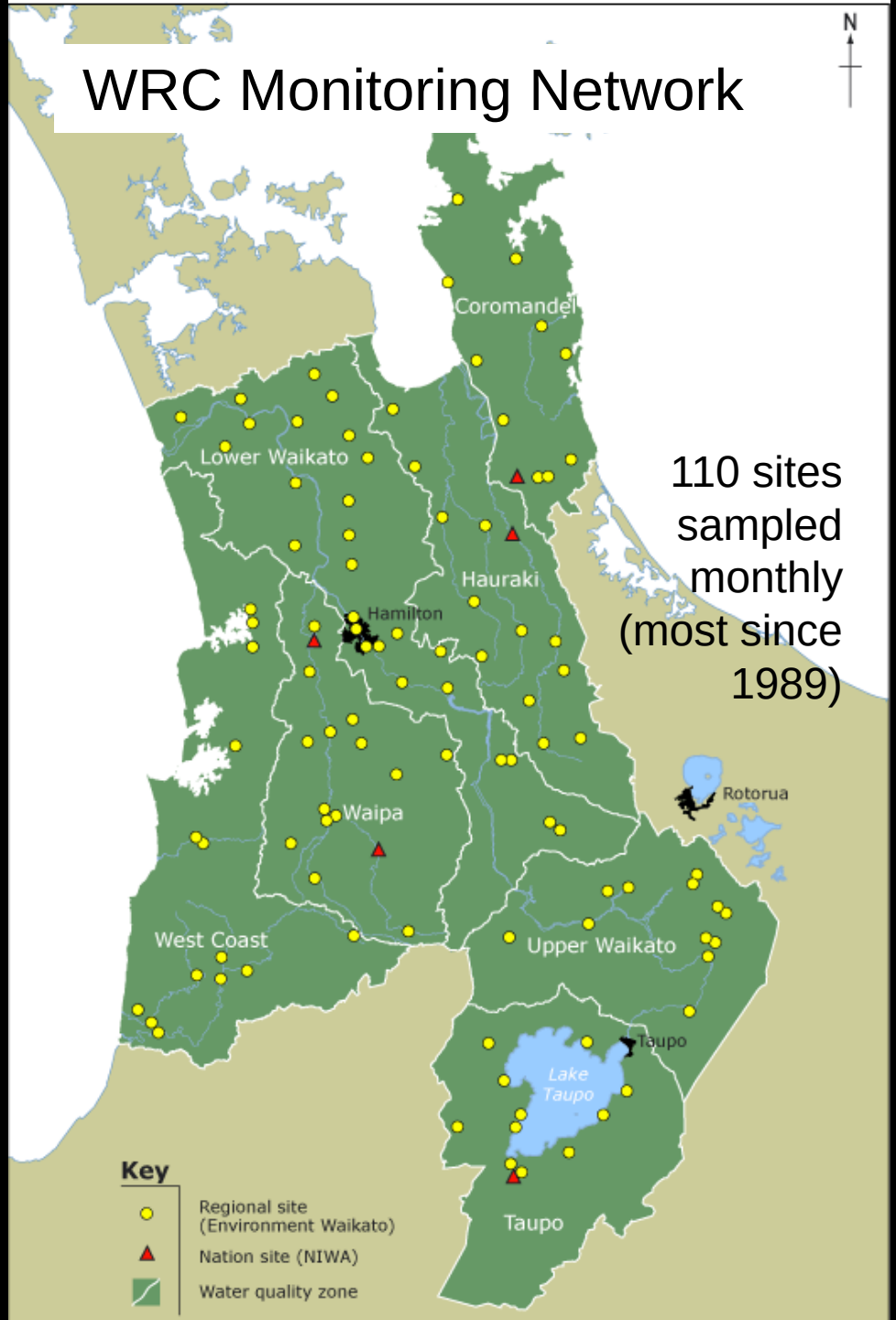
Water Quality of the Waikato and Waipa Rivers

Technical Leaders Group

Water Quality aspects in project scope

Variable (units)	Relevance
Pathogens (E coli/100 ml)	Human health: swimming, waka ama, kai gathering, boating, angling etc Cultural acceptability Livestock health: drinking water Domestic & industrial use: treatment needs
Sediment: Suspended sediment (g/m^3) Water clarity (black disk visibility, m) Turbidity (NTU)	Aesthetics, safe swimming, waka ama, kai gathering, boating, angling Cultural acceptability Ecosystem health (light, primary production, visual feeders - fish, birds) Sedimentation: drainage/flooding, dam volume
Nutrients (mg/m^3)**:** **Nitrogen** (TN, Nitrate, DIN) and **Phosphorus** (TP, DRP)	Algal and rooted plant growth – nuisance blooms with aesthetic, toxic (cyanobacteria) and ecosystem health impacts - Effects influenced by shade, clarity, flow dynamics, bed type, invertebrate grazers, temperature
Nitrogen toxicity (mg/m^3): Ammonium & nitrate	Toxicity to aquatic life (ammonium > nitrate) and drinking water safety (nitrate-N drinking standard = 10,000 mg/m^3)

WRC Monitoring Network



110 sites sampled monthly (most since 1989)

Water quality assessments

State – is it “good” or “poor”?

and

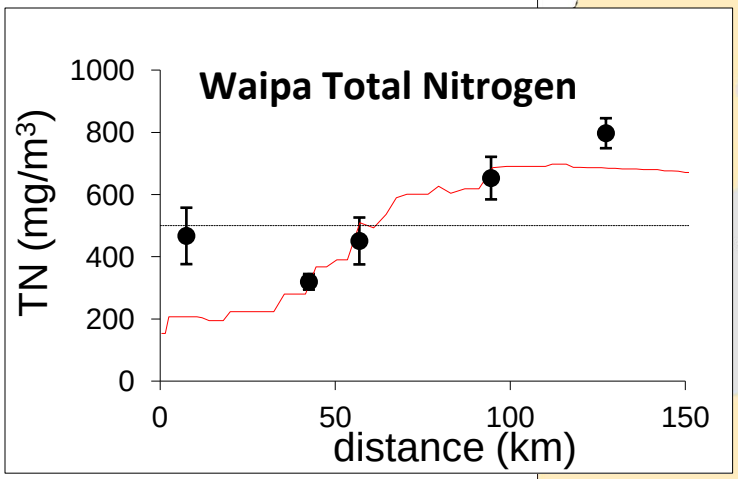
Trend – is it “better” or “worse”?

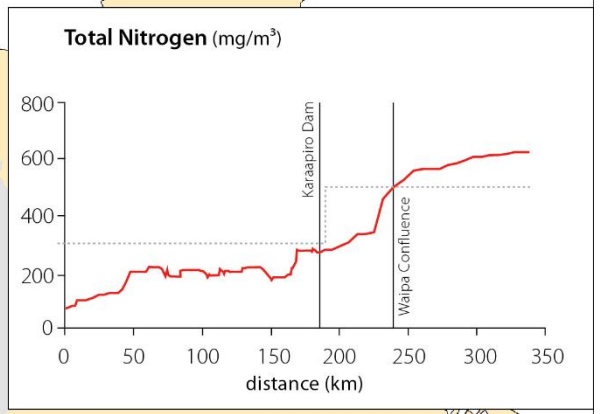
WRISS report card scores Karapiro, & Tuakau 2000-09,

Variable	Karapiro Score	Tuakau Score
Dissolved oxygen	A	A
E. coli	A	A
Algae (toxic blooms)	B	E
Total nitrogen	C	C
Total phosphorus	D	E
Water clarity	D	C

Data source: Waikato Regional Council

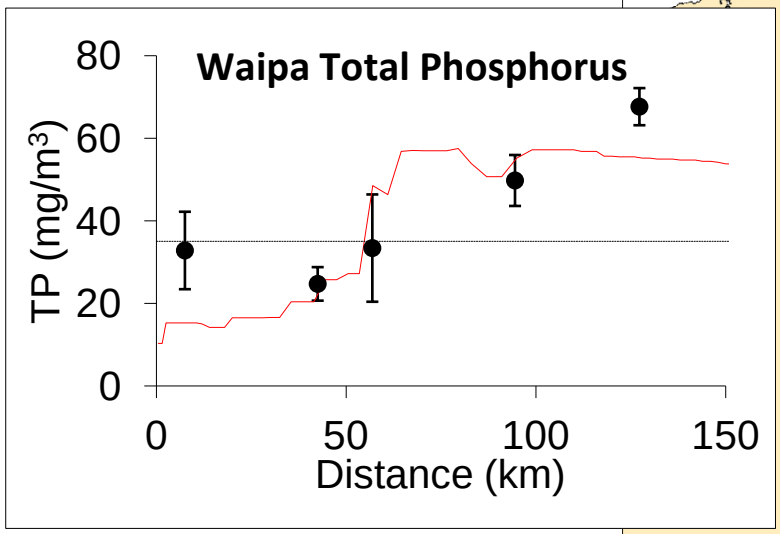
Variation in Nitrogen at baseflow

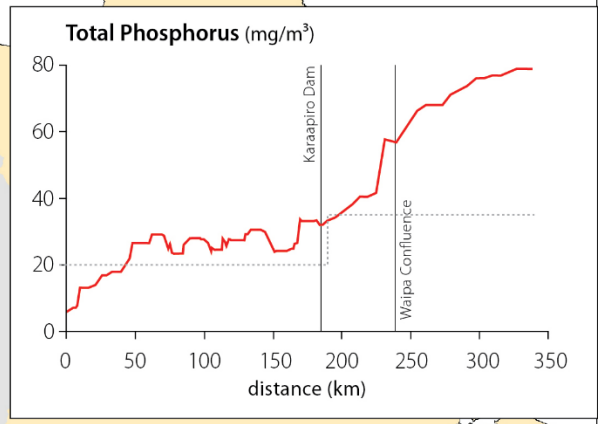




NIWA 2010 WRISS

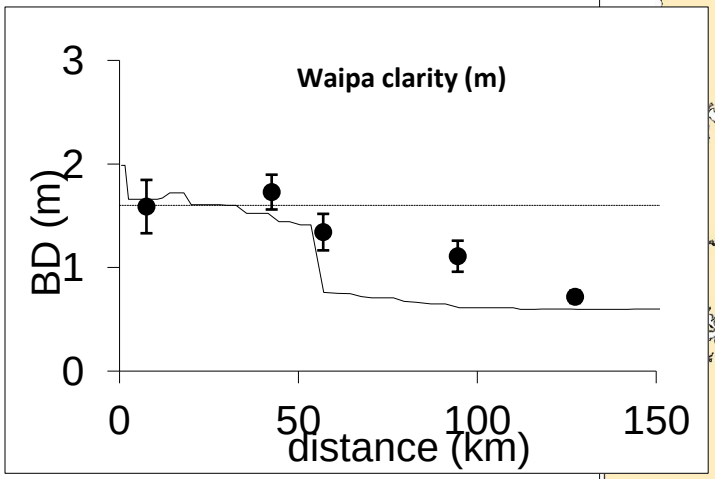
Variation in Phosphorus at baseflow

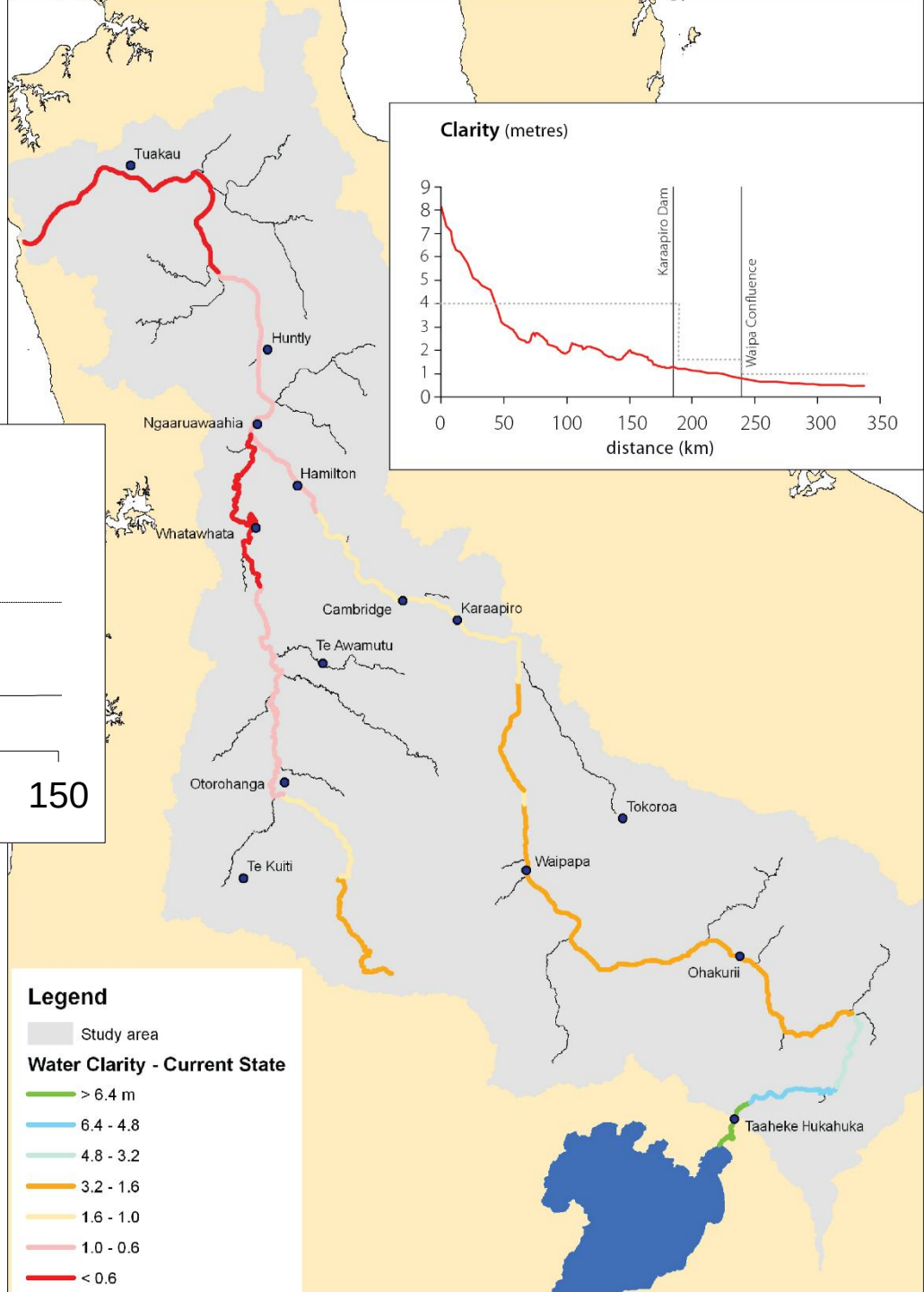




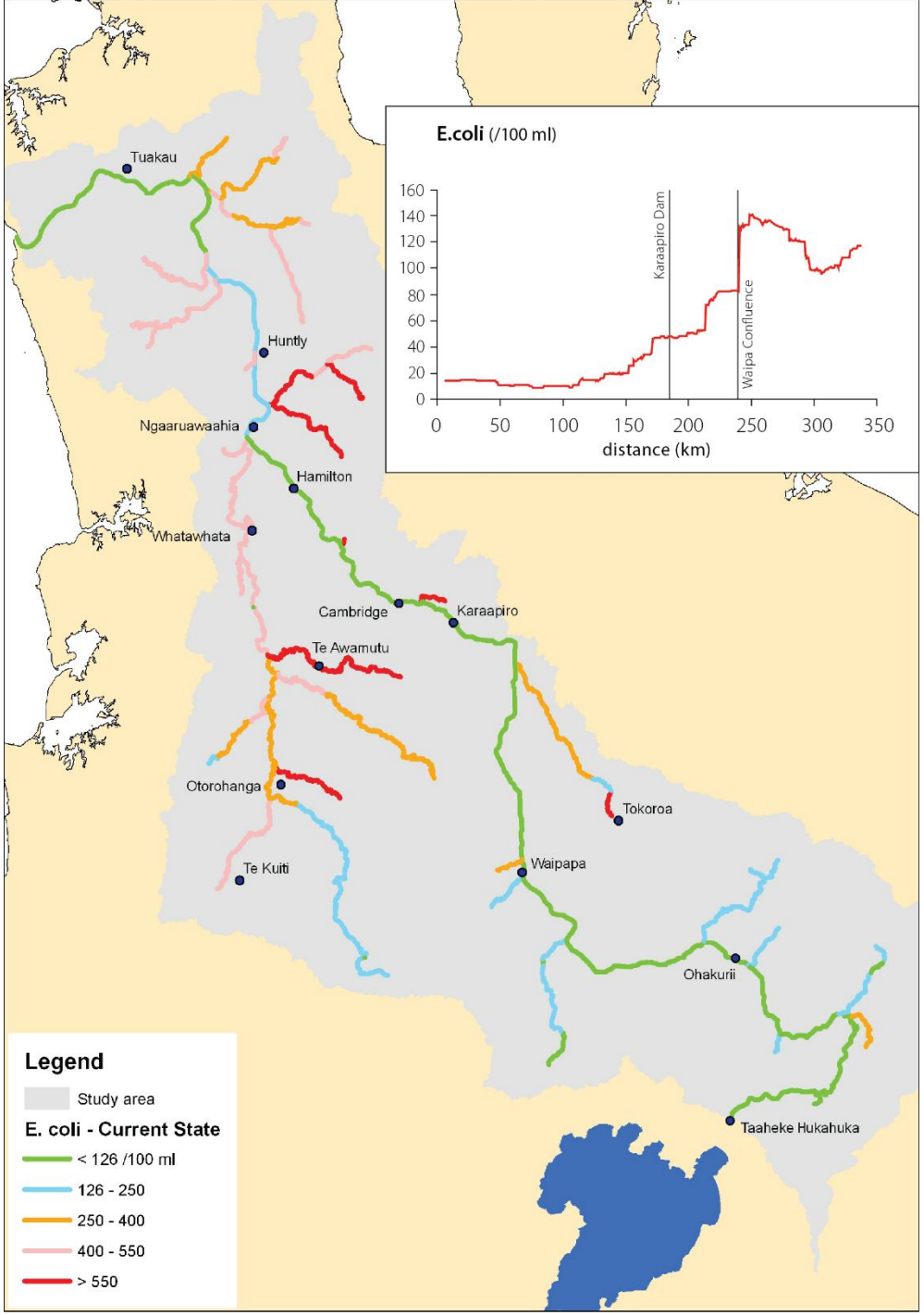
NIWA 2010 WRISS

Variation in Clarity at baseflow along Waipa and Waikato



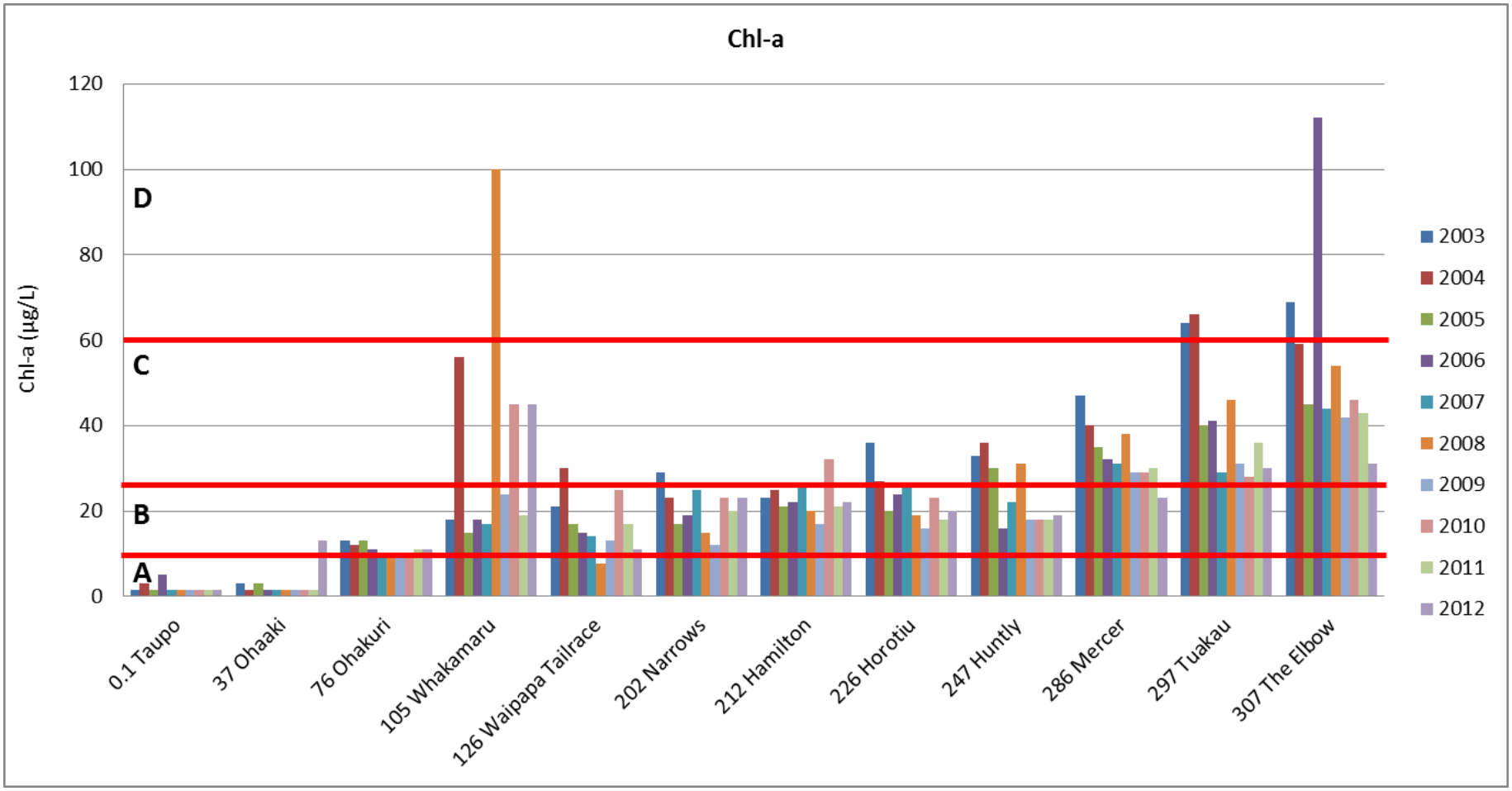


Variation in pathogen indicator *E. coli* at baseflow along Waipa and Waikato



NIWA 2010 WRISS

Waikato River maximum annual algal biomass vs National Objectives Framework (NOF) standards



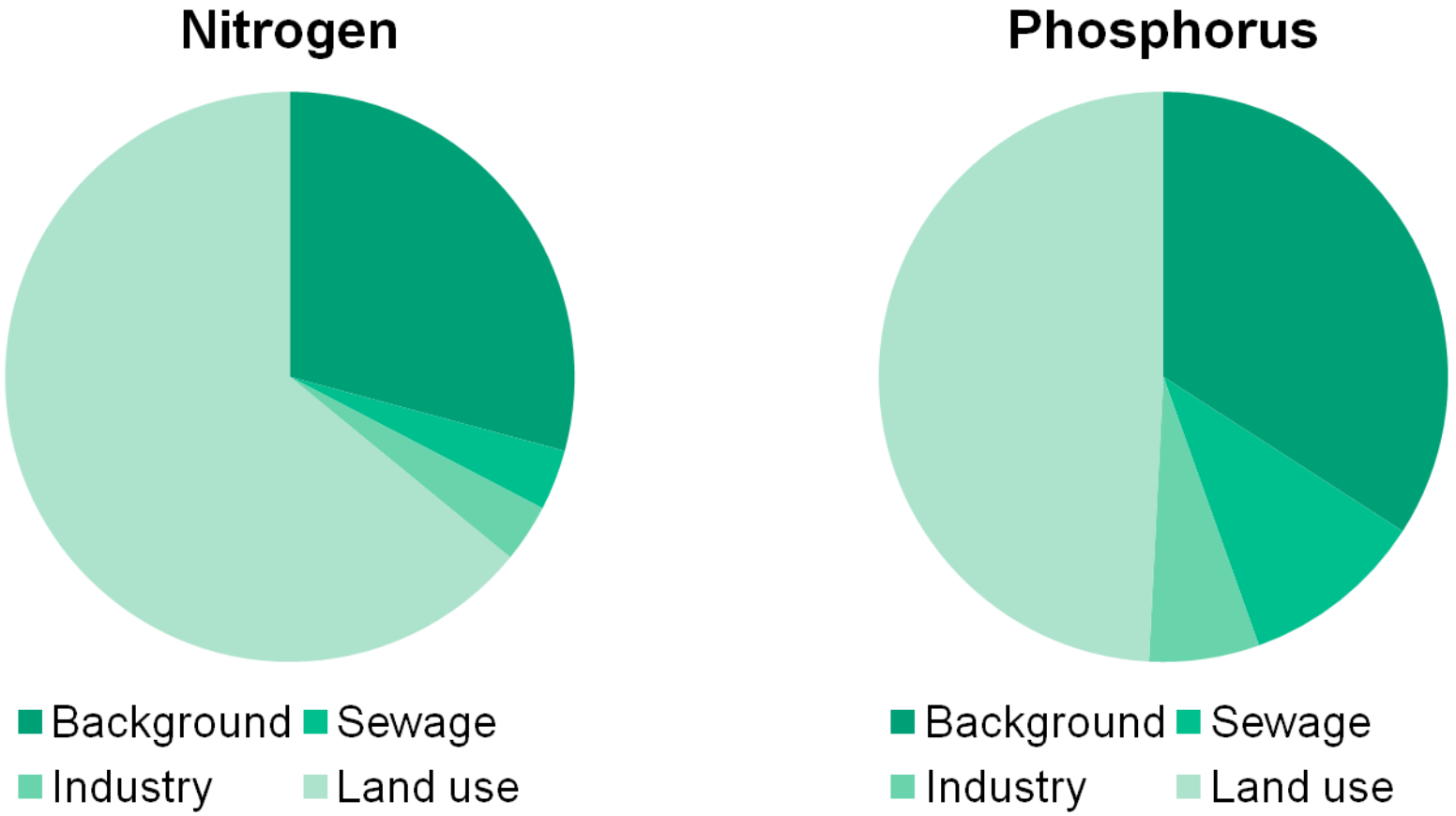
Data source: Waikato Regional Council

Lake Annual median concentration 2005-13 vs NOF states

Lake	Med Chl-a	Med TP
Lake Hakanoa	36	97
Lake Harihari	7	11
Lake Mangahia	54	660
Lake Maratoto	17	26
Lake Ngaroto	31	133
Lake Ohinewai	48	110
Lake Otamatearoa	5	11
Lake Puketirini	9	12
Lake Rotomanuka	11	18
Lake Serpentine	13	26
Lake Taharoa	7	20
Lake Waahi Centre	23	64
Lake Waikare	93	146
Lake Whangape	74	120

Excellent = A
Good = B
Fair = C
Unacceptable = D

Sources of nutrients, Taupo Gates to Port Waikato



Rural sources of contaminants

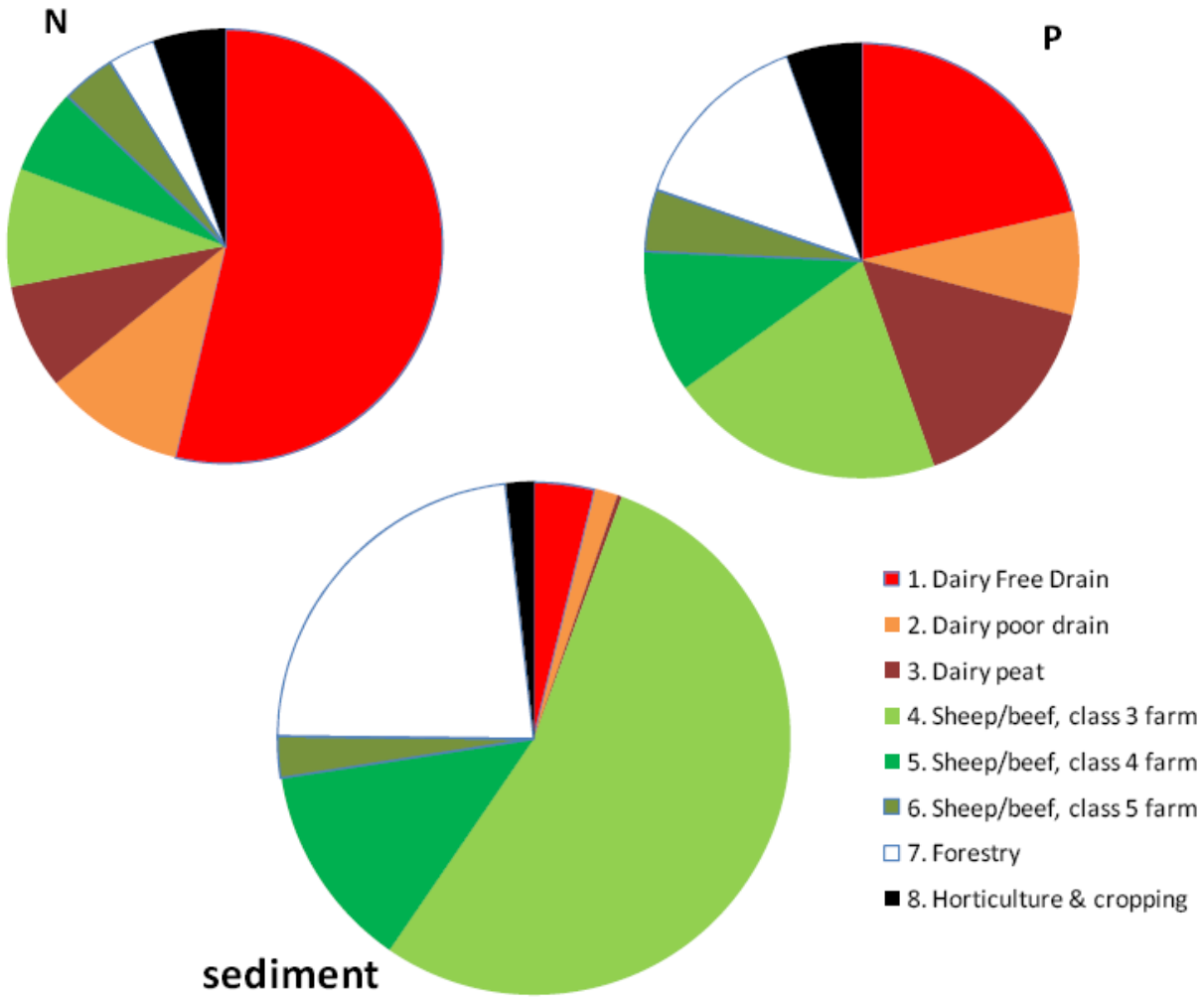


Figure 5.3: Estimates of the key sources of contaminants discharged from farms within the Waikato River catchment.

NIWA 2010 WRISS report

Summary: current state

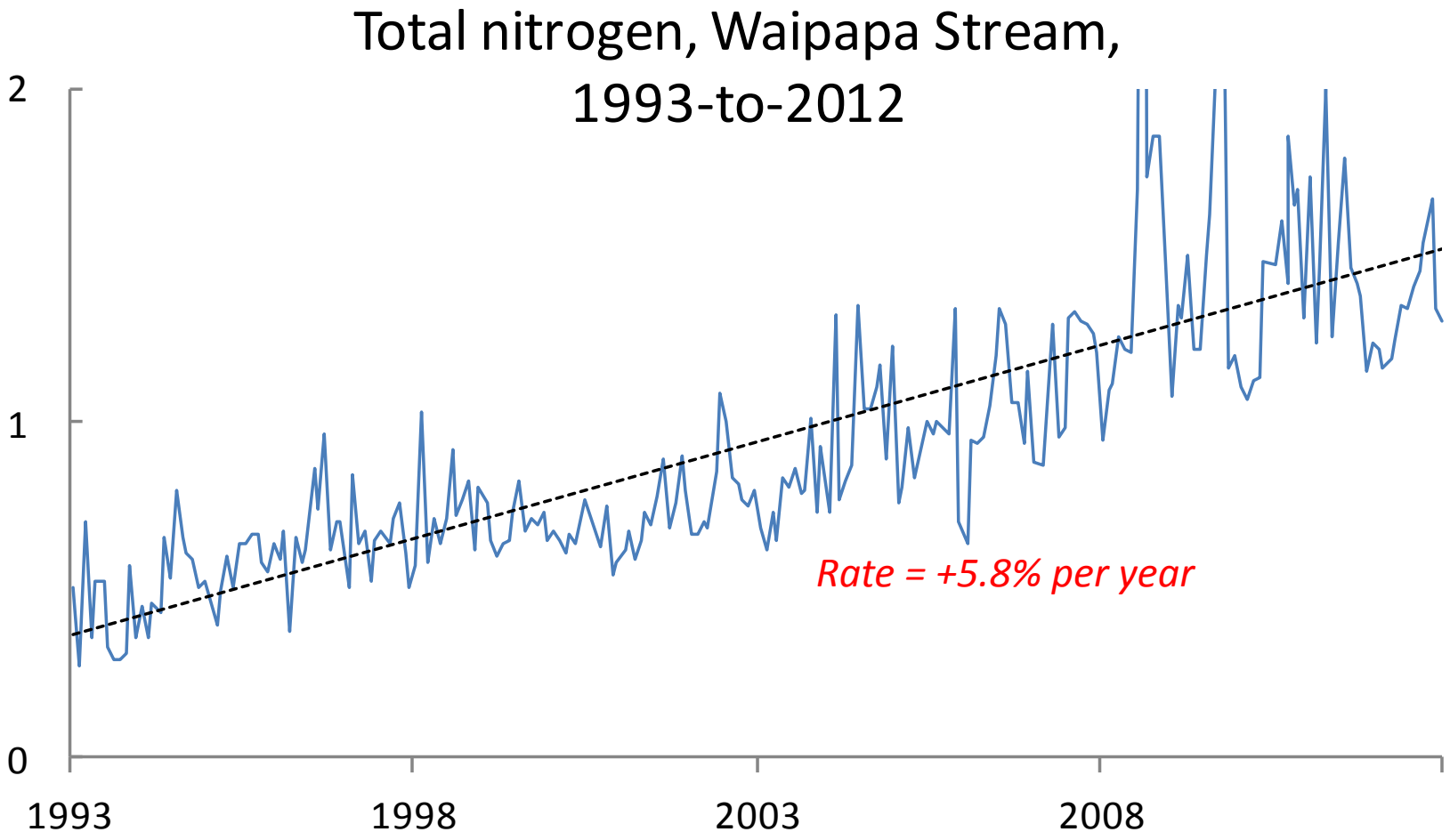
- excellent in places, poor in others—lowland lakes very poor
- conditions are often “at least satisfactory for desired uses”
  - differences between zones (e.g. Waipa c.f. Lower Waikato mainstem c.f. Riverine lakes)
  - these broadly reflect differing intensity of land use, geography and residence time in dams

Trends

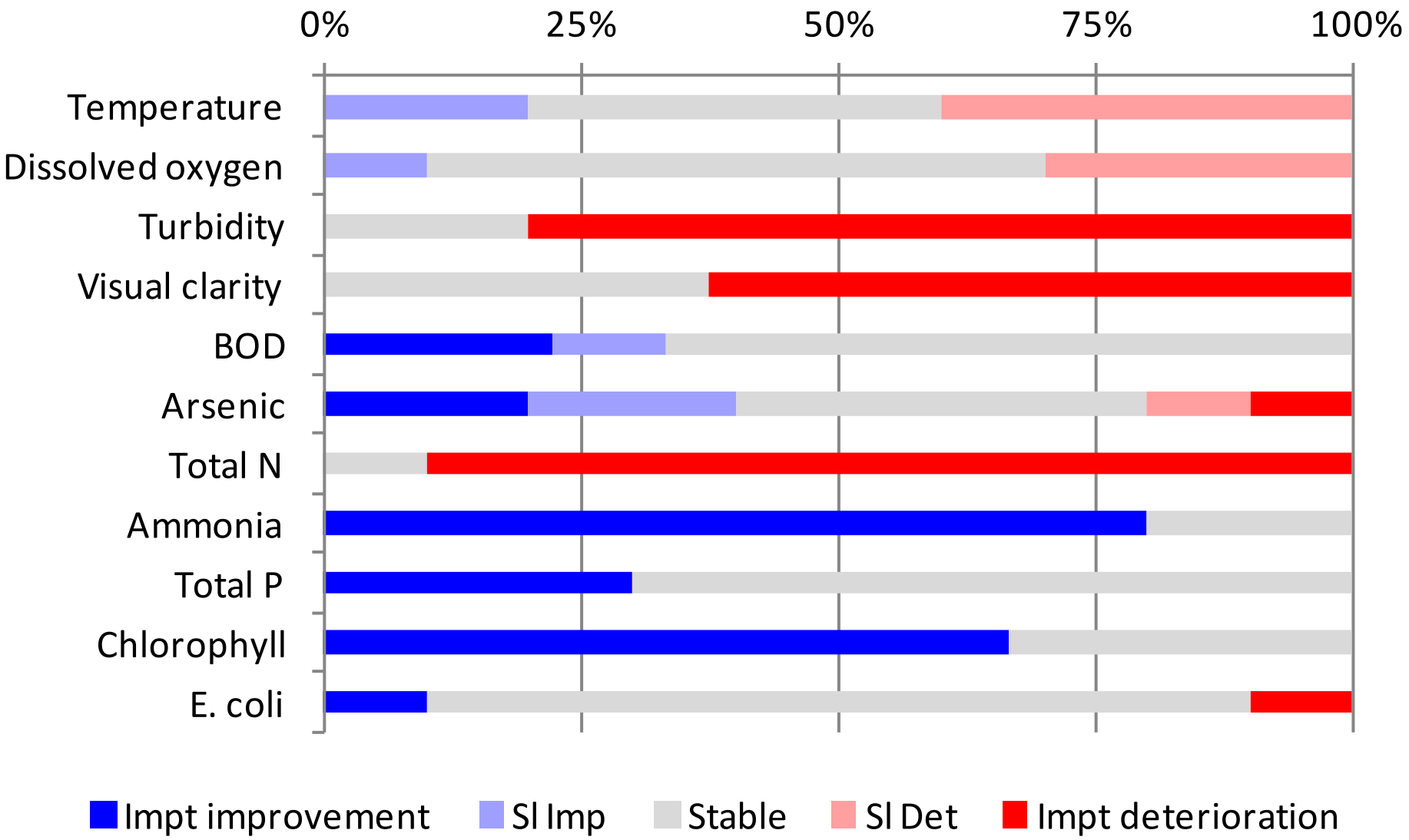
Direction of change – improvement
or *deterioration*

Rate of change – slight (<1% pa)
or ***important*** (>1% pa)

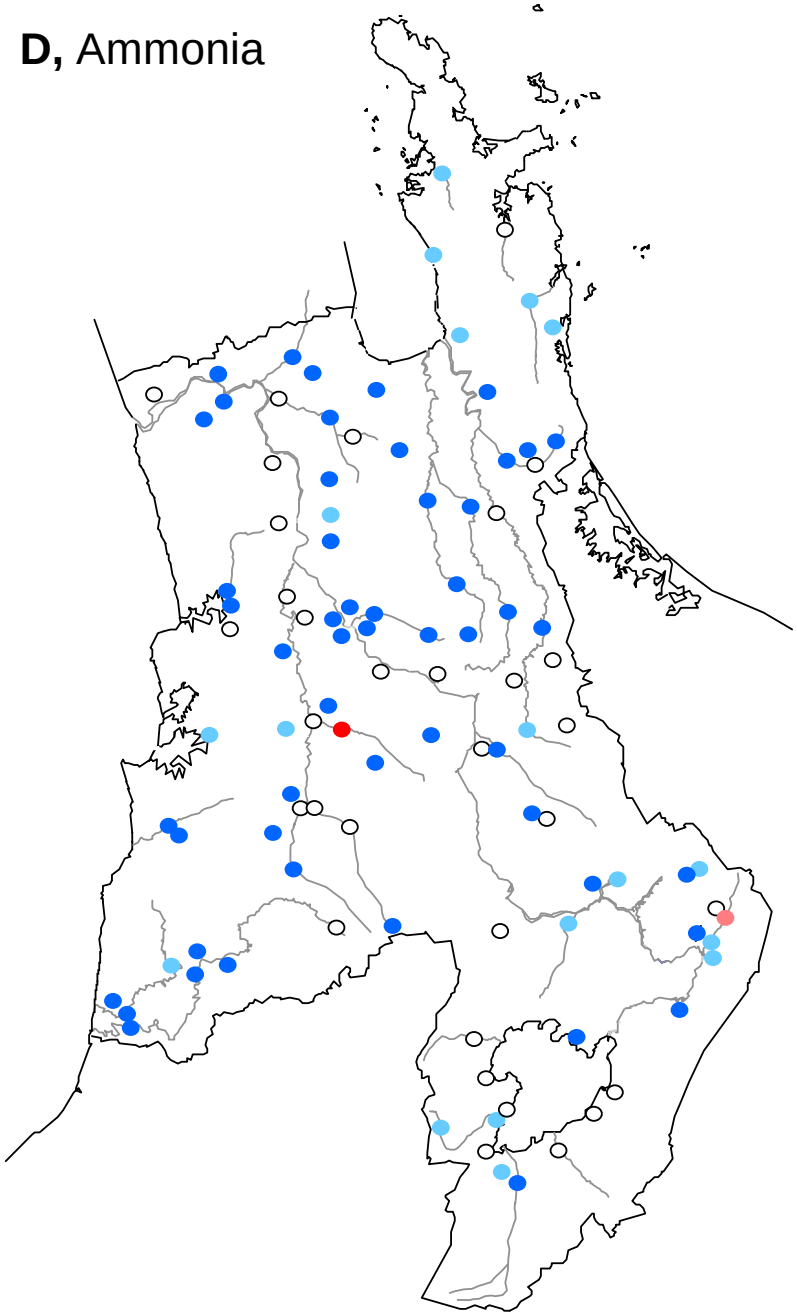
A water quality record with a trend



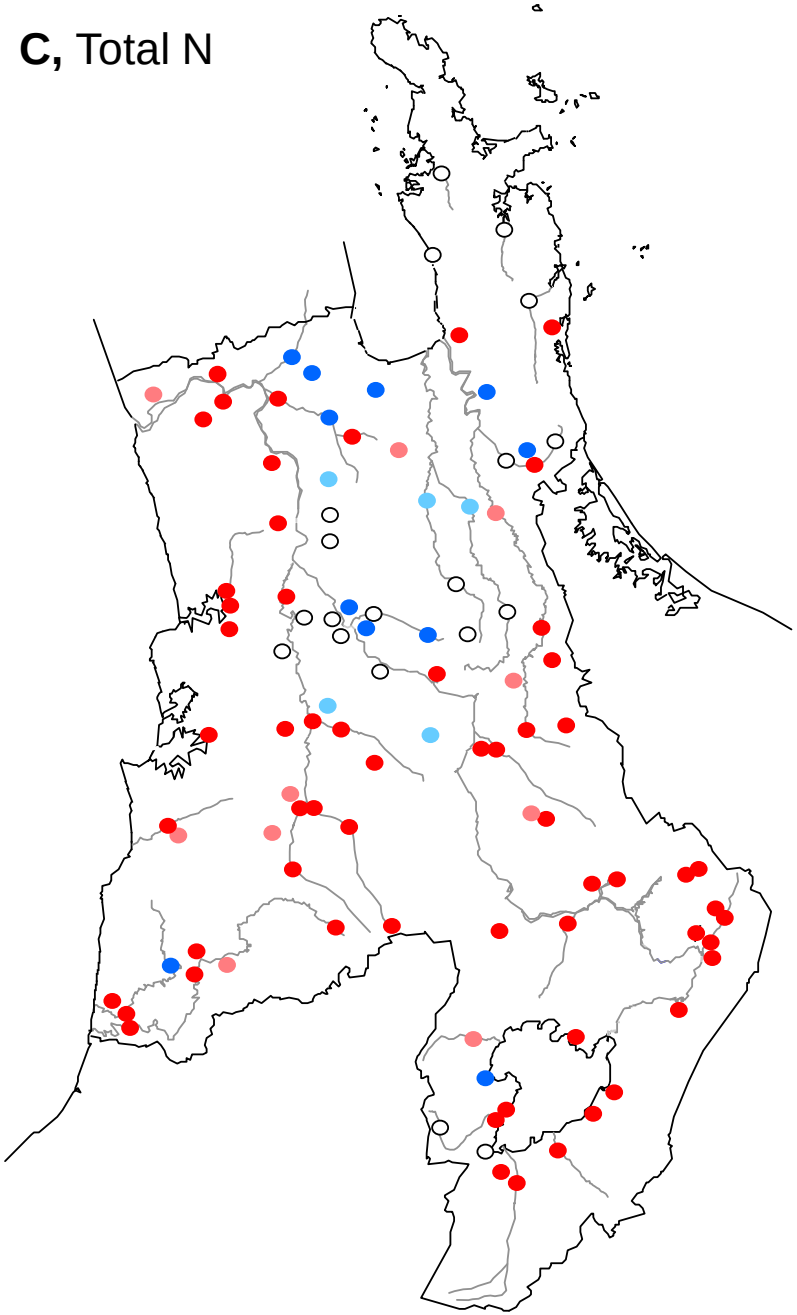
Water quality trends at Waikato River sites, 1993-2012



D, Ammonia



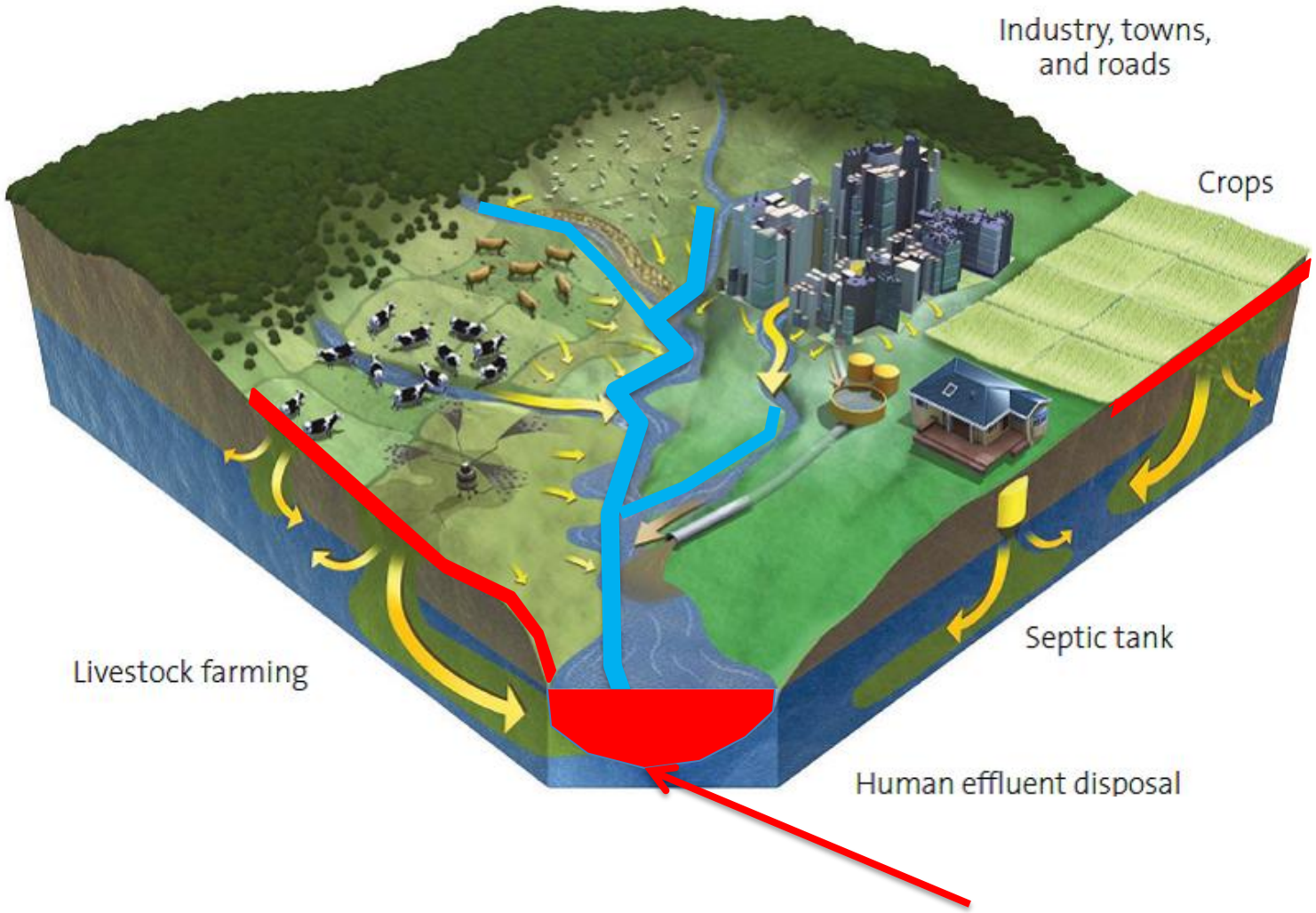
C, Total N



Summary: trends 1993-2012

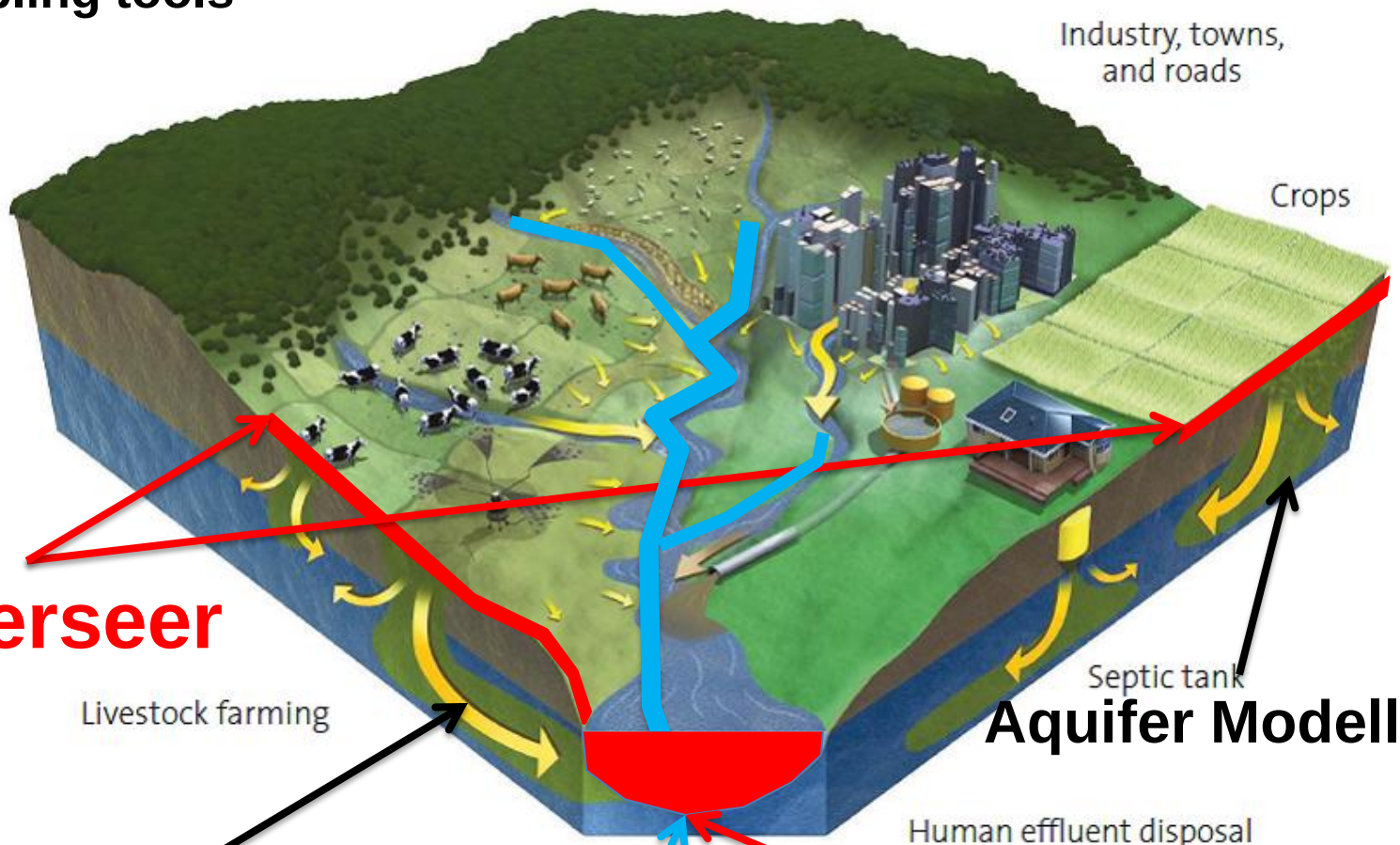
- Some improvement (ammonia, chlorophyll);
- Some deterioration (turbidity, nitrogen)
- Pastoral agriculture likely to be the cause of much of the increase in nitrogen
- Groundwater lags likely to influence future trends (N load to come)

The Challenge….Managing contaminant movement to waterways



Location where a water quality objective/ limit has been set

Enabling tools



Overseer

Aquifer Modelling

Aquifer Modelling

CLUES

Location where a water quality objective/ limit has been set


What level of
“quality” is desirable
and achievable?


Time to address
CSG's written
questions

Ngā Uara me ngā Tohu Māori o te wai

- Mai te timatanga o te ao, te wai – Ko Io matua kore
- Na Tane te waipuhi, te waiariki, te waiora
- Ko Parawhenuamea te ahuatanga o te wai
- Na te Atua te kawa, na te tangata te tikanga

- Ko Waikato te awa. Ka rere mai ōna wai i Te Wairere o Huka puta atu ki te Pūaha o Waikato.
- He tūpuna, he tipua, he taniwha, he taonga, te kōmitititanga me te hononga o nga awa, he

Ngā Uara me ngā Tohu Māori

- Nga wāhanga waiora ki Waikato
  - Mahinga kai
  - The integrity and knowledge of significant sites
  - Access to / abundance of taonga species
  - Recreation – swimming, paddling, fishing
  - Wai – identity, cultural practise and activities, knowledge, discrete and collective importance of bodies of water

Technical Questions from CSG#2

ANTOINE and LIZ

- I think the largest challenge is to communicate the evidence/facts on sources/results of the contaminants to:
  - CSG (Collaborative Stakeholder Group)
  - Healthy Rivers decision makers
  - Stakeholders who have to make a change.

Technical Questions from CSG#2

MIKE

- How long does it take for N in ground water to reach water bodies?
- How much understanding is there about flows & direction of aquifers at different depths and direction of diffuse losses?

GRAEME

- How much work has been done on milk urea nitrogen levels as a catchment tool?
- JOHN
- What is the amount of nutrient that a fully “natural system” either loses directly through leaf drop, soil movement or diffuse loss? (eg. Fiordland)
- What is the natural (native) NP within the catchment not related to urban, industry & agriculture?

GRAEME

- How can the modelling done for this process be useful over longer time to assist with continuous management and improvement?
- Who will be doing the whole farm modelling? What tools will they use?
- How will the economic analysis of farm level impacting thru to regional/national impacts be done?
- Do we have sound information that can link possible changes/tools that might be applied with their economic impact on the communities where this would be done?