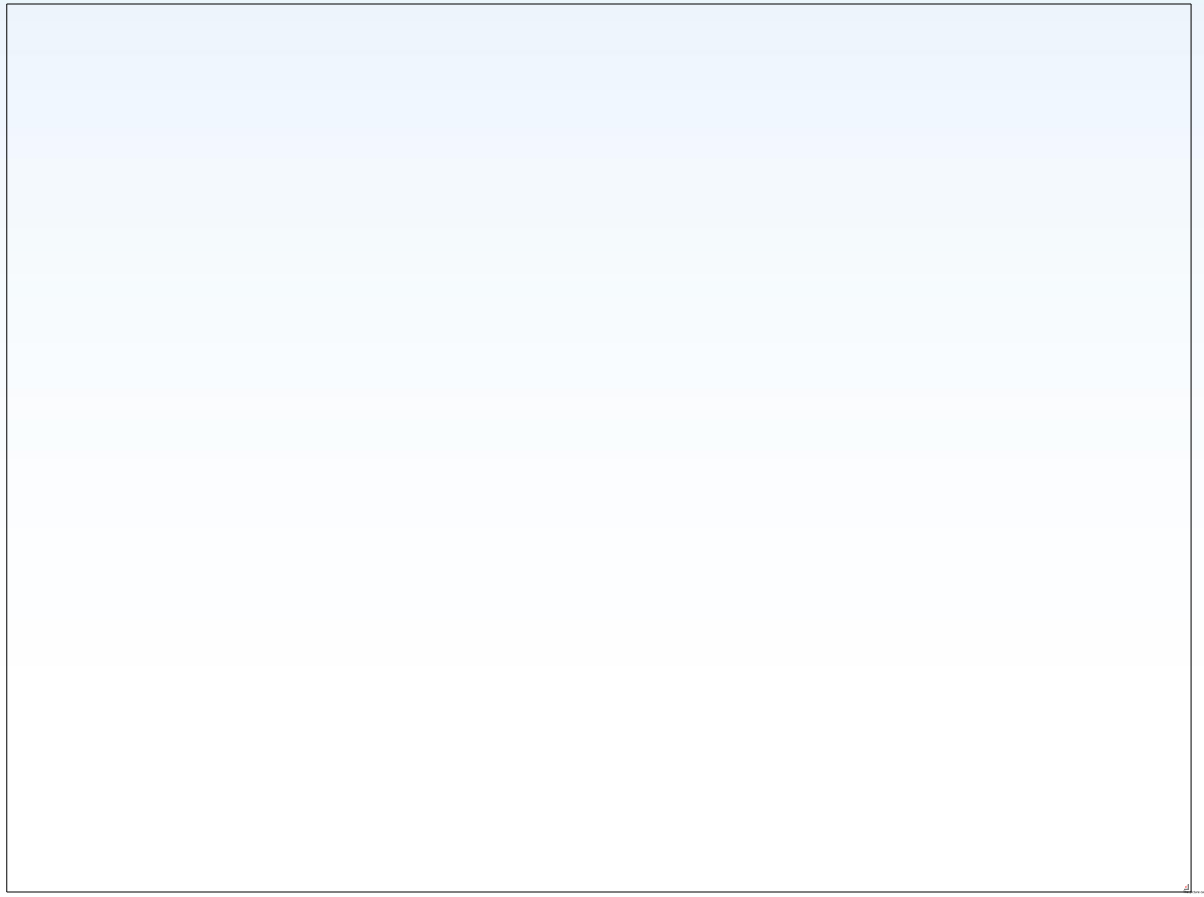
ProGanics BSM @ 5040kg/ha

Black D.A.P @ 250kg/ha

BioBoost @ 300kg/ha

Seed blend:
(Percentages indicated are weight)
20% Forage type Perennial Ryegrass (Expo) – *Lolium perenne*
44% Tall Fescue (Rebel Extreme) – *Festuca arundinacea*
30% Creeping Red Fescue (Governors) - *Festuca rubra sp.*
1% Colonial Browntop (Egmont) - *Agrostis capillaris*
2% White Clover (Huia)- *Trifolium repens*
2% Cocksfoot (Tekapo) – *Dactylis glomerata*
1% Lotus (Trojan) – *Lotus pedunculatus*

Flexterra HP-FGM @ 4500kg/ha



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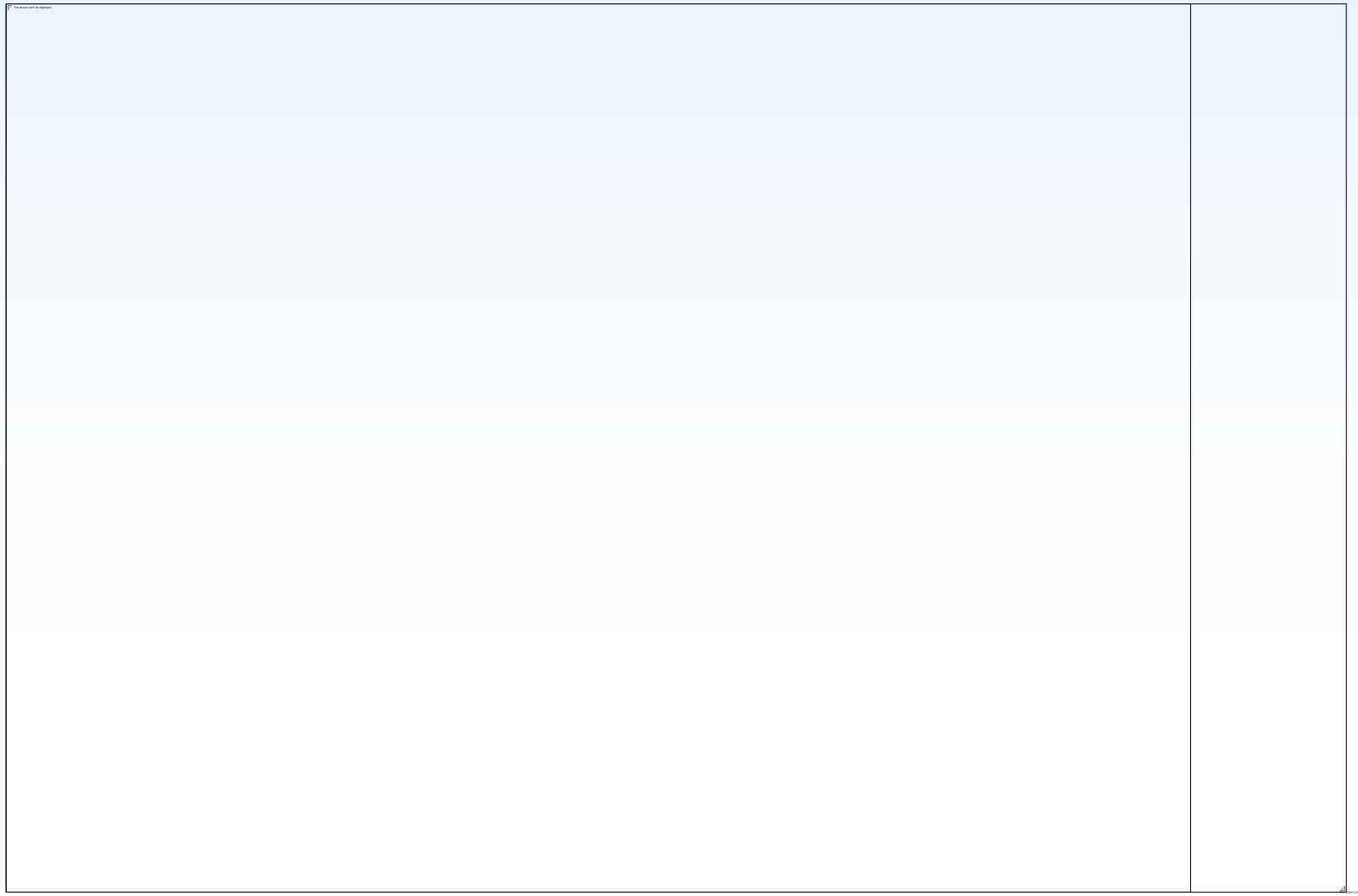

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Thank you.
Questions?