

Re-Assessment of the Risks of Protozoa in New Zealand's Natural Waters

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National Baseline Monitoring for Protozoa in NZ

Catchment Type	Number of Sites	% Samples Containing <i>Cryptosporidium</i>	% Samples Containing <i>Giardia</i>	% Samples Containing <i>E. coli</i>
Groundwater/Springs	8	0%	0%	8%
Bush Catchments	7	1%	3%	84%
Intermediate Rivers	7	1%	5%	87%
Lowland Rivers	5	43%	59%	100%

Intro to Protozoa

- What are protozoa?
- Why are they problematic for drinking water suppliers?



Ref: Centers for Disease Control and Prevention <https://www.cdc.gov/parasites/giardia/index.html>

Sampling for Protozoa in Groundwater

Location	Number of Sites Sampled	Number of Samples Taken	Number of Samples Positive For Protozoa
New Zealand	39	1,130	0
Overseas	>58	507	73 (14%)
Total	>97	1,637	73 (4%)

Outbreaks of Giardiasis and Cryptosporidiosis

New Zealand

- Giardia and Cryptosporidium are the top two causes of outbreaks of waterborne illnesses (ESR 2015, 2016 and 2018)
- But hard to attribute to type of water source

Overseas

- Outbreaks related to contaminated groundwater have been reported in the UK and USA
- Outbreaks are often associated with a clear contamination event or pathway

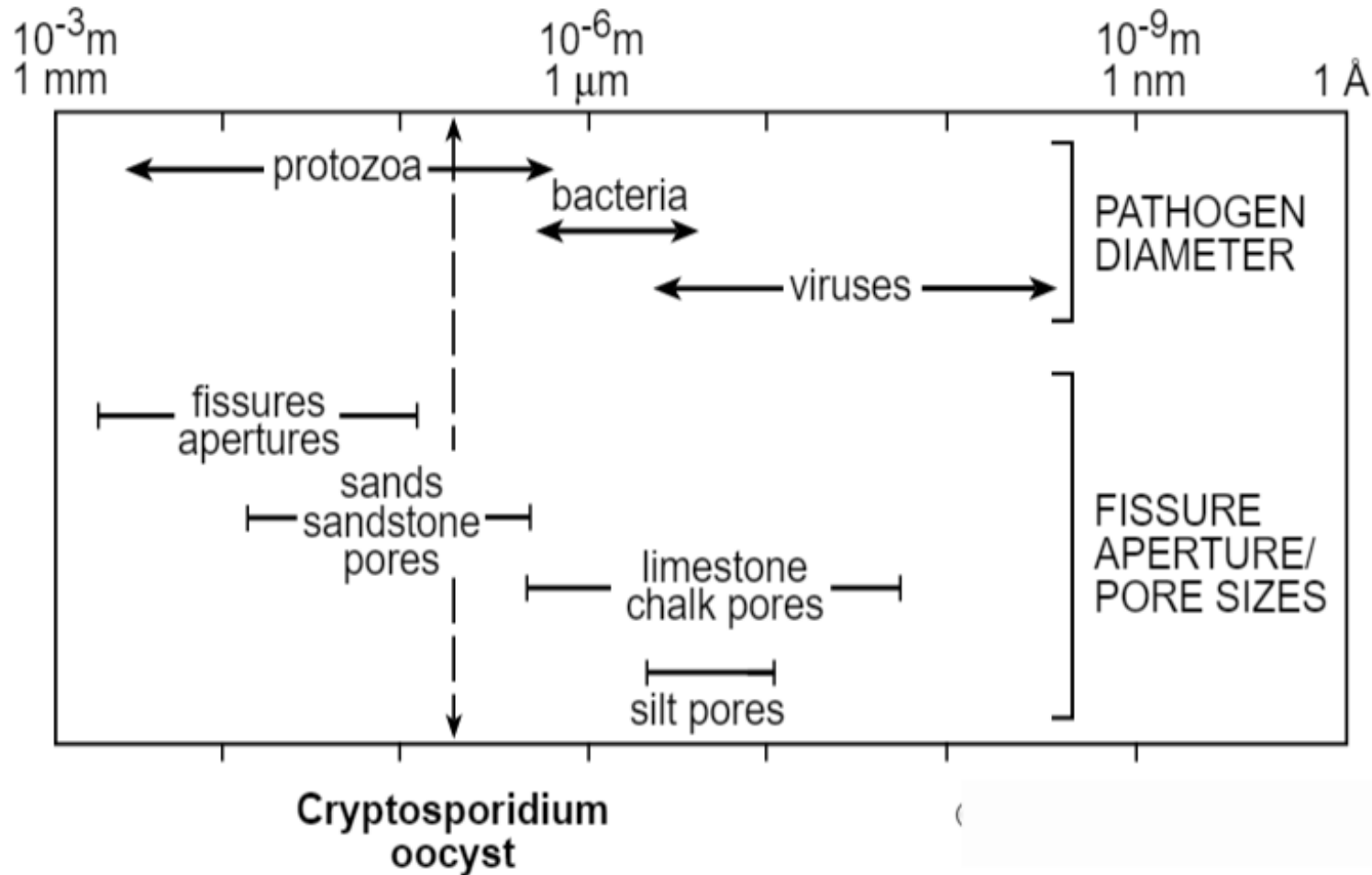
Outbreak Case Study

1992 – 1993 Cryptosporidiosis outbreak in Warrington, UK with 47 confirmed cases (Brigman, et al., 1995)



Ref: Centers for Disease Control and Prevention
<https://www.cdc.gov/parasites/crypto/index.html>

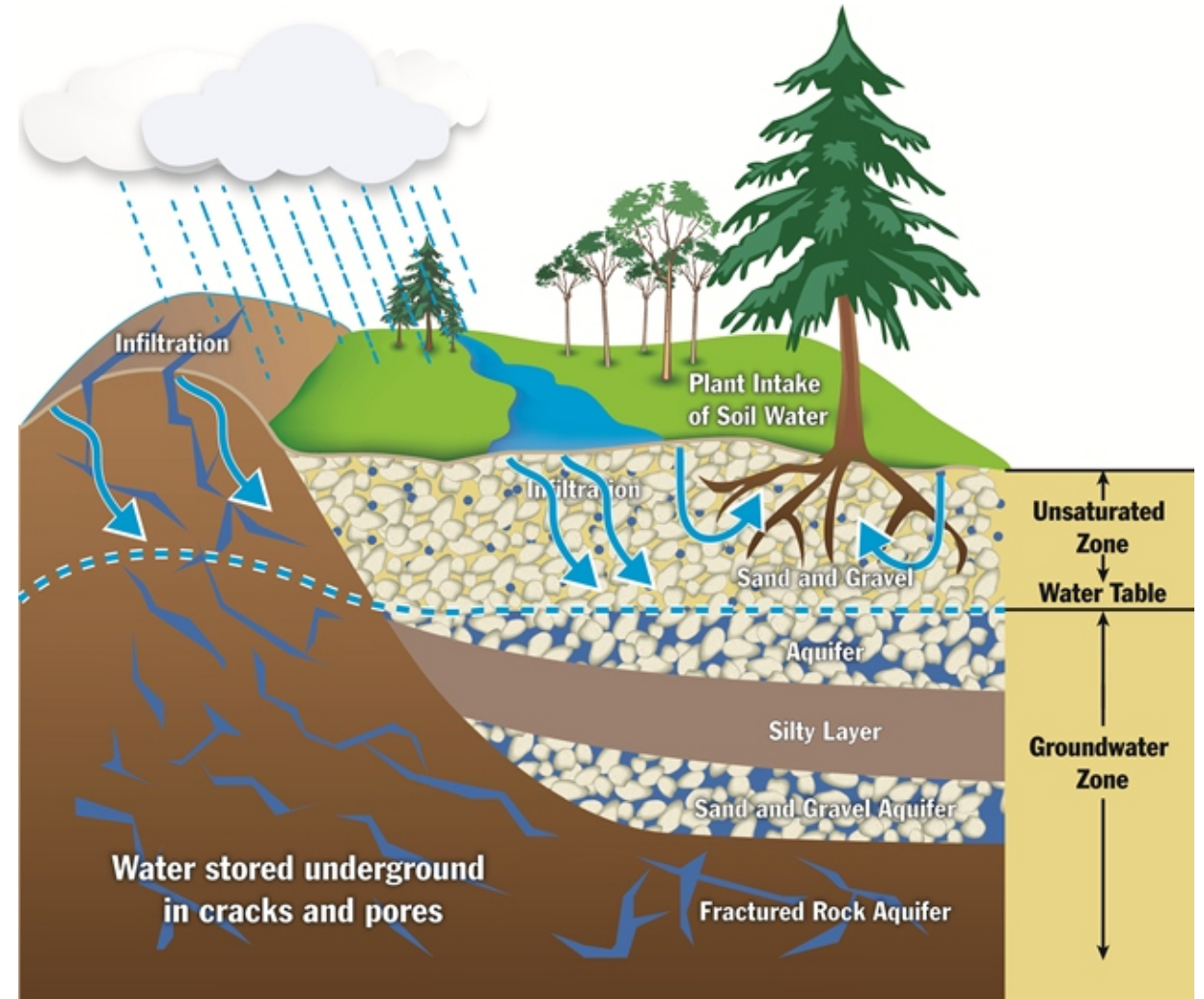
Natural Filtration Mechanisms



Pathogen Diameters Compared to Aquifer Matrix Dimensions Ref: taken from ARGOSS, 2001; British Geological Survey ©NERC in Schmoll, et al., 2006

Bypassing Mechanisms

- Karst or fissured bedrock
- Deep sewer pipes
- Condition of bores
- Condition of other infrastructure
- Overland flow

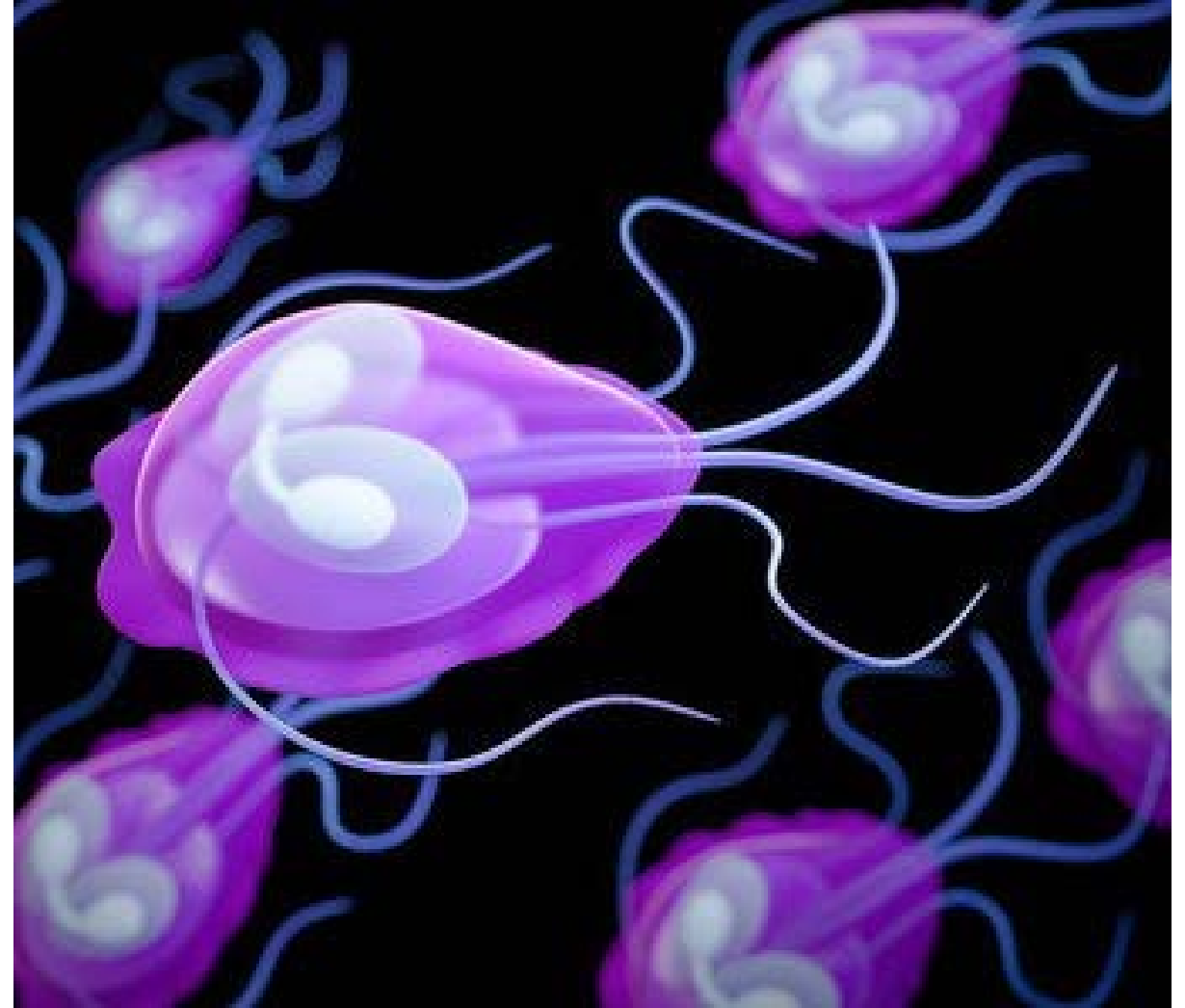


Ref: Govt of Newfoundland and Labrador at American Geosciences Institute

<https://www.americangeosciences.org/critical-issues/factsheet/managed-aquifer-recharge>

World Health Organisation and US EPA

- WHO acknowledges that the potential for contamination of groundwater exists
- USEPA considers that 'true' groundwaters do not contain protozoa

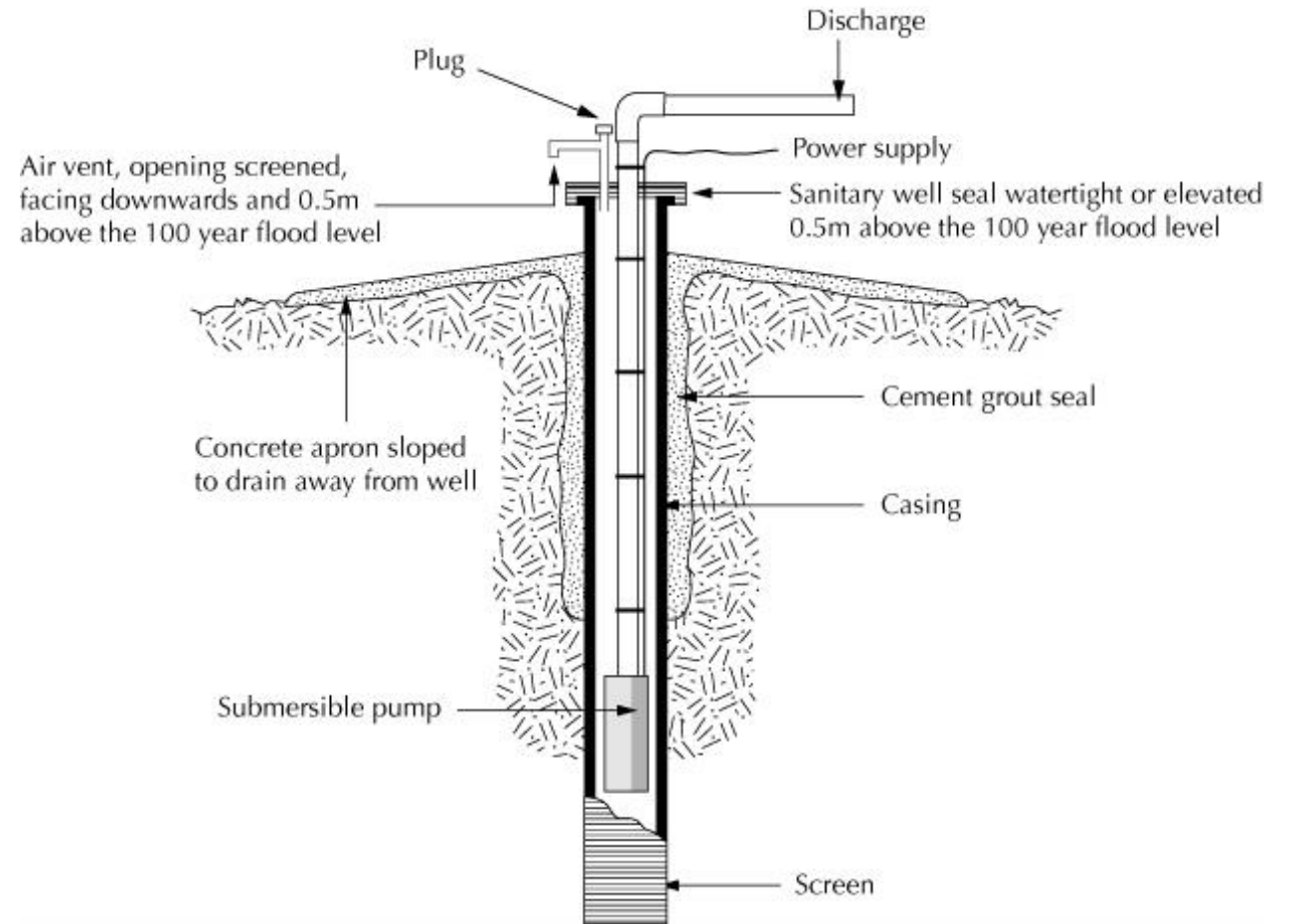


- Unless secure, treatment for protozoa is required (except for Section 10)
- Secure groundwater classification relies on the natural filtering mechanisms and long residence times within the aquifer



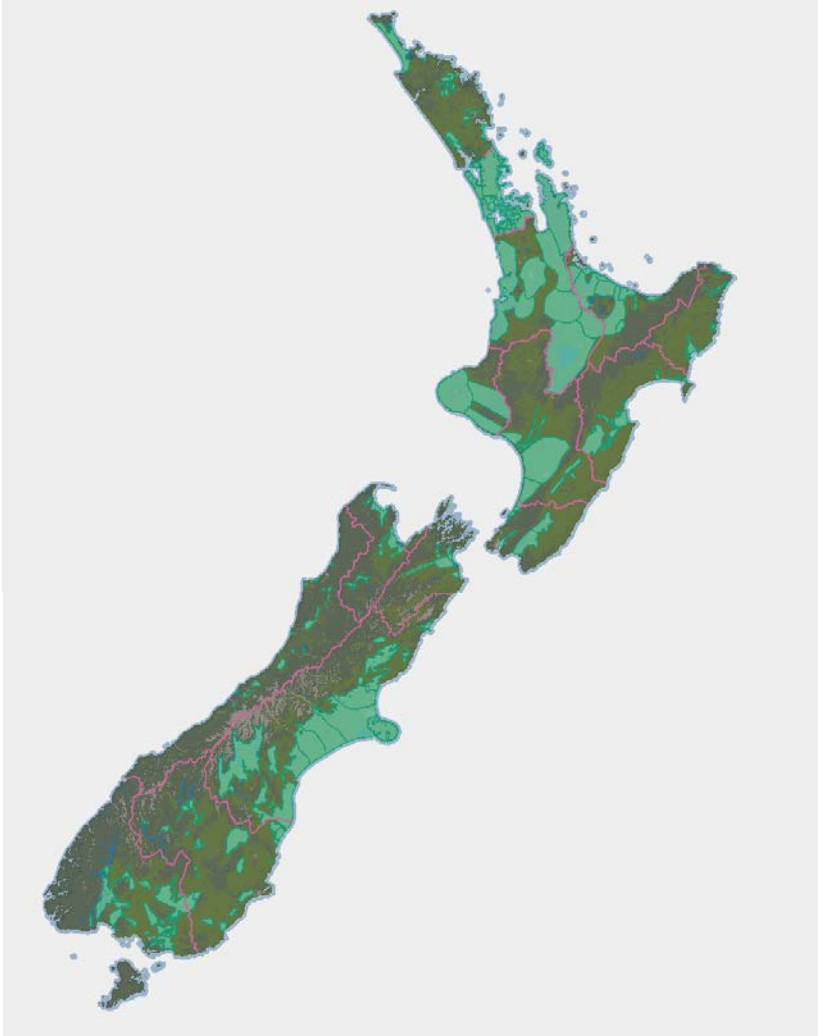
Best Practice

- Source water protection barriers
- Well and water system integrity barriers
- Septic system integrity barriers
- Operations and system maintenance barriers
- Disinfection requirements



Sanitary Protection of a Typical Bore Ref: Ministry of Health , 2018

Where to Now?



- Estimate that 40-45% of the population served by networked supplies >25 people drink groundwater
- Lack of evidence that protozoa is of high risk in NZ groundwaters
- Opportunity to make changes to the DWSNZ
- Balance of cost and risk

References/Questions

- Schmoll, O., Howard, G., Chilton, J. & Chorus, I. eds., 2006. *Protecting Groundwater for Health: Managing the Quality of Drinking-Water Sources*.
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- Bridgman, S.A. et al., 1995. Outbreak of Cryptosporidiosis Associated with a Disinfected Groundwater Supply. *Epidemiology and Infection*, 115(3), pp. 555-566
- Ministry of Health. 2018. *Guidelines for Drinking-Water Quality Management for New Zealand* <https://www.health.govt.nz/publication/guidelines-drinking-water-quality-management-new-zealand>