



Central Plains Water - Groundwater quality

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Evidence addressed

- Cliff Tipler: nitrate concentrations in groundwater
- Dr. Glyn Francis: nitrate leaching from crops
- Murray Close: micro-organisms and pesticides
- Claire Mulcock: nutrient management
- Ian Brown : nutrient management
- various submitters

Main Contaminants of Concern

- Nitrate - some risk
- Pathogenic micro-organisms
 - mainly low risk
- Phosphorus - low risk
- Pesticides - low risk

Pathogenic micro-organisms

- within scheme area: low risk
 - leaching from grazed paddocks / effluent disposal
 - localised effect - within 10s to 100s of metres
 - highest risk after heavy rainfall
 - only where water table is shallow
- lowland coastal areas: low-medium risk
 - water table closer to ground surface
 - less treatment of septic tank discharge, offal pits

Phosphorus

- low risk
- generally not mobile in groundwater
- does occur in Canterbury groundwater, but :
 - no clear link to land use
 - pattern more closely related to geology

Pesticides

- low risk
- main risk - herbicides
- not widely used for pastoral farming
- risk could increase in future if CPW results in widespread cropping
- risk only where water table is shallow

Nitrate

Comments on Cliff Tipler evidence

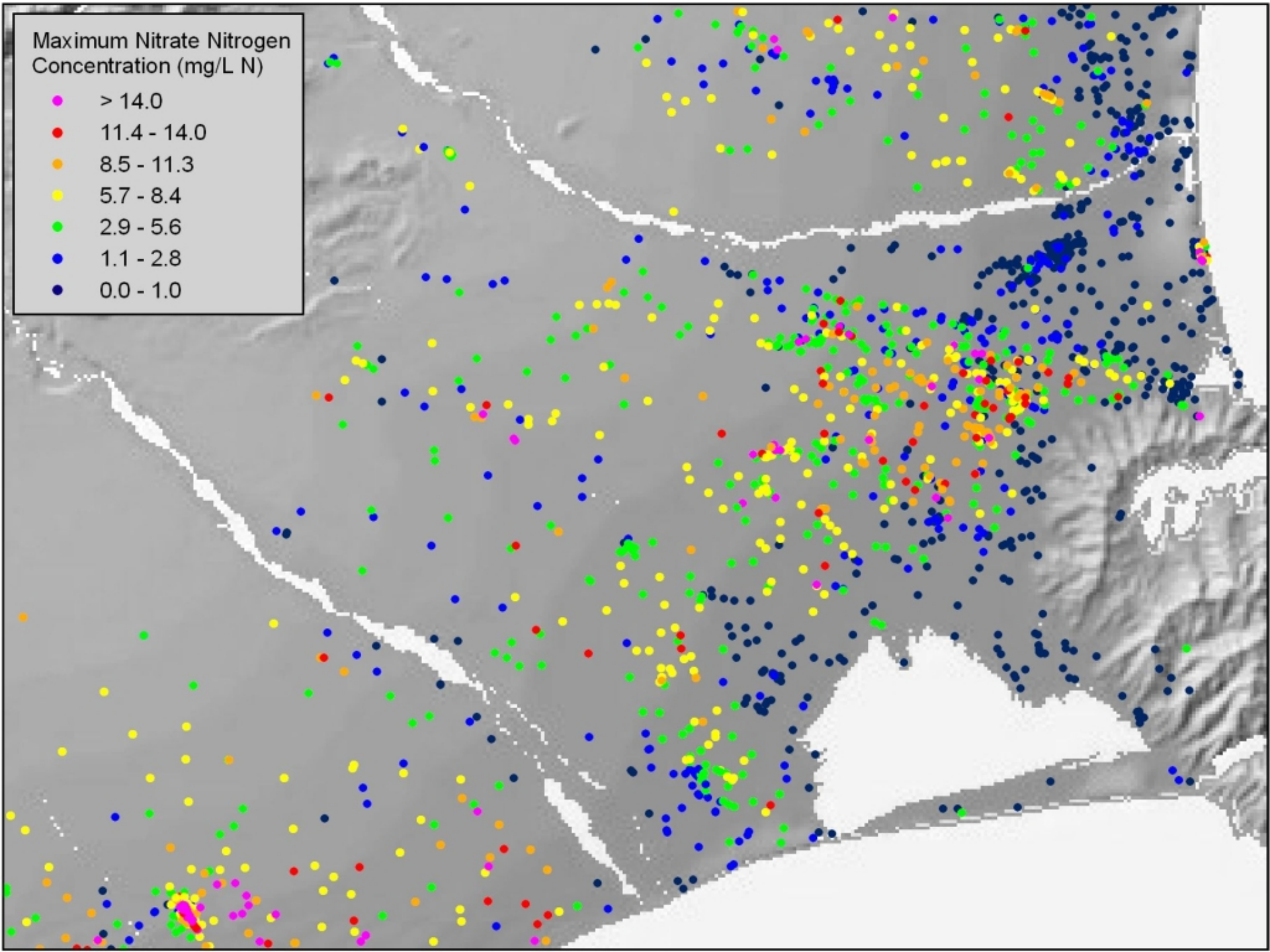
- **Points of agreement**
 - mass loading of nitrate to groundwater will increase
 - concentrations in groundwater will increase
 - depth of contamination will increase
- **Points of disagreement**
 - potential magnitude of increases
 - uncertainty in predictions

Sources of Uncertainty

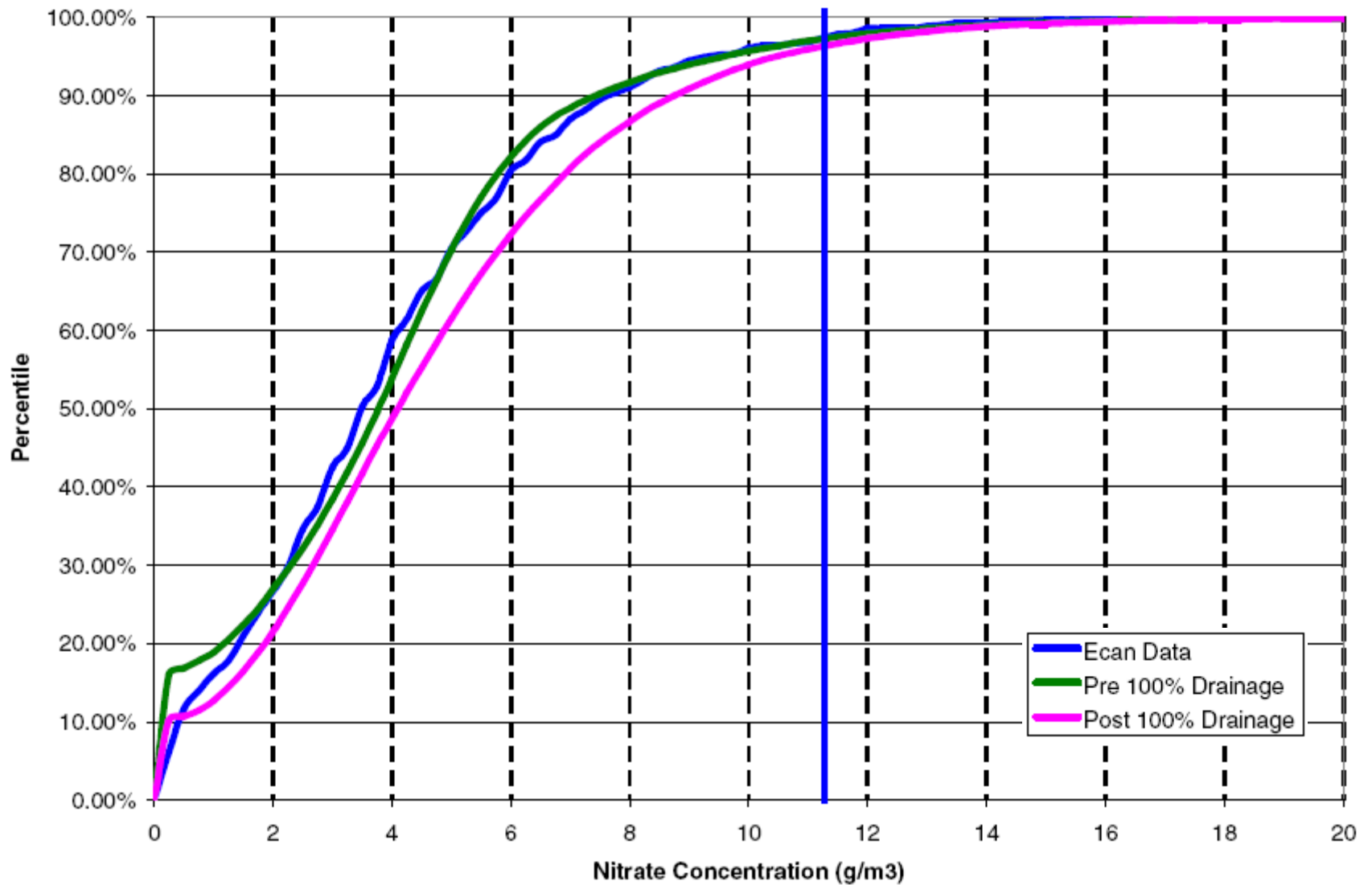
- leaching rates from different land uses
 - dairy: high leaching rates from some studies
 - drainage rates versus mass loss
 - winter grazing of dairy cattle
- land uses resulting from the CPW scheme
- hydrogeology
- spatial variations
- seasonal variations

Maximum Nitrate Nitrogen
Concentration (mg/L N)

- > 14.0
- 11.4 - 14.0
- 8.5 - 11.3
- 5.7 - 8.4
- 2.9 - 5.6
- 1.1 - 2.8
- 0.0 - 1.0



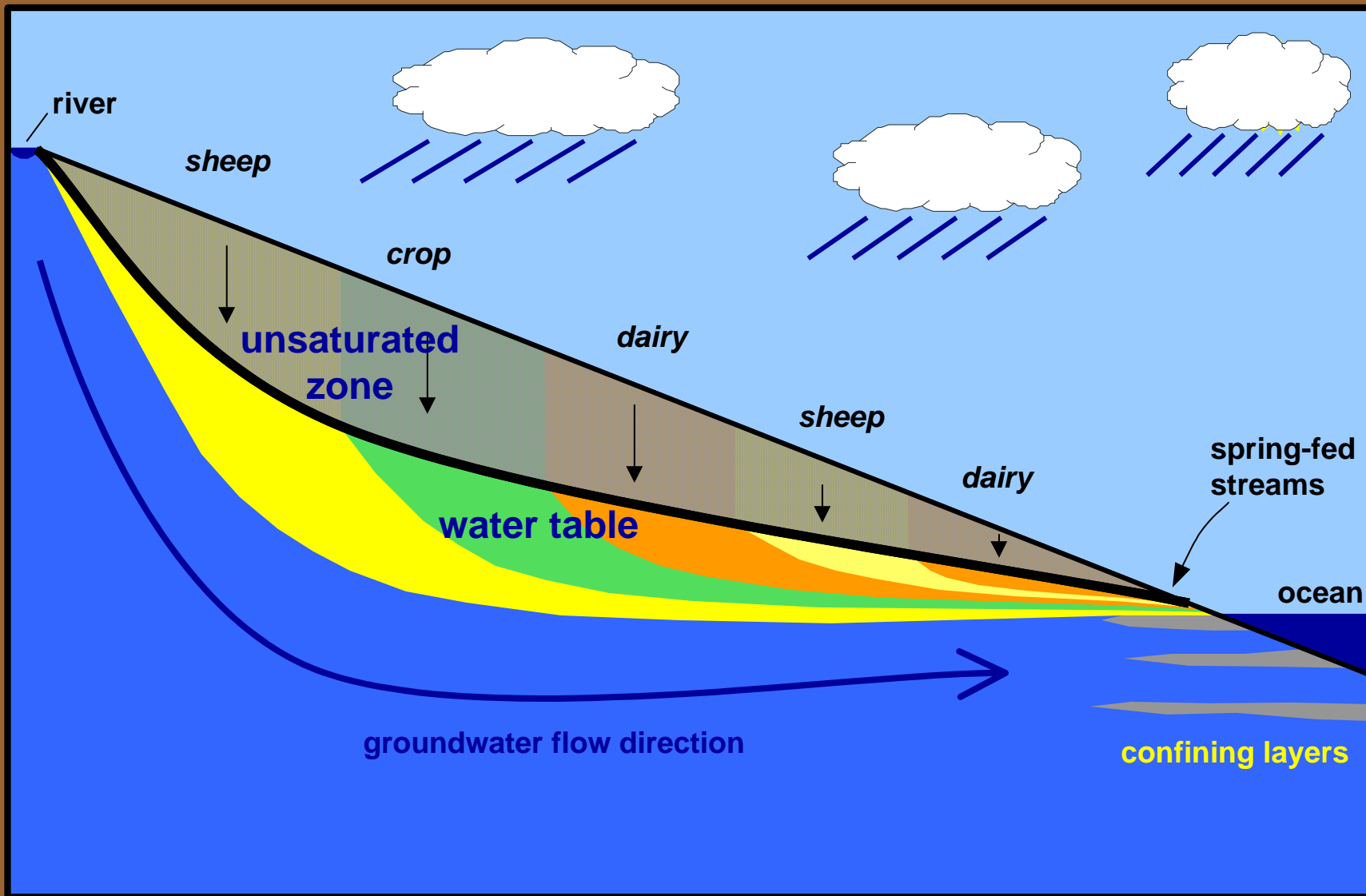
Pre and Post CPWES - Full drainage, Full leaching



Magnitude of Uncertainty

	<u>Cliff Tipler</u>	<u>alternate scenario</u>
Nitrate leaching losses (kgN/ha/yr)		
dry pasture	15	5
dry crop	33	35
irrigated pasture	55	75
irrigated crop	33	75
Median increase in groundwater nitrate concentration (mg/L)	1	4

alternate scenario assumes 84,000 ha total irrigated area



groundwater system beneath the Canterbury Plains

Effects of other irrigation schemes

- No clear increase in contamination from other scheme areas
- Flood irrigation schemes
 - RDR schemes (southern Canterbury Plains)
 - Amuri Plain (Culverden)
- Spray irrigation schemes
 - Waimakariri Irrigation

Nutrient Management

- Goal: match nitrate input to plant uptake
- options
 - fertiliser management (rate, timing)
 - nitrification inhibitors
- dairy
 - herd homes
 - stocking rate
- cropping
 - cultivation timing
 - winter cover crops (plant early)

Nutrient Management (continued)

- good record-keeping critical
- nutrient budgets useful
- evolving science
- probably not possible to dictate specific practices
- difficulties in enforcement and monitoring
- effectiveness unclear

Groundwater quality monitoring

- Very large and complex task
 - results of any monitoring are commonly not clear
- Nine wells not nearly adequate
 - ECan currently monitors 72 wells in the Central Plains area, 25 wells in the CPW scheme area
- Time delay
 - effects of change could take years to reach groundwater
- Very difficult to tie monitoring results to CPW
 - Groundwater Technical Review Panel not practical

Potential threats to Christchurch aquifer system

- contaminants from CPW scheme area: low risk
 - long travel distance
 - most of scheme outside Christchurch catchment
- change in Christchurch catchment: low risk
 - contaminants that currently flow toward Lake Ellesmere could be diverted to Christchurch
 - change in catchment likely to be minor
 - shallow wells in southern Christchurch would be most at risk

- Generally low risk (with some caveats) from micro-organisms, pesticides, and phosphorus
- Low risk to Christchurch aquifer system
- Nitrate contamination could be significant
 - effectiveness of mitigation unclear
 - difficult to monitor compliance with consent conditions
 - difficult to monitor effects of scheme