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He Pūtaiao, He Tāngata

Meg standing in earthquake fissures on the banks of the Avon River after the earthquake in Ōtautahi, Christchurch

E/S/R
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Framework assessment for water quality

Meg Devane, Carla Eaton, Margaret Leonard, Brent Gilpin,

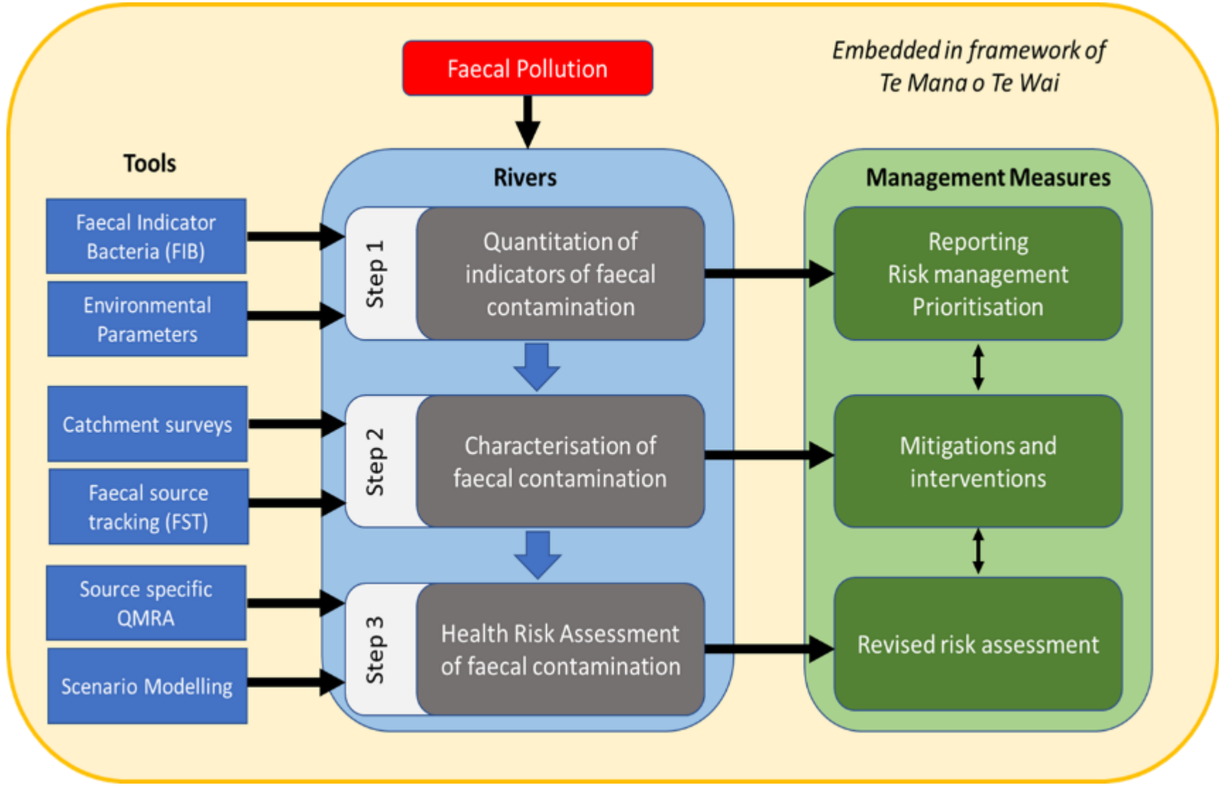
Brent Gilpin collecting samples

Why the need for a Framework for assessment of microbial freshwater quality?

- ***E. coli* is only one of 16 attributes in** National Policy Statement for Freshwater Management 2020
- **Limited guidance** when *E. coli* concentrations exceed the current Recreational WQ Guidelines:

Provide **guidance on the next steps**:

1. Is there a problem with faecal pollution?
2. If yes, what is the reason for it?
3. What are the health risks associated with the identified faecal contamination source?



First draft of Framework for assessment of water quality

Andreas Farnleitner and colleagues at the Karl Landsteiner University of Health Sciences in Austria (Farnleitner et al. 2018, Savio et al. 2018).

Why the need for a Framework for assessment of microbial freshwater quality?

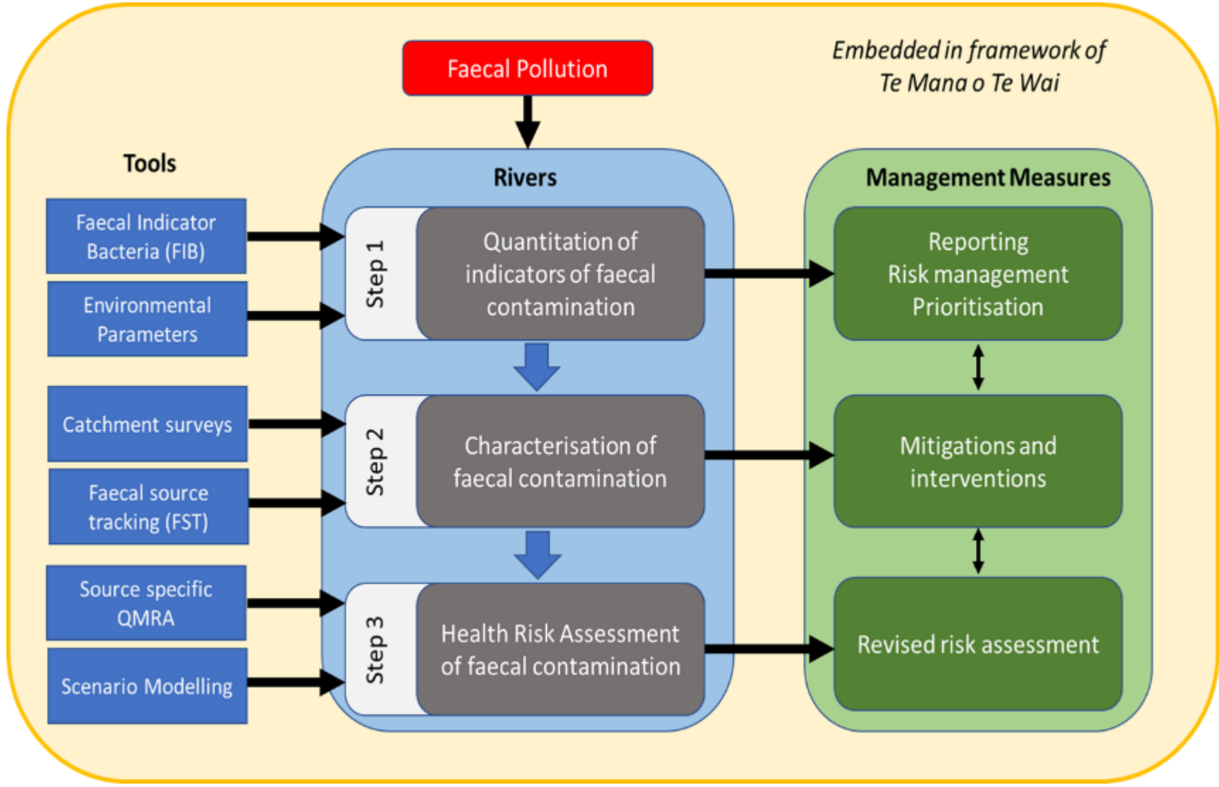
Consultation meetings with councils

- Summary of freshwater survey MfE Pilot project
- Presentations to four national conferences

- **Collation of Case Studies**

- Capture and formalise the approach taken by councils to address *E. coli* exceedances:

"Refinement of the Framework for Assessment of Recreational Water Quality"
Report for Our Land Water prepared by ESR June 2021



First draft of Framework for assessment of water quality

Insights from consultation and case studies

Partnership beween iwi/hapū & councils

Te Mana o te Wai

Consultation with communities

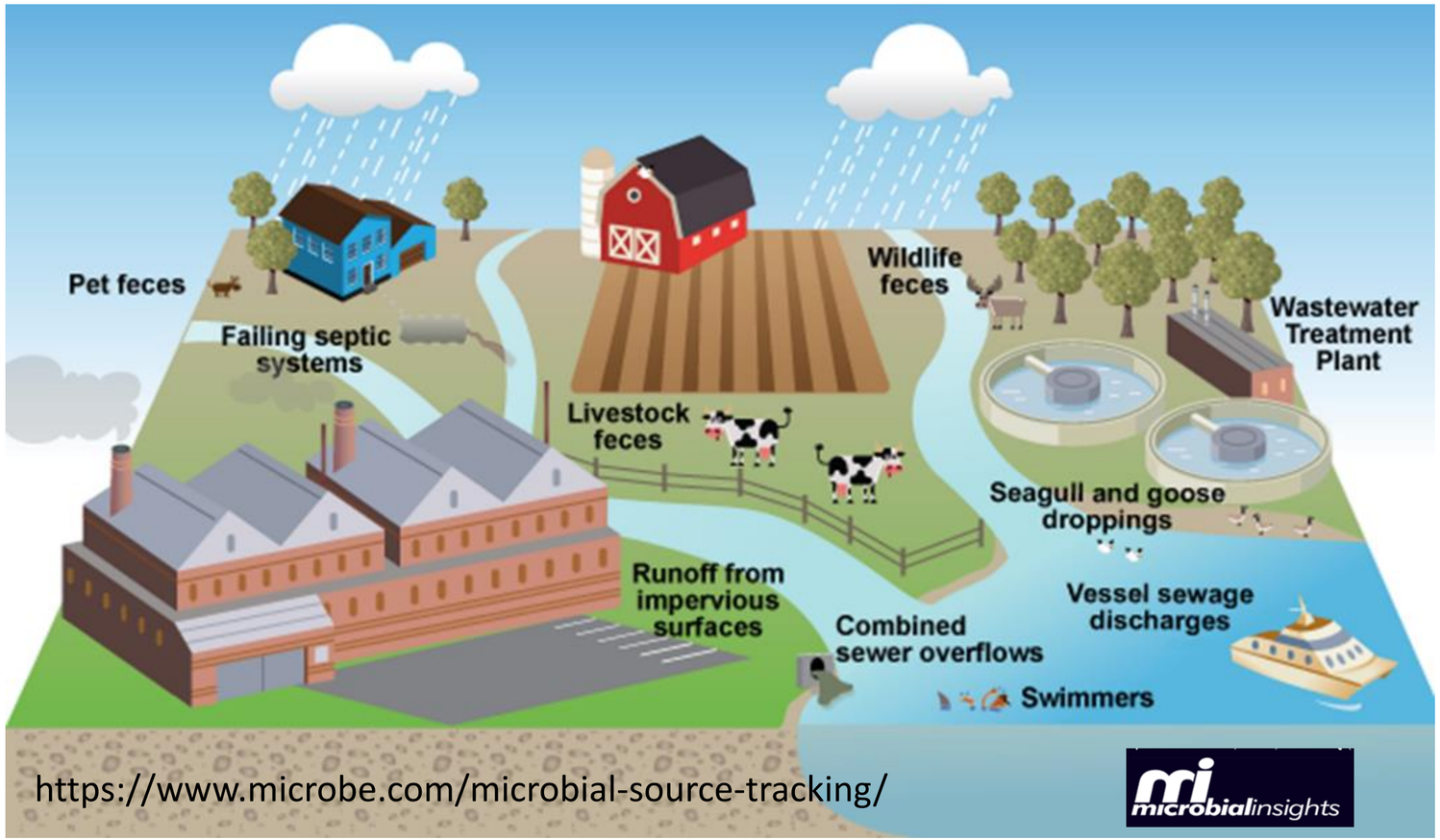
Catchment Survey & land walk

Design sampling strategy: Identify Hotspots of *E. coli*

Target contamination pathways

Flow weighted measures of *E. coli*

Target tributaries contributing the majority of the *E. coli*



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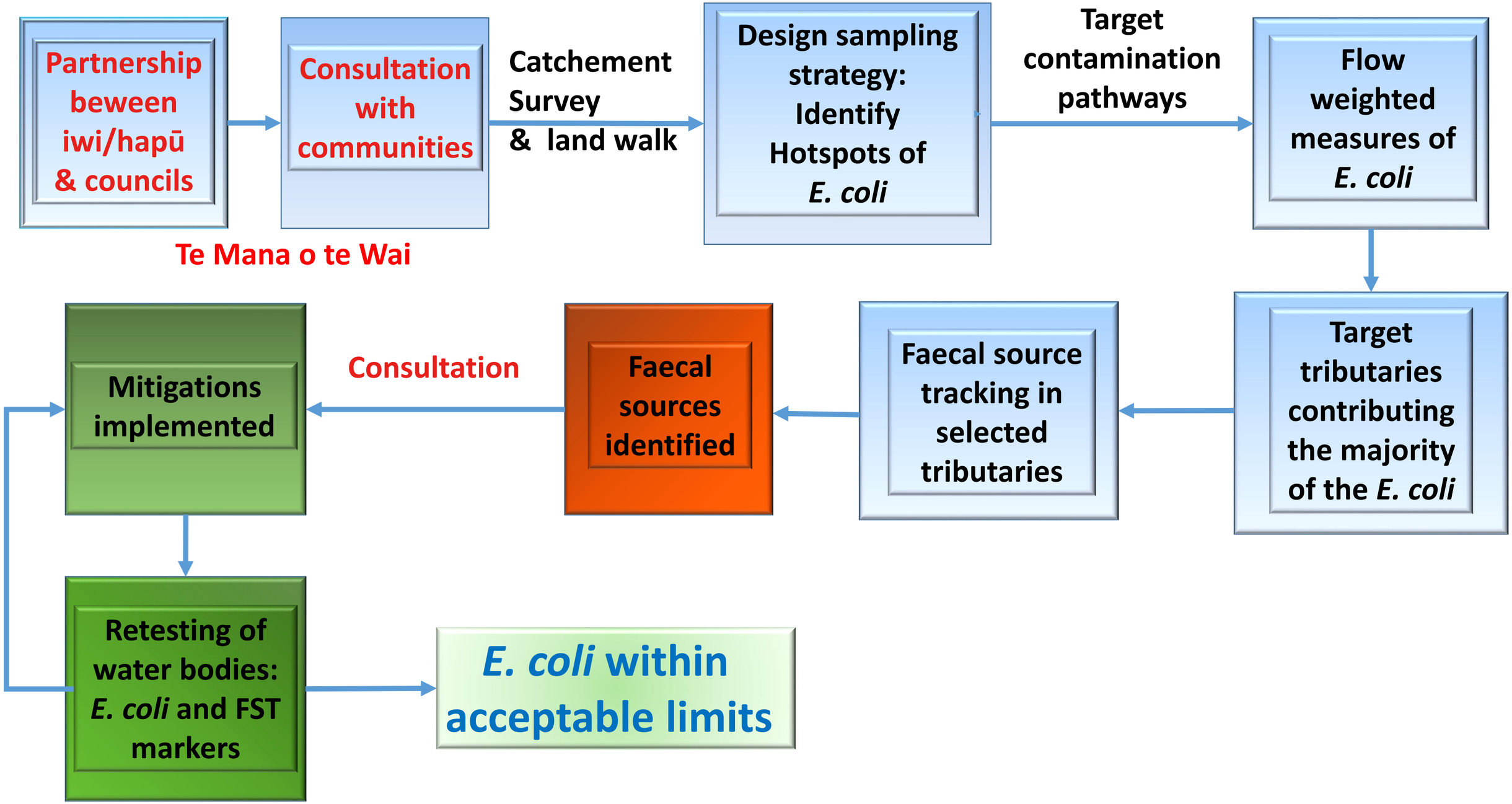

Human Sources = highest priority

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Sanitary survey,
Resource consents,
OWMS-septic tanks

Human faecal source identified

Point source versus diffuse source

Faecal source markers
Recent versus aged inputs

Contamination pathways

Tracer techniques:
Dyes,
synthetic tracer DNA markers,
in-situ cameras for drains

Sediment resuspension

ESR photos
Point sources

Livestock Sources

Localised land mapping
Resource consents,
Environment walk

Livestock faecal source identified

Point source versus diffuse source

Faecal source markers
Recent versus aged inputs,

Record Farm management practices
Seasonal influences

Contamination pathways
Flow-weighted measures of *E. coli*

Point sources:
Storage effluent ponds
Milking shed runoff

Sediment resuspension
Macrophytes, in-stream weeds

Diffuse sources:
Tile drains
Land effluent application

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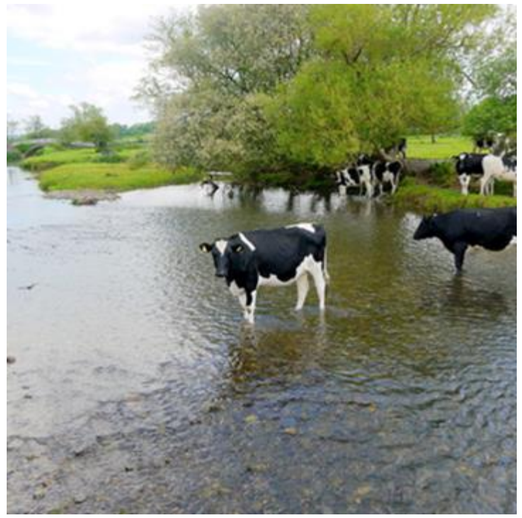


Credits: Geograph.org.uk & ESR

Localised land mapping for agricultural point sources

- **Geology** of soils, land cover, **topography** (even within paddocks)
- **Local resource consents** for effluent ponds, OWMS
- Soil moisture considerations

Pathways for diffuse pollution include:

- Leaking **effluent ponds**/unintended pond discharges
- **Effluent land application**
- **Dairy tracks** that slope towards streams
- **Water troughs** where cattle congregate
- Subsurface flow e.g., **tile drains**
- **Stock holding areas**
- **Soil pugging** (trampling) by livestock and dairy shed tracks alongside waterways

Land application of effluent
Credits: ESR staff

Non-human/non-livestock e.g. Avian

Lower likelihood of illness compared to human & livestock

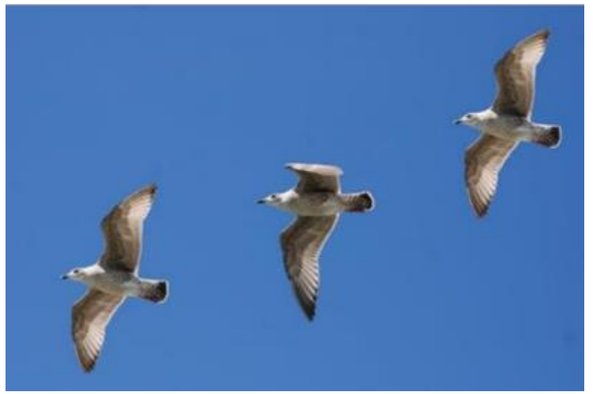
- **Avian :**
  - **Direct and diffuse faecal inputs**
- Cannot compare avian with livestock/human faecal source marker concentrations
- **When no faecal sources identified**

  Expand the FST toolbox - feral animals and indigenous avian species

  Ruminant FST marker for feral deer and goats

JJ Harrison-possum (https://www.jjharrison.com.au/)

Credits: pixabay.com



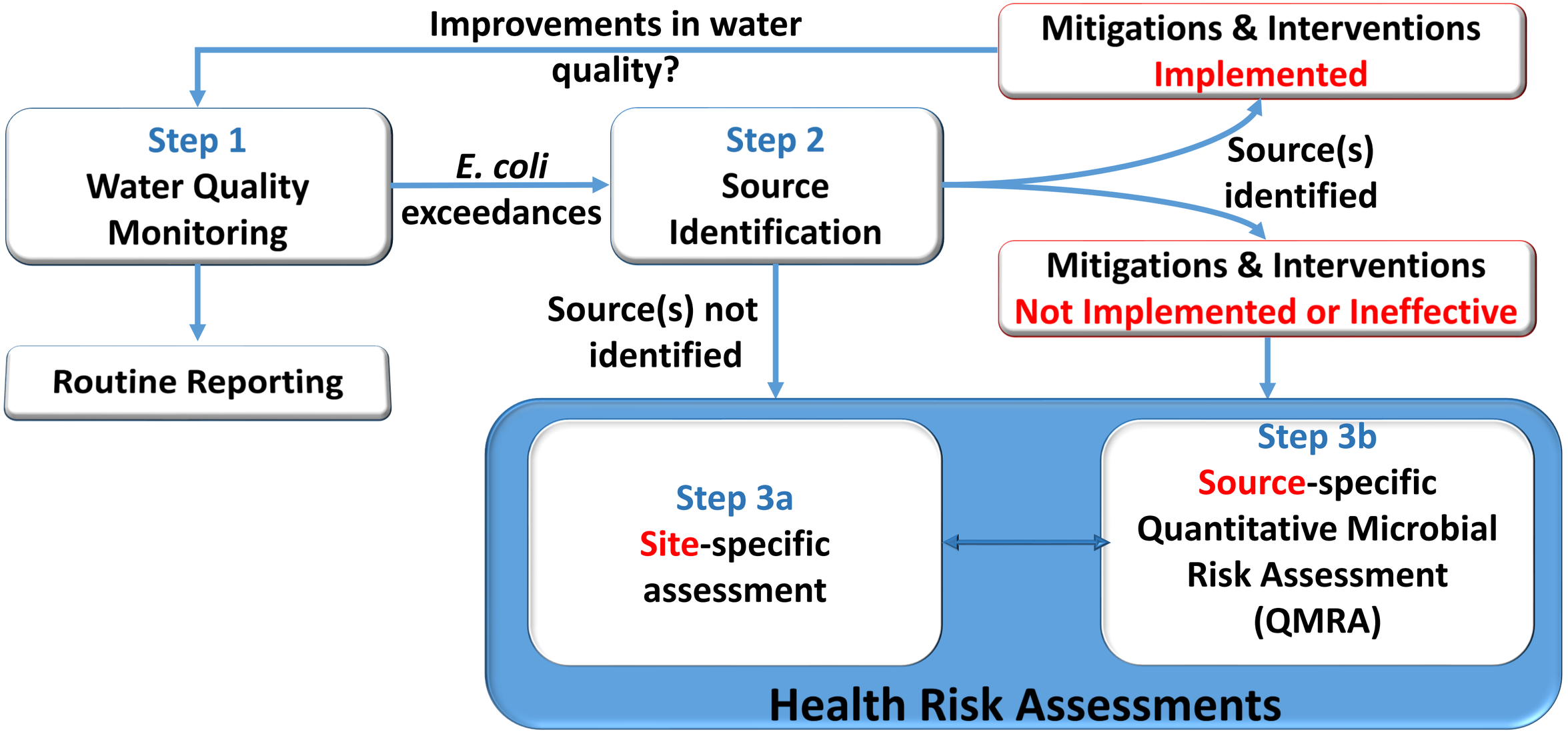
No faecal sources identified by current FST toolbox

Routine monitoring detecting Naturalised sources of *Escherichia*

- **Are naturalised sources of faecal *E. coli* identified?**
  - YES then aged faecal contamination is a problem
  - Proceed to step 3 of the framework to assess health risks
- **Are naturalised non-faecal sources of *Escherichia* identified?**
  - YES -Continue routine monitoring of

E. coli

Framework for assessment of water quality



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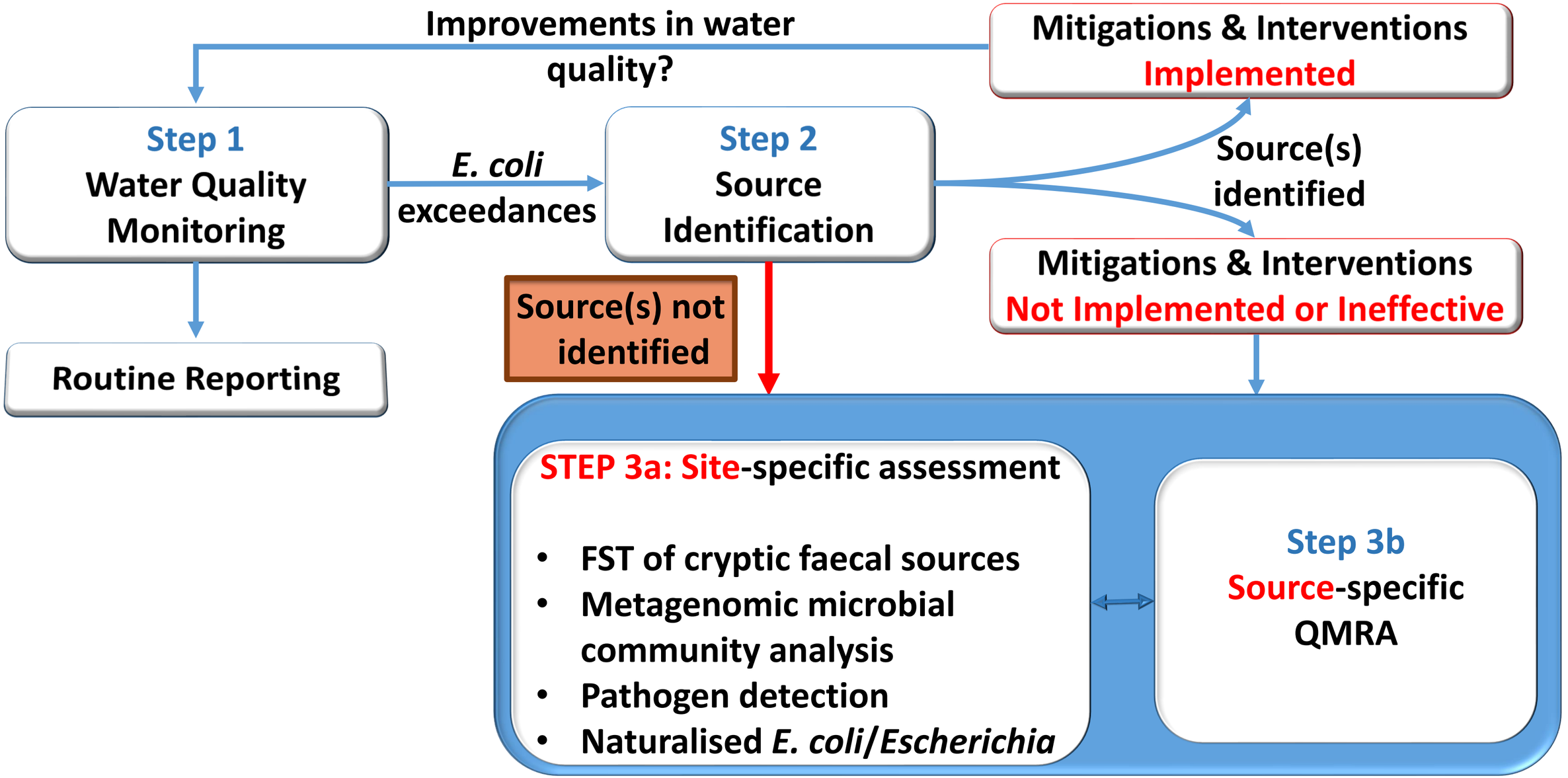

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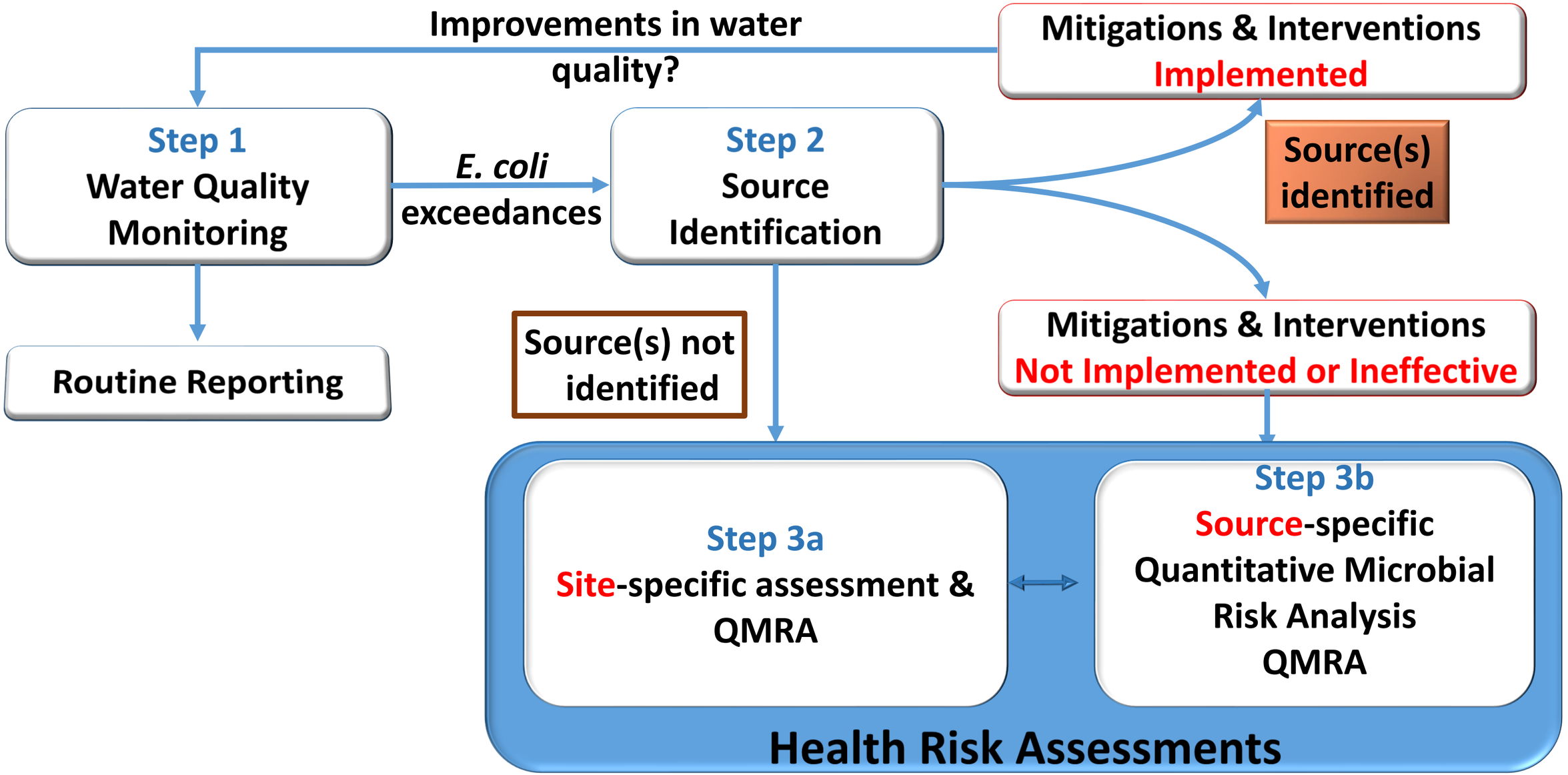

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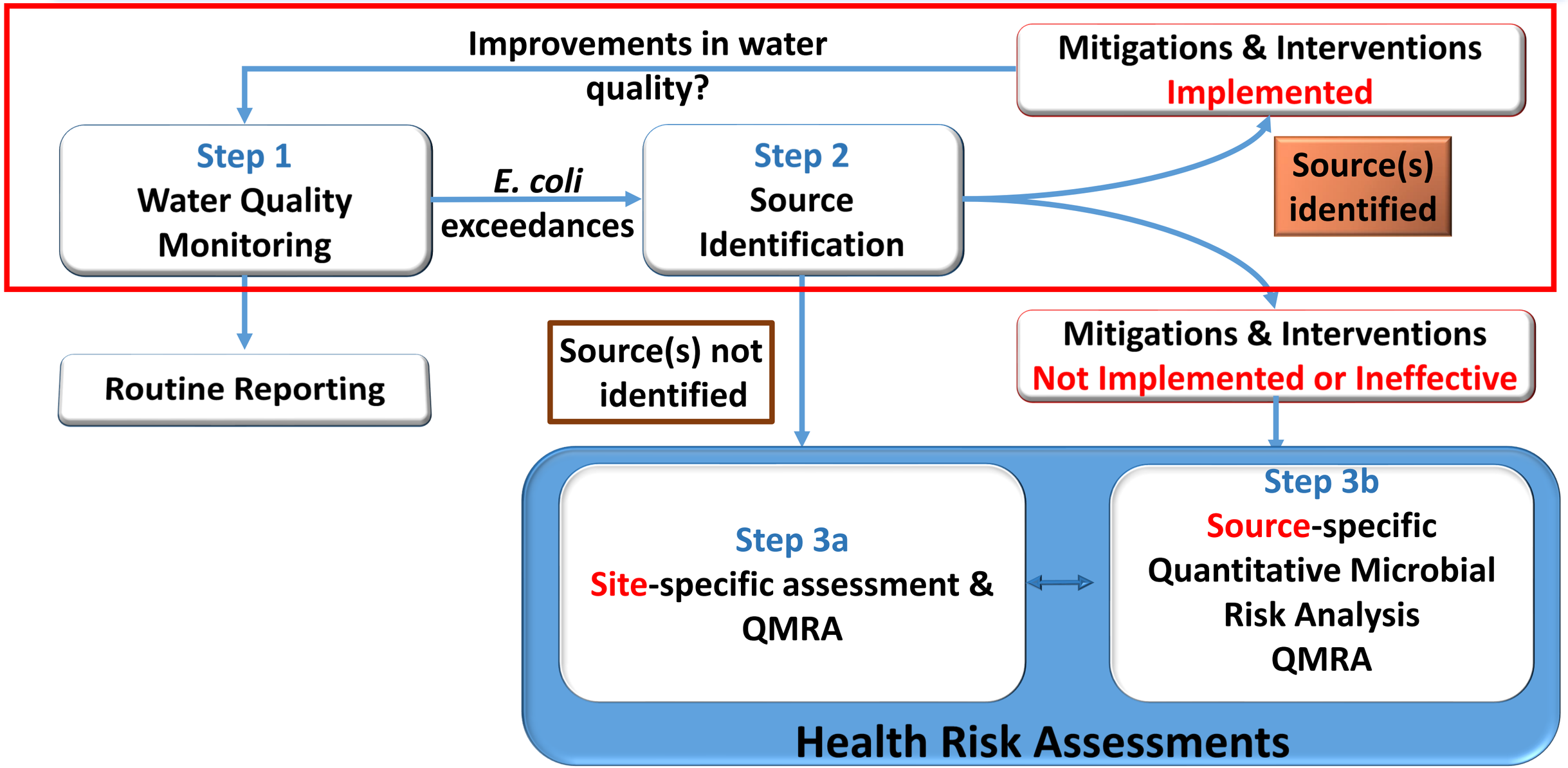

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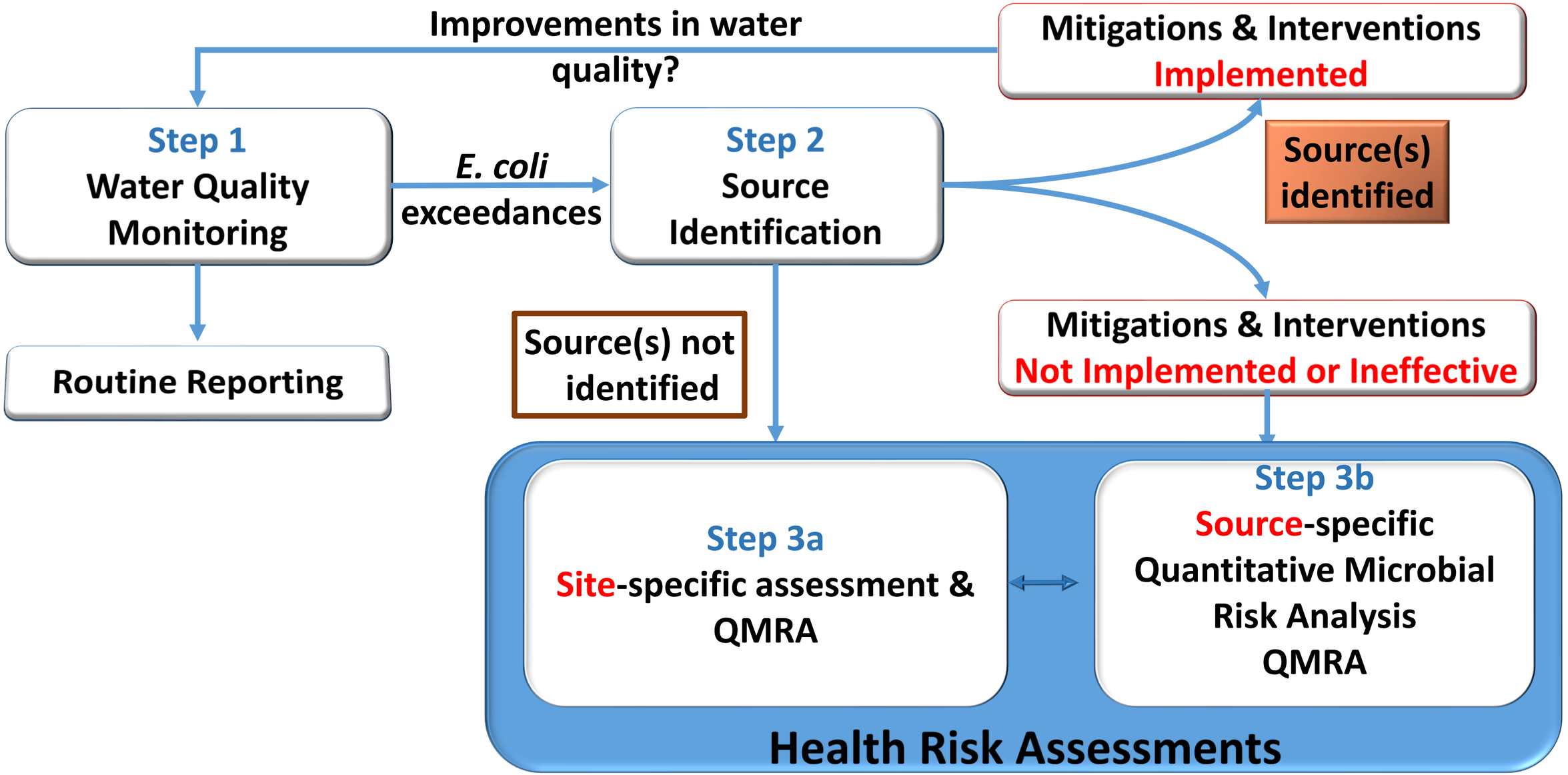

Step 3a: Quantitative microbial risk analysis QMRA

- Known faecal source = known pathogens
- **Hazard characterisation**
  - Which pathogen is most likely to cause infection
- **Exposure assessment**
  - Volume of water ingested & concentration of target pathogen
- **Dose response**
  - Prediction of individual becoming infected or ill
  - Vulnerable populations
- **Risk characterisation**
  - Integrates the above three components to **indicate public health risk**

Credit: ESR photos

Iwi/hapū Partnership and Community consultations : Trusted relationships

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- **Māori partners - ki uta ki tai**
  - **Kaupapa Māori = Māori approach**
  - **intergenerational transfer of knowledge**

- **Iwi/hapū and community values**:
  - Avian species – game birds
  - Tāonga indigenous speces eg pūkeko
  - Mahinga kai

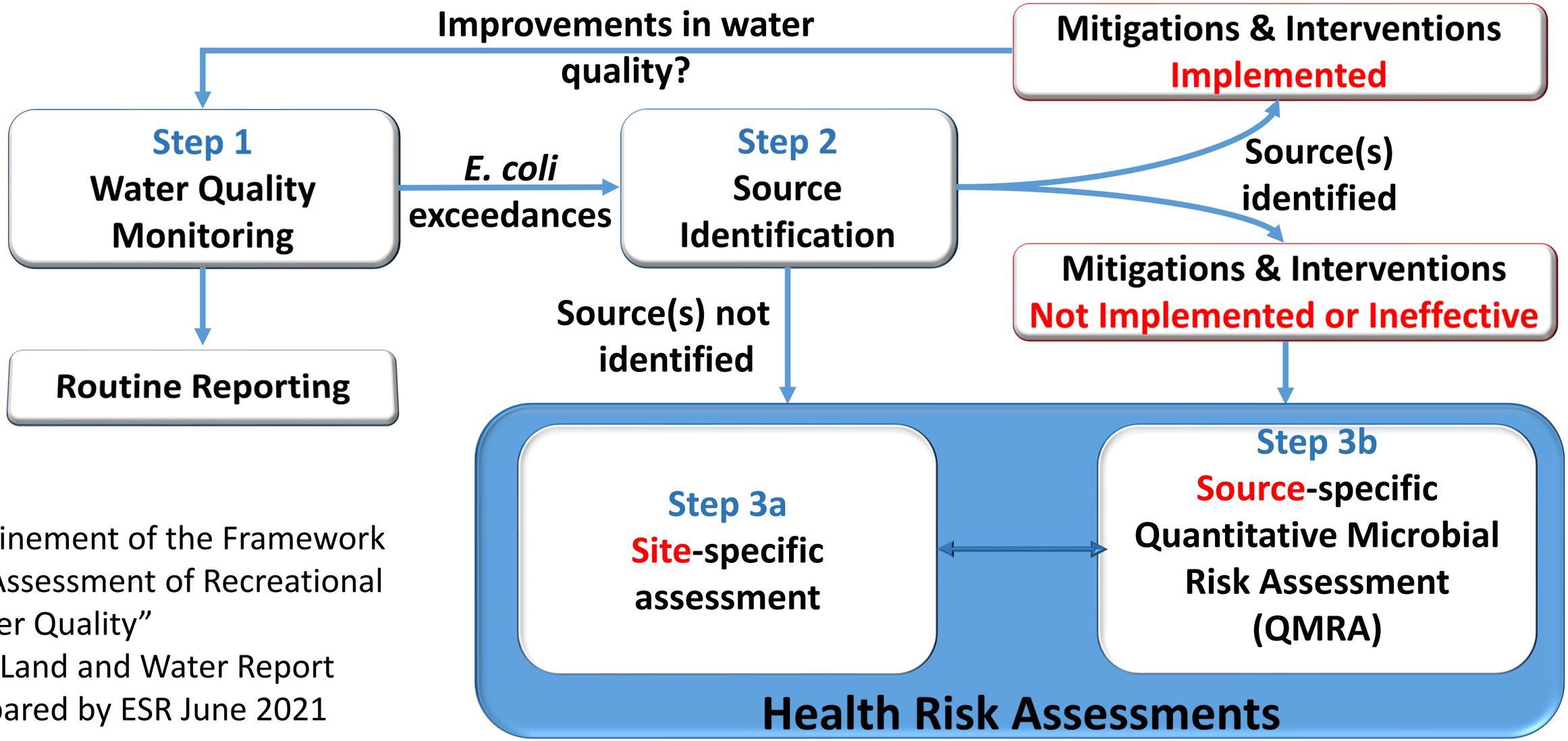
  What is acceptable to community values?

  e.g.

  - **Signage – no recreational activites**
  - **Secondary contact only**
    - **eg Boating only and**

      no Swimming, no Mahinga Kai

Framework for assessment of water quality



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