Healthy Rivers | Wai Ora

PLAN FOR CHANGE | HE RAUTAKI WHAKAPAIPAI

MANIAPOTO MAORI TRUST BOARD

A muri kia mau ki tena kia mau ki te kawau maro, whanake ake, whanake ake

RAUKAWA CHARITABLE TRUST

TE POARI MANAAKI O RAUKAWA

TŪWHARETOA MĀORI TRUST BOARD

TE ARAWA RIVER IWI TRUST

Waikato Raupatu River Trust

Waikato REGIONAL COUNCIL

Te Kaunihera ā Rohe o Waikato

Description of mitigations

Overview

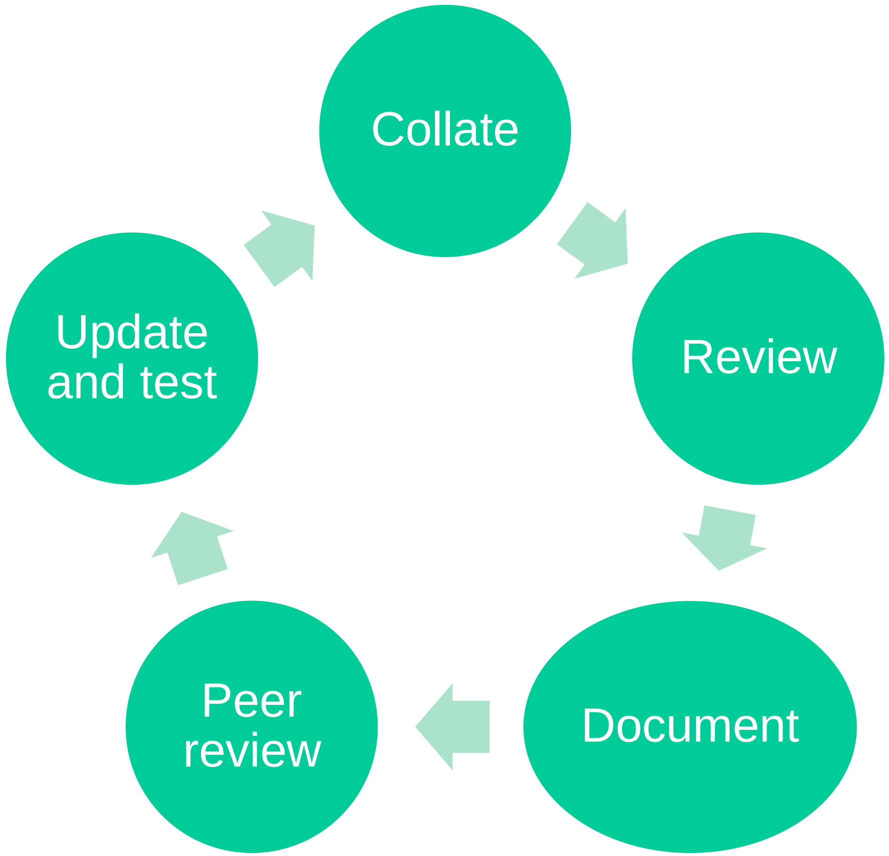
Goals

- Describe process used to generate data
- Outline assumptions for some key options
- Present results of a sensitivity analysis
- Some items require large up-front cost
- BUT, model is annual
- Determine cost as annual debt payment required to pay off the asset

Constraints

- No definitive set of assumptions regarding cost and efficacy of mitigations
- Wide variation in cost and efficacy across space and time
- Integration is important though
  - How far can we get?
- Utilise assumptions consistent with chief conceptual insights (see report)

Process



Sensitivity analysis

- Identify primary mitigation strategies
  - Identify cost parameters
  - Identify efficacy parameters
- Generate new estimates of cost/efficacy
  - -50%, -25%, +25%, +50% of current baseline
- Run model with these new estimates
- Repeat for 10%, 25%, and 50% steps towards Scenario 1

Identify the sensitivity of the model

- Profit is used to compare models
- For each model run, compute the % change in model profit associated with a 1% change in that parameter
- Generally:
- If this number > 1, then model is sensitive
- If this number < 1, then model is insensitive

Examples of some options

Stream fencing

Stream fencing

- Dairy stream fencing
  - No cost for water provision
  - One side of stream fenced
- Estimate of $5 m^{-1} (annualised: $0.47 m^{-1})
- Drystock stream fencing
  - Cost for water provision ($10 m^{-1})
  - Two sides of stream fenced
- Estimate of $12.5 m^{-1} per stream bank
- Annualised to 3.28 m^{-1}

Stream fencing

- Use of 5 m buffer strips to reduce N and P
- Pasture is the sole plant species used in these buffers
- Stock exclusion is the main benefit of fencing
- Fencing is significant mitigation for *E. coli* delivery
- Riparian planting of little benefit for reducing microbial loss to water

Sensitivity of model to changes in assumptions

% change	10% step to S1		25% step to S1		50% step to S1	
	Cost	Efficacy	Cost	Efficacy	Cost	Efficacy
-50%	0	-0.004	0.003	-0.011	0.011	0.003
-25%	0	-0.002	0.003	-0.004	0.014	0.011
+25%	0	0.002	0.001	0.008	0.02	0.034
+50%	0	0.004	0.001	0.014	0.023	0.046

Edge-of-field mitigations

Edge-of-field mitigations have key role

	Unit	10% step	25% step	50% step	75% step	100% step
Area serviced by detention bund	% of all pasture	7	14	14	13	13
Area serviced by bund + wetland	% of all pasture	4	9	14	16	15
Area serviced by sed. trap + wetland	% of all pasture	4	8	9	10	9
Area serviced by small wetland	% of all pasture	1	3	11	8	8
Area serviced by medium wetland	% of all pasture	4	6	13	20	19

Source: CSG 2nd round report (Table 5)

Detention bunds

- Moderately-well drained soils
- Ephemeral channels
- Less expensive
- Efficacy:
  - 70% reduction in sed.
  - 50% reduction in *E. coli*
  - 30% reduction in P
  - 10% reduction in N

Source: Clarke et al. (2013)

Detention bund sensitivity analysis

% change	10% step to S1		25% step to S1		50% step to S1	
	Cost	Efficacy	Cost	Efficacy	Cost	Efficacy
-50%	0.002	-0.002	0.007	-0.003	0.027	0.017
-25%	0.001	0	0.005	0.001	0.025	0.02
+25%	-0.001	0.002	0.002	0.007	0.022	0.027
+50%	-0.001	0.003	0.001	0.009	0.02	0.031

Source: Mitigation report (Table 16)

Detention bund and wetland

- Poorly-drained soils
- Ephemeral channels
- Headwater wetland with low residence time
- More expensive (exclusion and planting)
- Efficacy:
  - 70% reduction in sed.
  - 50% reduction in *E. coli*
  - 50% reduction in P
  - 10% reduction in N

Detention bund and wetland sensitivity analysis

% change	10% step to S1		25% step to S1		50% step to S1	
	Cost	Efficacy	Cost	Efficacy	Cost	Efficacy
-50%	0.002	0	0.006	-0.001	0.026	0.02
-25%	0.001	0	0.005	0.001	0.025	0.022
+25%	0	0.001	0.004	0.007	0.022	0.027
+50%	0	0.002	0.003	0.01	0.021	0.031

Source: Mitigation report (Table 16)

Sediment trap and wetland

- More poorly-drained soils
- First-order streams in flatter country
- More expensive (exclusion and planting)
- Loss of land
- Efficacy:
  - 70% reduction in sed.
  - 50% reduction in *E. coli*
  - 30% reduction in P
  - 10% reduction in N

Source: John Quinn

Sediment pond and wetland sensitivity analysis

% change	10% step to S1		25% step to S1		50% step to S1	
	Cost	Efficacy	Cost	Efficacy	Cost	Efficacy
-50%	0.002	-0.001	0.006	0	0.026	0.019
-25%	0.001	0	0.005	0.002	0.025	0.021
+25%	0	0.001	0.003	0.007	0.022	0.025
+50%	0	0.002	0.003	0.009	0.021	0.027

Source: Mitigation report (Table 16)

Small wetland

- Flatter land at base of 1st-3rd order streams
- Very expensive (exclusion and planting)
- Loss of land (often low productivity)
- Efficacy:
  - 60% reduction in sed.
  - 75% reduction in *E. coli*
  - 35% reduction in P
  - 20% reduction in N

Small wetland sensitivity analysis

% change	10% step to S1		25% step to S1		50% step to S1	
	Cost	Efficacy	Cost	Efficacy	Cost	Efficacy
-50%	0.004	0.001	0.008	0.002	0.048	0.008
-25%	0.002	0.001	0.006	0.003	0.035	0.01
+25%	0.001	0.002	0.002	0.006	0.014	0.031
+50%	0.001	0.004	0.003	0.009	0.012	0.039

Source: Mitigation report (Table 16)

Medium wetland

- Flatter land at base of 1st-3rd order streams
- Very expensive (exclusion and planting)
- Loss of land (often low productivity)
- Efficacy:
  - 80% reduction in sed.
  - 90% reduction in *E. coli*
  - 70% reduction in P
  - 40% reduction in N

Source: www.ruraldesign.co.nz

Medium wetland sensitivity analysis

% change	10% step to S1		25% step to S1		50% step to S1	
	Cost	Efficacy	Cost	Efficacy	Cost	Efficacy
-50%	0.014	-0.022	0.024	-0.072	0.067	0.005
-25%	0.007	-0.008	0.013	-0.031	0.042	0.016
+25%	-0.002	0.009	-0.004	0.029	0.008	0.033
+50%	-0.005	0.018	-0.013	0.048	-0.003	0.048

Source: Mitigation report (Table 16)

Conclusions

Conclusions

- A wide set of mitigations are incorporated in the model
- Cost and efficacy assumptions are in line with standard knowledge
- Strong focus on broad search and expert peer review
- Extensive sensitivity analysis highlights that model is very robust to large changes