

Water and Our Health

The Future of Our Water Community Symposium
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Te Hāu o te Whenua Te Hāu o te Tangata

Waiora



Drinking Water and Health

The introduction of safe water drinking water has been identified as the reason for 75% of decline in infant mortality and 66% decline in child mortality in US during 20th century

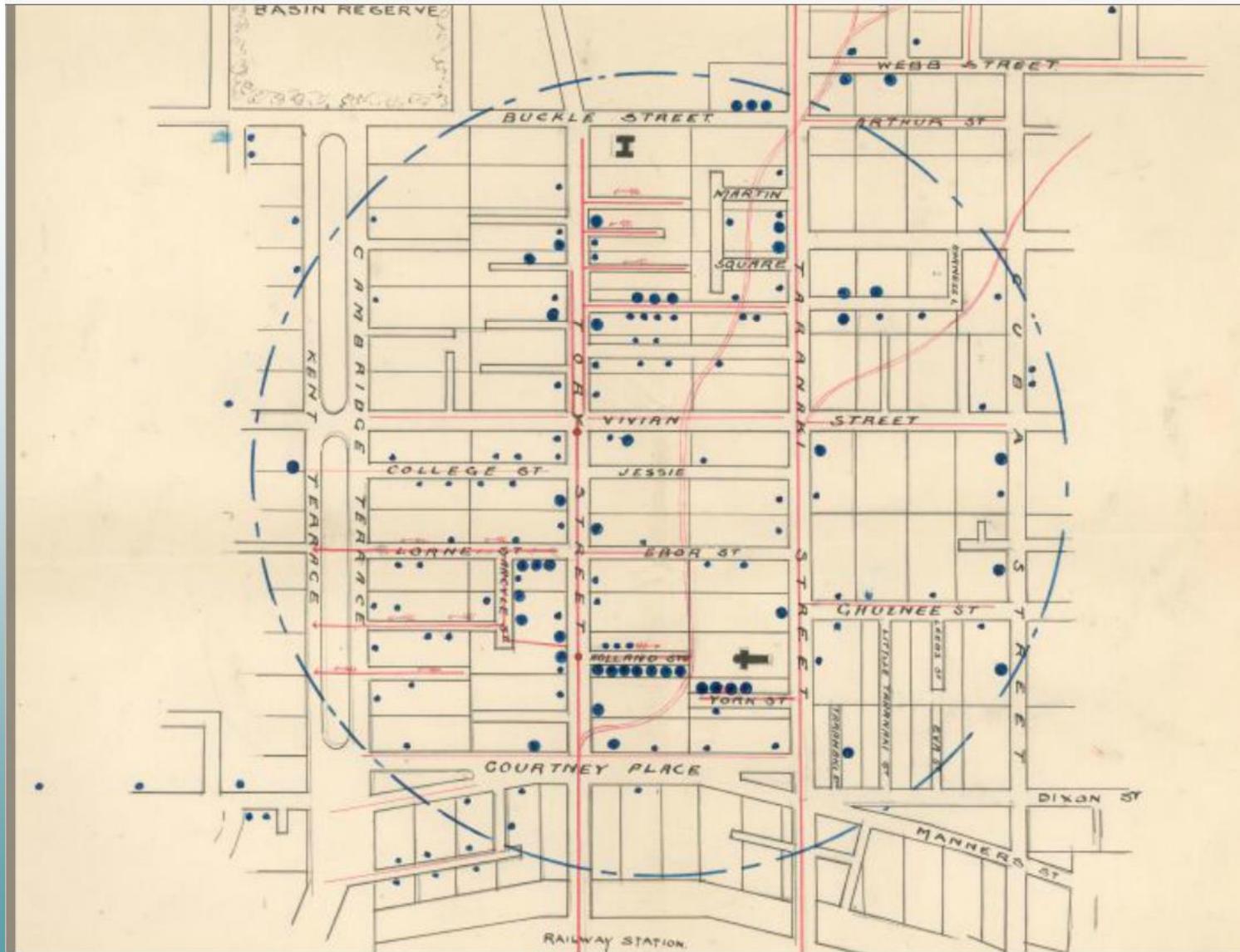
Queen Street 1860s



Source: teara.govt.nz

Backyard Well





Typhoid Wellington 1892 - linked to blocked sewers and storm

Hawke's Bay

Typhoid Fever and Paratyphoid Fevers. These diseases occur sporadically throughout New Zealand. Outbreaks in areas in which population is congested have been traced to contamination of milk and

water supplies. Water-borne epidemics have occurred most often in the low-lying areas along the eastern coast, especially in the vicinity of Hawke Bay, where overcrowding and pollution of the soil and water are common. In 1941 the mortality rate for typhoid fever and paratyphoid fevers in the white population was 0.5 per 100,000. This rate is about the average rate for the past eight years. In the white population the morbidity rate for these two diseases has varied between 3 and 5 per 100,000. Morbidity and mortality rates for typhoid fever and paratyphoid fevers—as well as bacillary dysentery—are higher among the Maoris than among the white people.

Global Epidemiology

A GEOGRAPHY OF DISEASE AND SANITATION

SIMMONS ■ WHAYNE ■ ANDERSON ■ HORACK

India and the Far East
The Pacific Area

★



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Water Health Issues Today

- How does water contribute to human health?
- What are the risks?
 - Quantity and reliability of supply
 - Contaminants in drinking water sources
 - Microbial contaminants
 - Chemicals
 - Contaminants in water used for recreation
- Preventing and detecting contamination of water
- Treatment of Drinking Water

Water benefits to human health

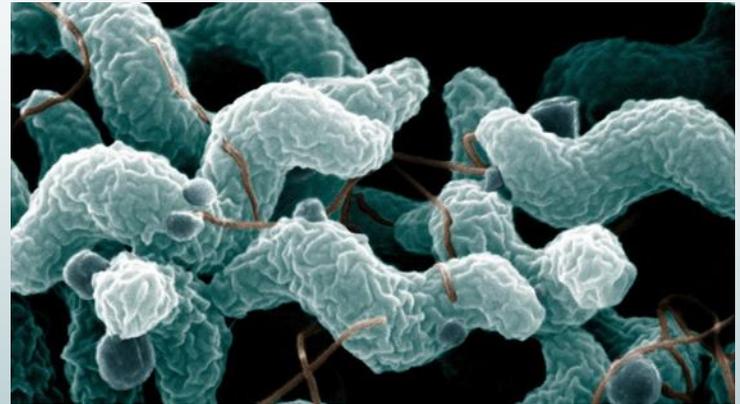
- Necessary for body function and other basic aspects of health and well being eg hygiene
- Provides for recreational, aesthetic and spiritual human need
- Ecosystem services eg provision of habitat for food species, transport of waste and contaminants away from human contact and drinking water sources
- Basic requirement for production of food
- Other economic benefits

Risks - Not enough water

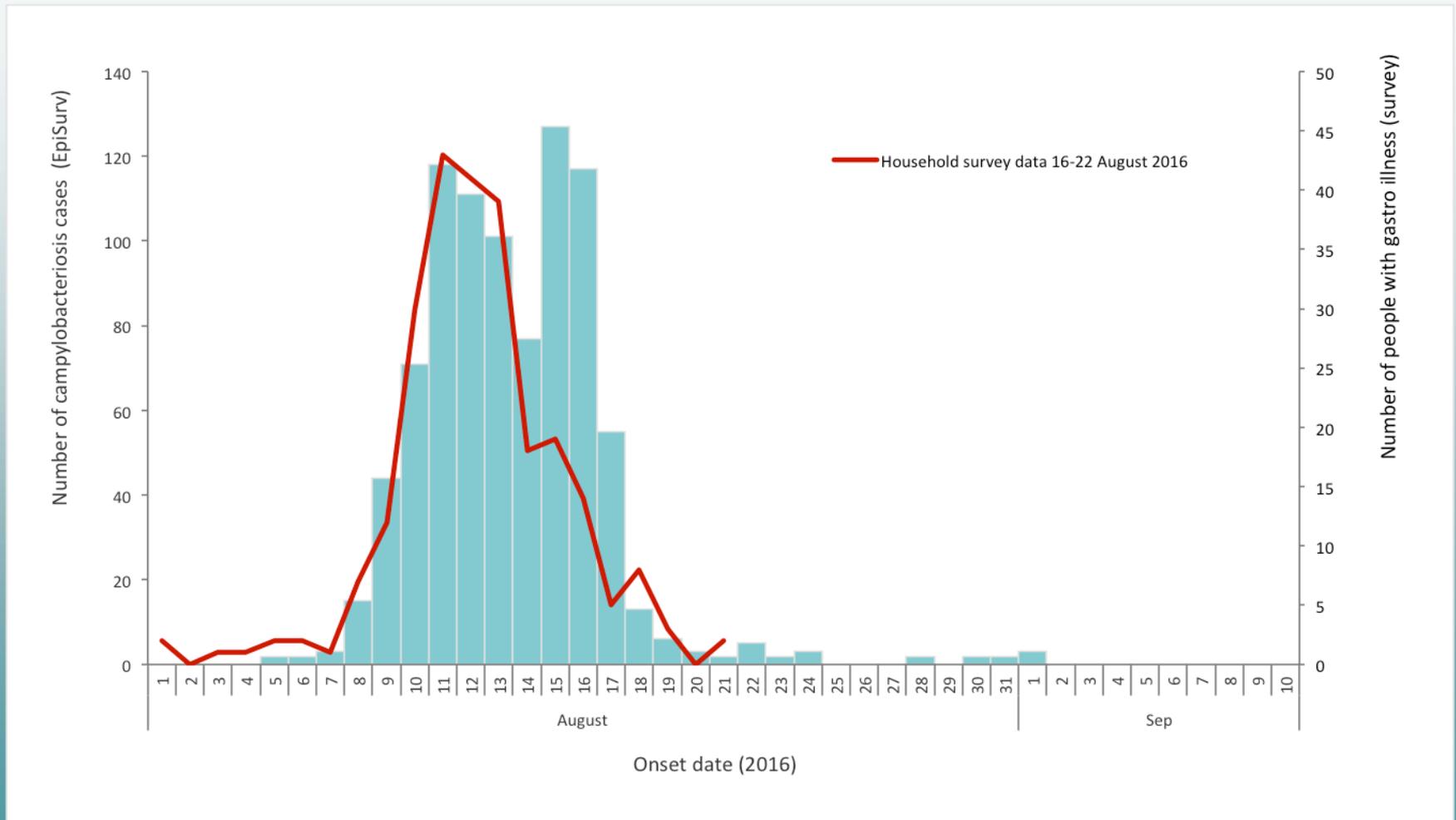
- Availability or security –
- Rainfall dependent communities
 - Low rainfall in CHB
 - Inconsistent rainfall in late summer and autumn (Wairoa)
 - 20% less rainfall by 2070
 - Reduced use or use of unsafe water
 - Hygiene problems or enteric diseases
 - Cost of trucking water and other economic impacts
- Ground water self supplies
 - Ground water levels dropping in summer

Risks - Microbes

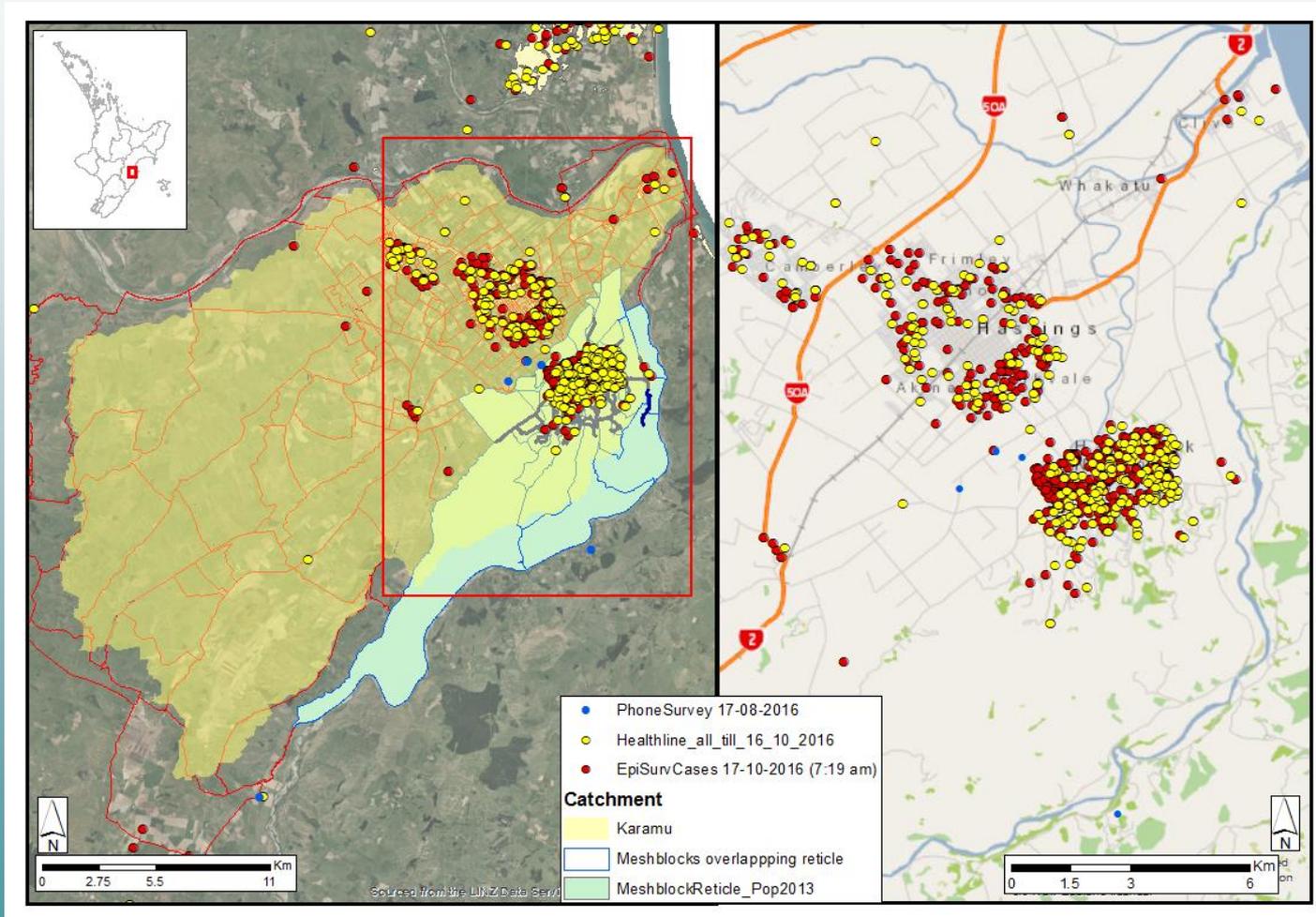
- Bacteria
 - Campylobacter
 - Salmonella
 - Shiga toxin producing e.coli
 - Others eg Cholera rare in NZ
- Viruses
 - Norovirus
 - Hepatitis A virus
- Protozoa
 - Cryptosporidium
 - Giardia



Campylobacter associated with Outbreak 2016



Campylobacter Outbreak case locations



last updated 17/10/16 Case location points randomly shifted to preserve privacy

Campylobacter - longer term health effects

- Kidney and bowel problems
- 3 Guillain-Barré Syndrome (GBS) cases
 - 1 Severe
 - 2 Mild
- Reactive arthritis (ReA)

	Min ReA Rate	Max ReA Rate
Confirmed Cases	7%	23%
Non-notified Cases	2%	14%
Controls	0.5%	2%

- Frailty

Self-supplies



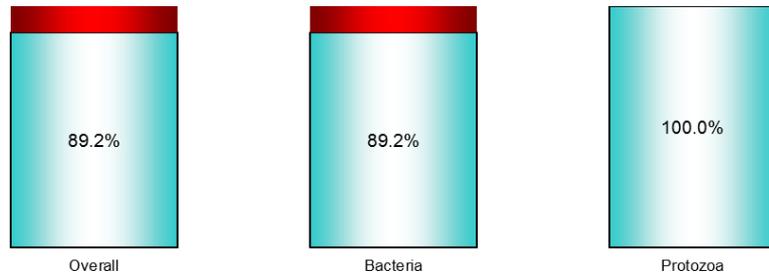
Surface or non secure ground s
Low cost treatment
Infrequent monitoring

STEC in children
major risk factor is living on a farm

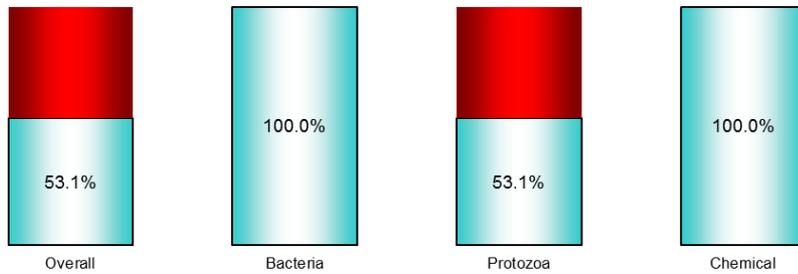


Which supplies are most at risk

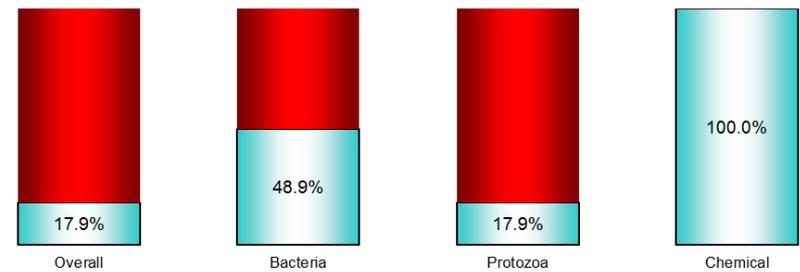
Large supplies



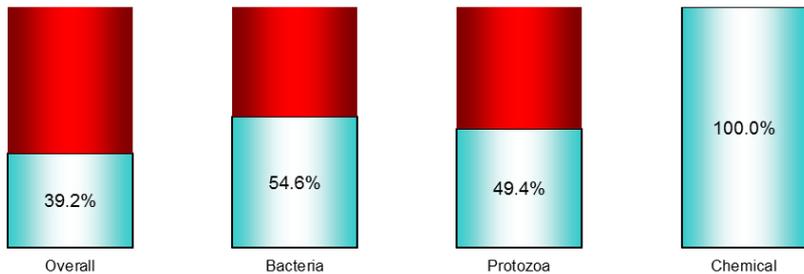
Minor supplies



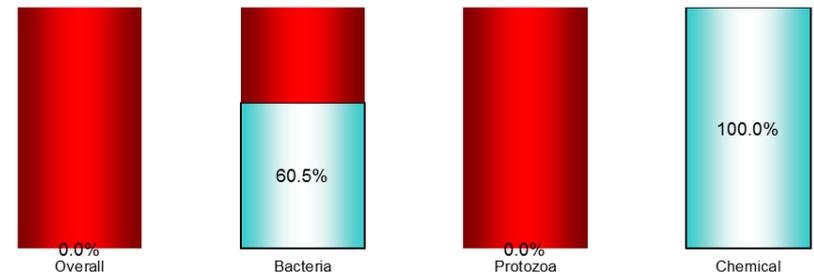
Neighbourhood supplies



Small supplies



Supplies with population <25

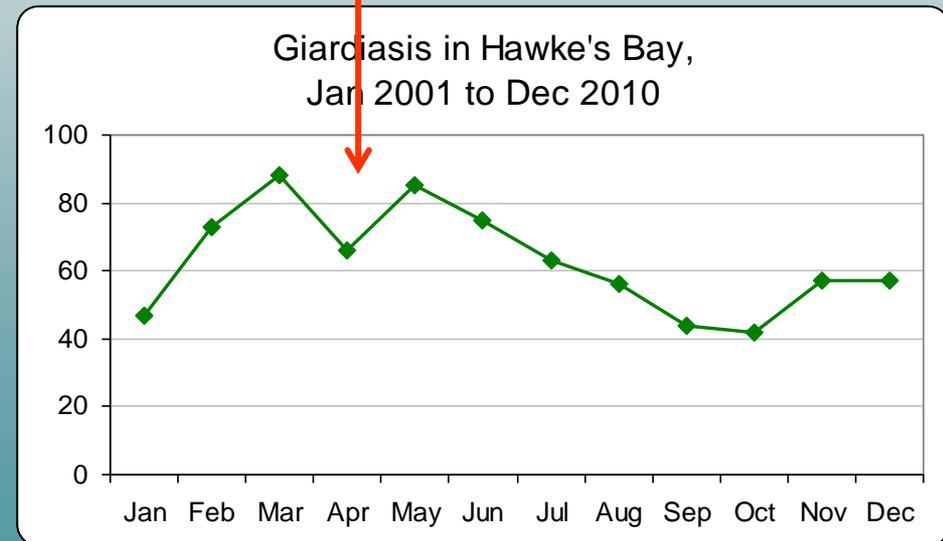
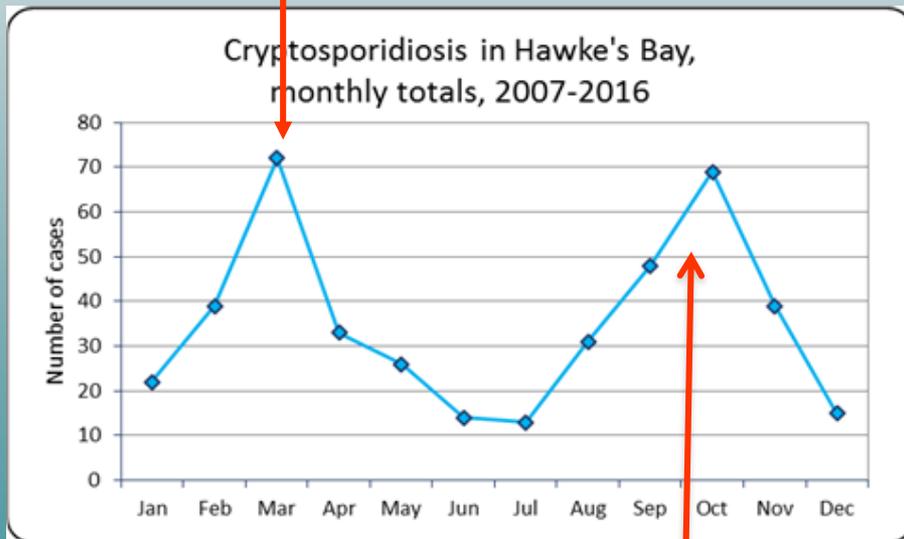


Based on survey of all registered supplies in HB 2014

Other Waterborne Diseases in Hawkes Bay

- Most common illnesses – Giardia, Cryptosporidium
- Giardiasis risks incl. swimming and drinking water from small supply
- Cryptosporidiosis risks – contact with farm animals, attending daycare and drinking or using untreated drinking water

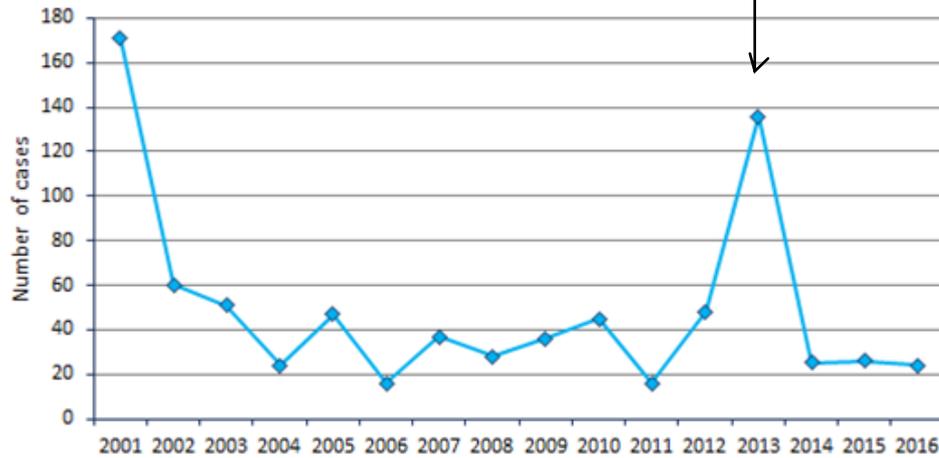
Ingestion while swimming?



lambing/calving

"Waterborne" Disease Trends

Cryptosporidiosis in Hawke's Bay by year,
2001-2016



Swimming (probably pools)

Giardiasis in Hawke's Bay by year,
2001-2016



Risks - Chemicals and Drinking Water

- Surface water –
 - disinfection byproducts (chlorine combined with organic material)
 - Theoretical risks of cancer and other effects eg reproductive health
 - Chemical spills
 - Cyanobacteria toxins
 - Others eg endocrine disrupting chemicals
- Ground water
 - Nitrates – associated with high intensity agriculture
 - Methaemoglobinemia
 - ? Cancer risk
 - Impacts on spring fed rivers
 - Chemicals affecting taste (iron, manganese)
 - Pesticides

Methaemaglobinaemia (Blue Baby)

Main risks nitrate attributable to conversion to nitrite.

Nitrite - conversion of normal Hb to met HB which can not transport oxygen to the tissues.

Symptoms when met HB above 10% - normally less than 2% (3% infants)

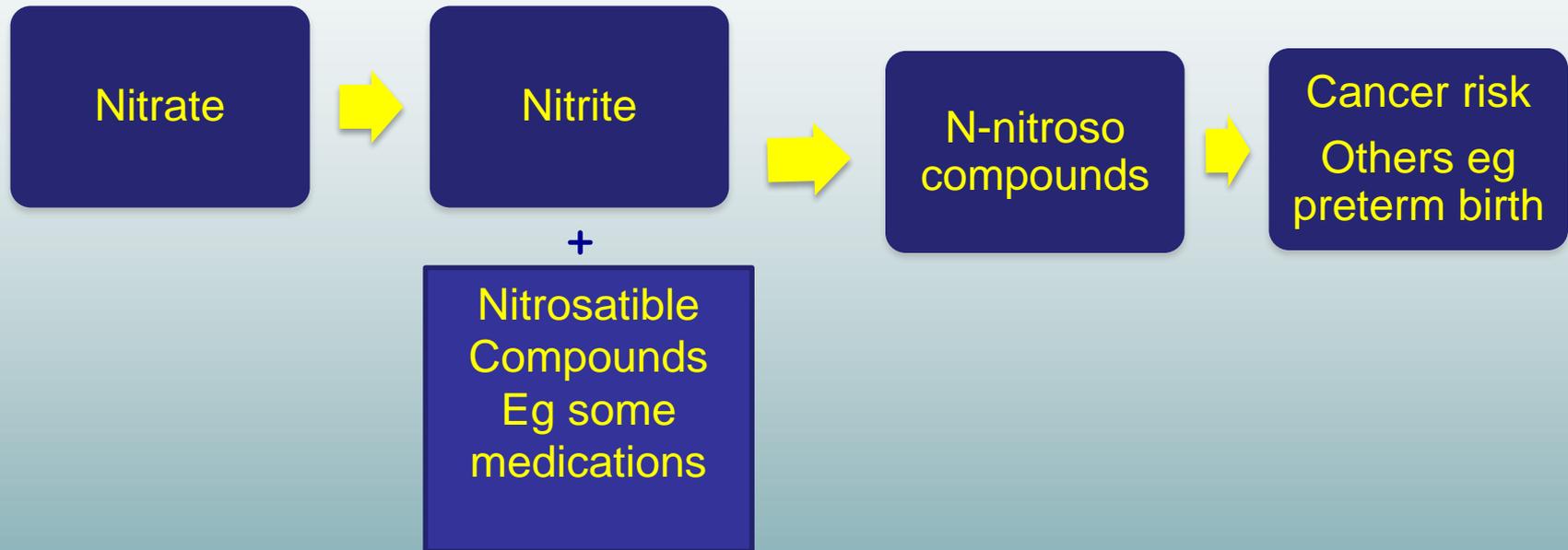
Infants at greater risk:

- size, lack of enzymes to convert met HB back to HB

- conversion of nitrate by gastric bacteria – lower production of gastric acid

Presence of bacterial contaminants in water important cofactor

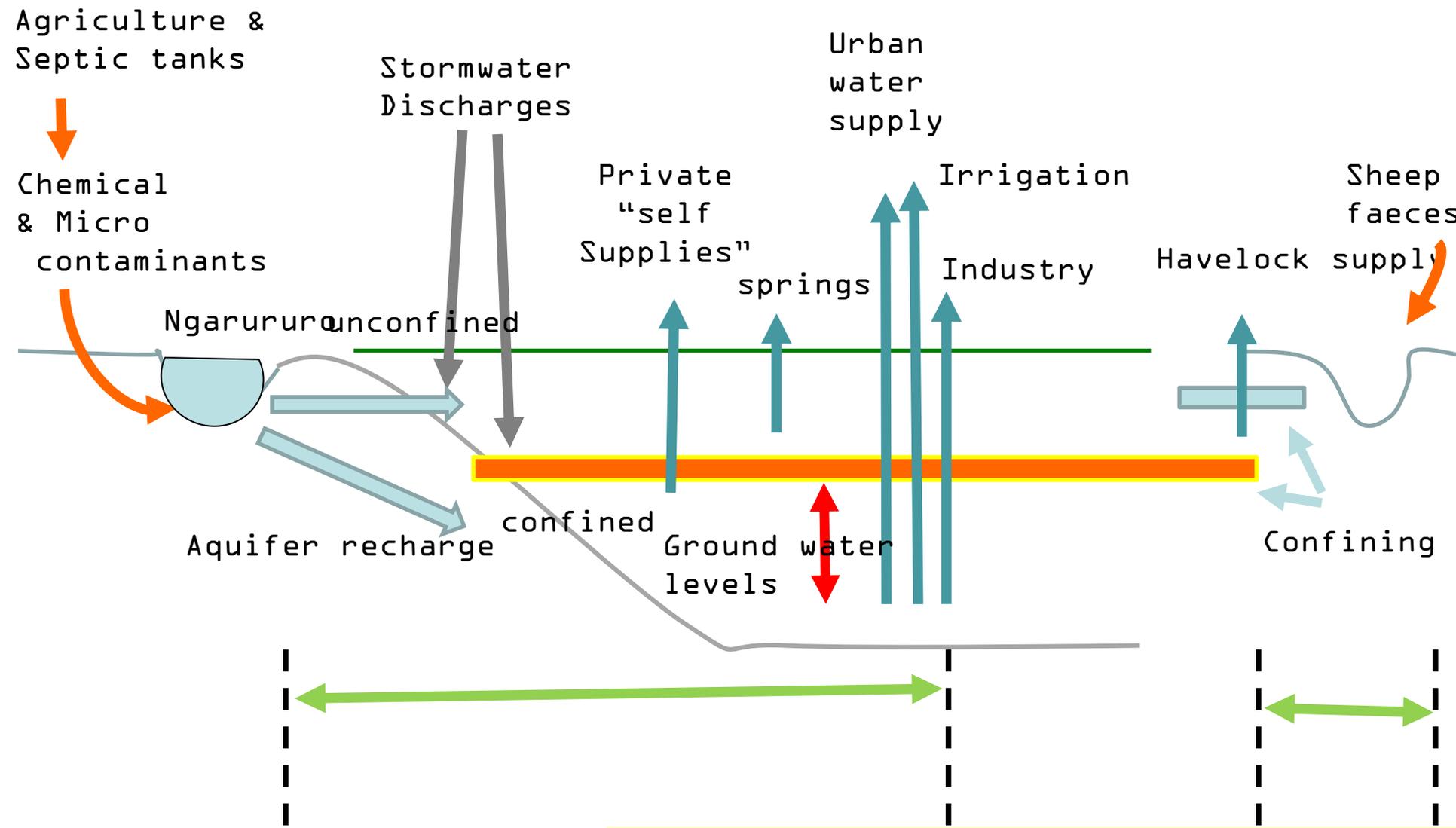
Nitrates - other potential indirect effects



- No evidence that nitrates on their own pose a risk
- Dietary **nitrites** from animal sources higher risk than plant
- Role of **nitrites** from drinking water **nitrates** inconclusive

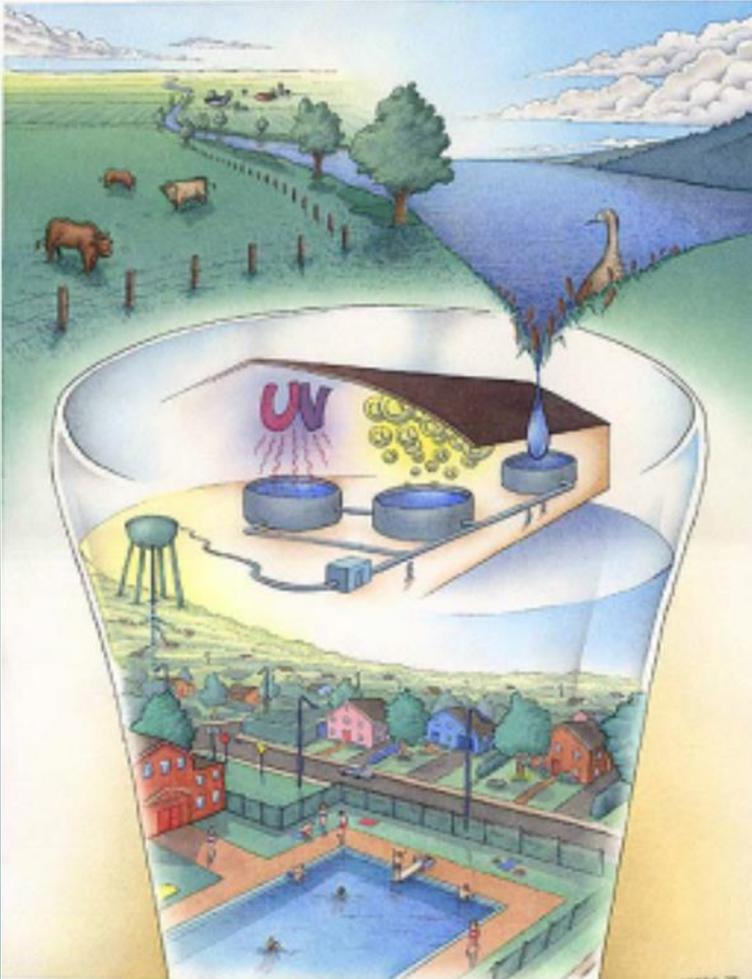
Where do water contaminants come from?

- Microbes
 - Human and animal faeces through waste water, effluent discharges and storm water run off
 - Other organic material eg compost
- Nutrients
 - Fertilizer
 - Animal urine
 - Sediment loss from erosion
- Chemicals
 - DBP from the combination of chlorine and organic matter
 - Pesticide run off and ingress to ground water
 - Domestic and industrial storm water
 - Road run off
 - Cyanobacteria toxins



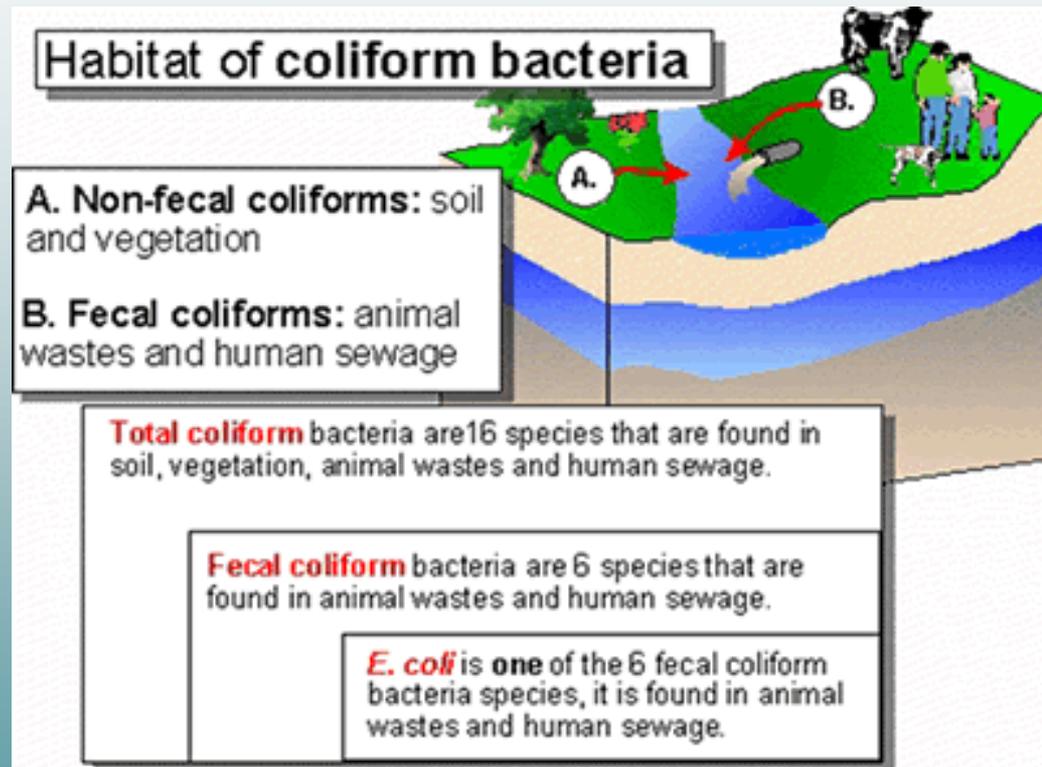
Water age and pathogen die off - virus, bac
 Contaminant fate and transport

The multi-barrier approach



- 1st Barrier: Source Water Protection
- 2nd Barrier: Water Treatment Technology
- 3rd Barrier: Distribution System Maintenance
- 4th Barrier: Water Quality Monitoring, and Testing
- 5th Barrier: Emergency Response Planning

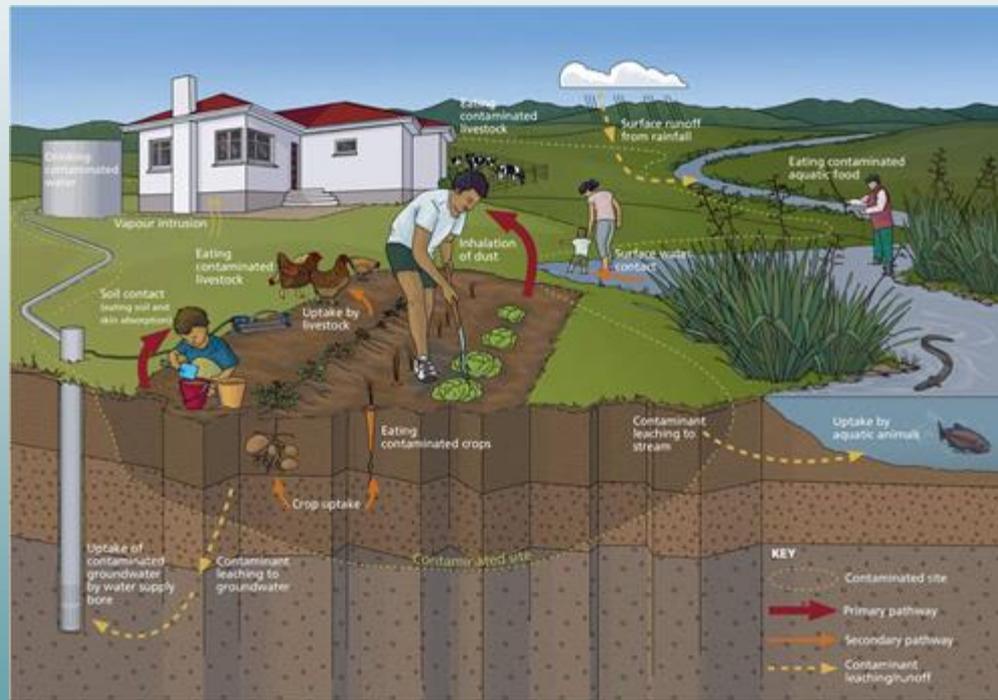
Monitoring drinking water



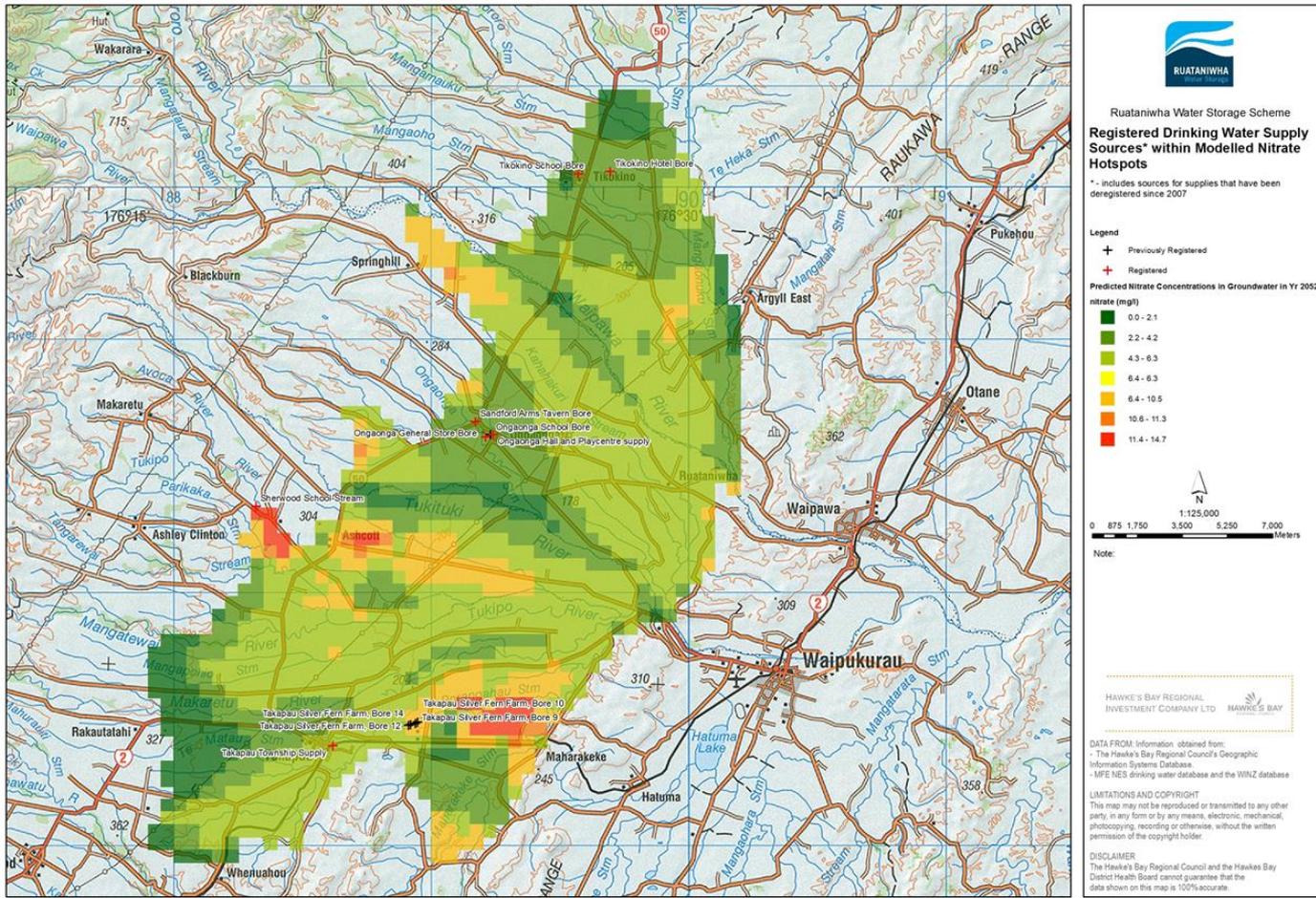
Source Water Protection

- Land use – farm management plans
- Chemical use
- Stock exclusion
- Discharges to ground
- Discharges to water
- Hazardous substances and contaminated land
- Sensitive Receiving Environments

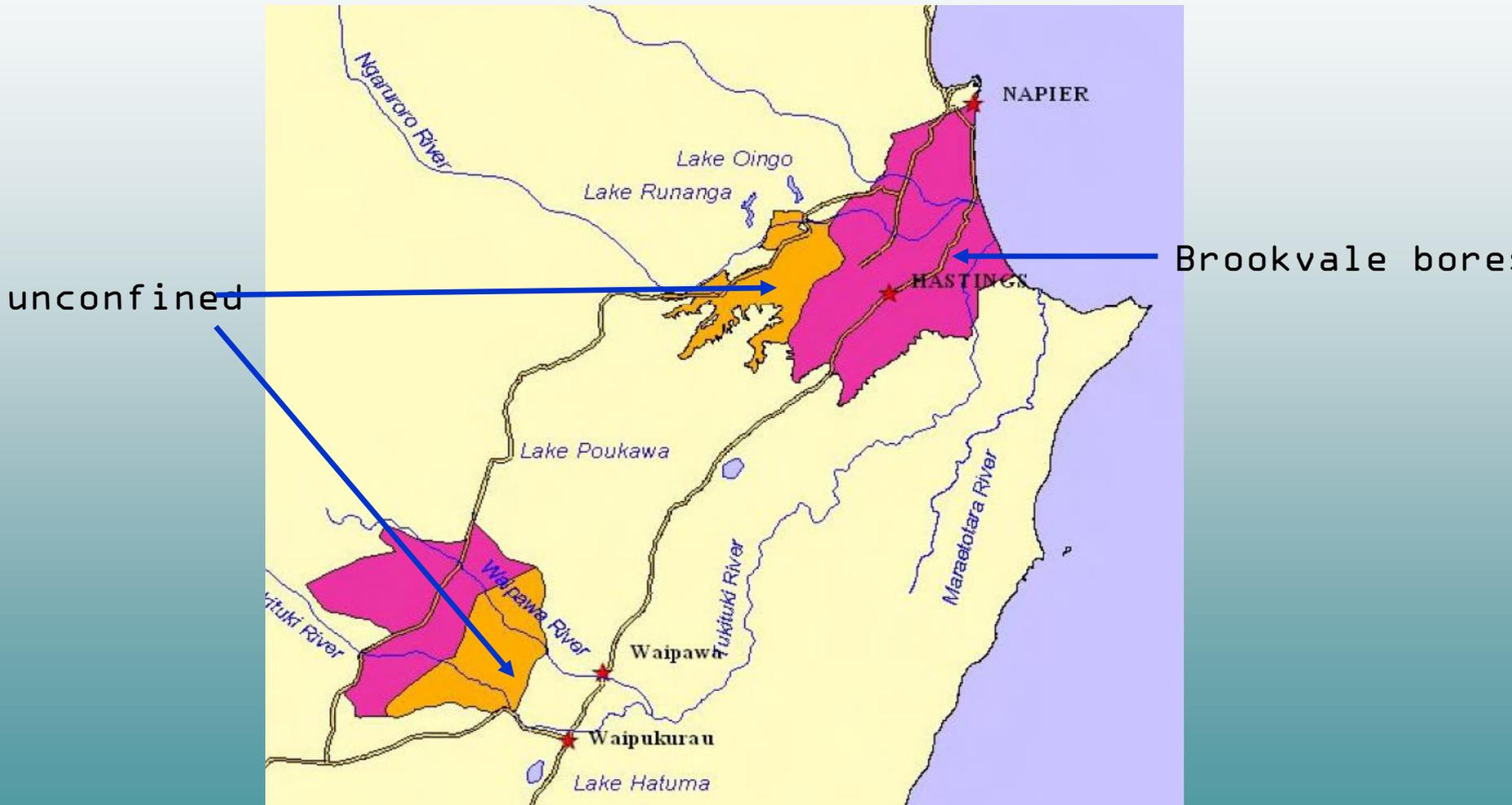
Keeping soil contaminants out of water sources



Potential Nitrates Levels



Protection of the unconfined aquifer



Water used for recreation

- Fresh, marine, pools
- Pathogens from human or animal faeces
 - Viruses, bacteria, protozoa
- Hazardous algal blooms
 - Irritant and toxic effects
- Duck itch – cercarial dermatitis
- Drowning and injury

Hawke's Bay Recreational Water Quality

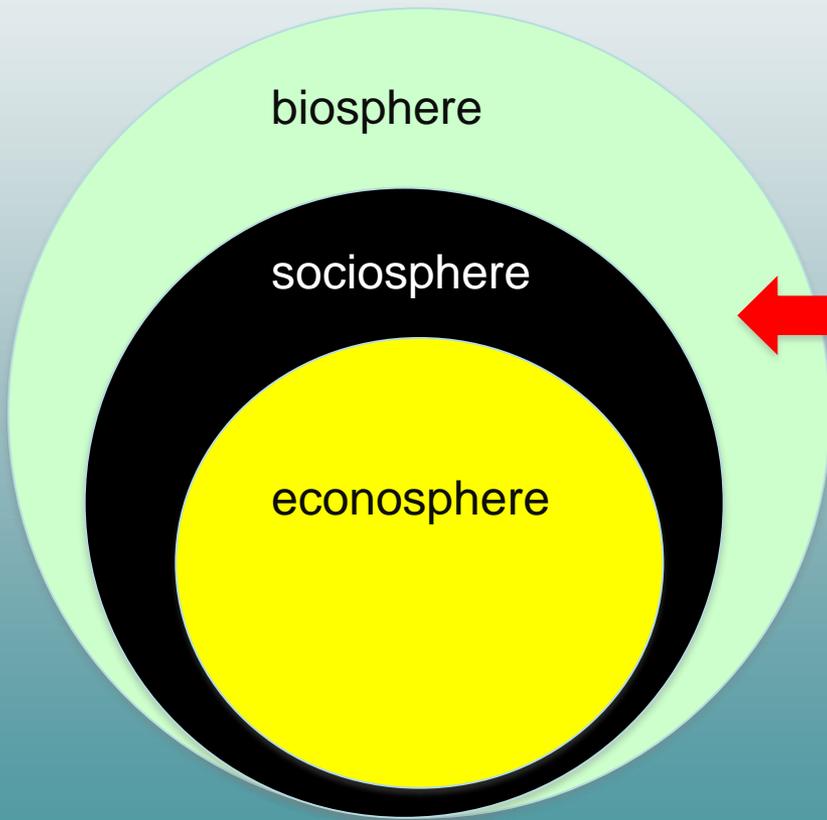


Source: www.lawa.org.nz

- “Climate change is the biggest global health threat of the 21st century”
 - Lancet and University College London Institute for Global Health Commission, 2009

Sustainability Models

Strong sustainability



Triple bottom line

