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

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RAUKAWA CHARITABLE TRUST | TE POARI MANAAKI O RAUKAWA

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Waikato Raupatu River Trust

Waikato REGIONAL COUNCIL

Te Kaunihera ā Rohe o Waikato

Scenario modelling: the first set

Presented to the Collaborative Stakeholder Group

CSG#15

26 August 2015

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PLAN FOR CHANGE
Wai ora
HE RAUTAKI WHAKAPAIPAI

Maniapoto Māori Trust Board
Raukawa Charitable Trust
Te Arawa River Iwi Trust
Tūwharetoa Māori Trust Board
Waikato Raupatu River Trust
Waikato Regional Council

Key things to remember

- Brings together technical work to date
- “Fit for purpose” but need to take care
- Time scale of ‘average annual’
- Spatial scale of sub-catchment (74)
- Constrained and unconstrained land use

Key model findings

- 3 of the 4 CSG scenarios (scenarios 1-3) have significant costs ($ and jobs)
- Impacts across the catchment, sectors, and wider regional and national economy
- Scenarios require full range of mitigation tools, but breaches of limits still occur
- *E.coli* attribute for swimming particularly difficult to meet

Economic Modelling

Overview

Goals

- Evaluate relative economic impacts of the CSG scenarios
- Farm, catchment, and regional impacts
- Integrate information from TLG research streams
- Inform the integrated assessment
- Indicate broad distributional impacts

How the model works…

- Scenarios define limits
- We set limits in the water
- The model searches among all ‘possible ways’ of reaching these goals
- Identifies the best in terms of least cost
- ‘Possible ways’ set out by model inputs
- Extensive data collection and review

Land-use change

- Land-use change is typically an effective mitigation for many contaminants
- How flexible should land use be?
- Short-term versus long-term
- A trade-off
  - Flexibility vs data quality
- Use two approaches:
  - Within trends defined by historical patterns
  - Full flexibility

Key insights: Constrained land-use change

Catchment-level annual profit

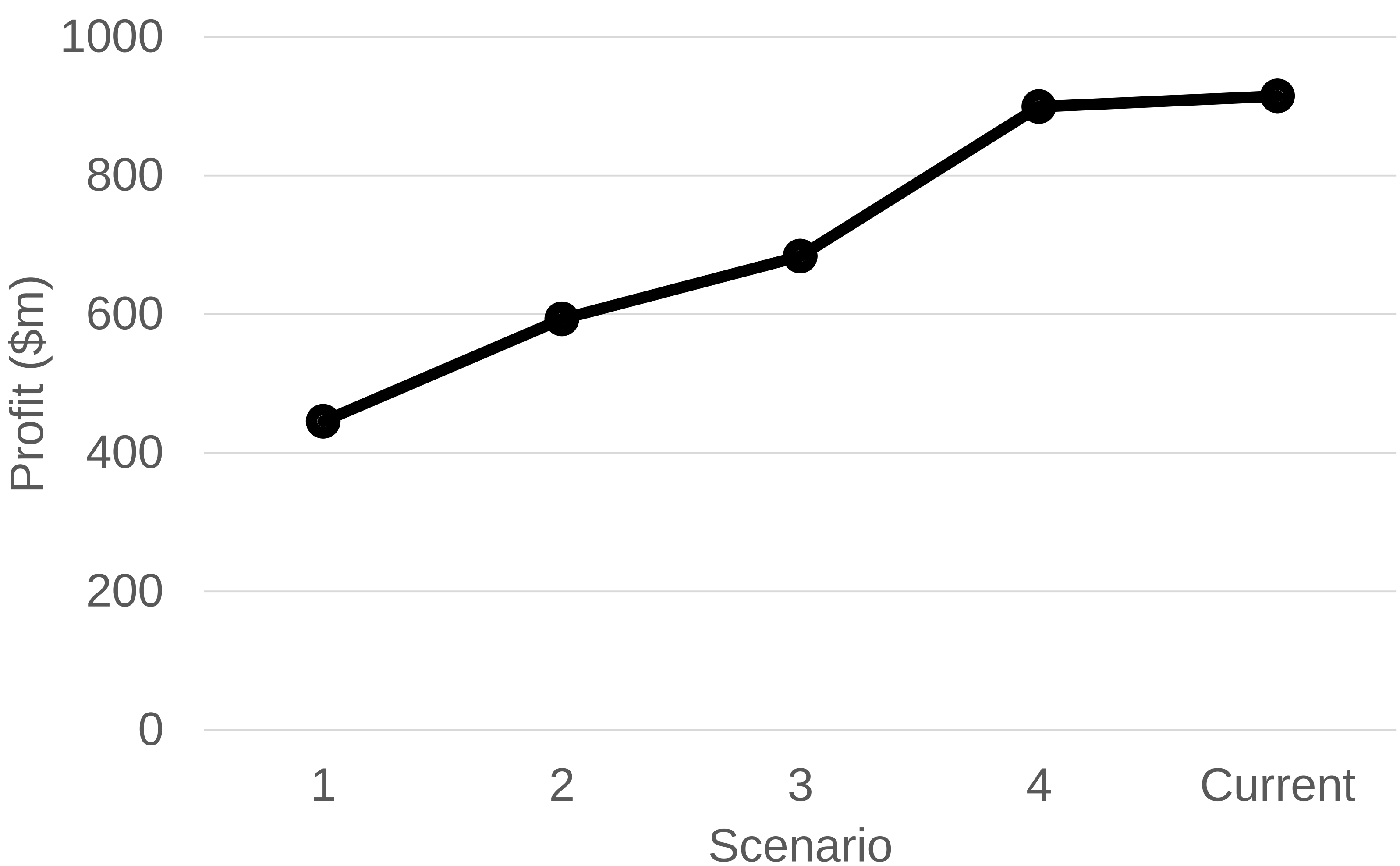


Table 2

Impacts on annual profit (% change)

	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Dairy	-27	-18	-16	-6
Drystock	-14	1	1	4
Hort.	-153	0	-30	2
Forest	10	10	11	7

Table 2

Annual cost of mitigations ($m)

	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Transition	+21	+21	+21	+17
Fencing	-8	-10	-7	0
Effluent	-2	-1	-1	0
Plans	-41	-29	-31	0
Point source	-138	-138	-46	-1
Wetlands	-70	-66	-67	-9

Table 2

Conversion (% of total sector land)

	Sc. 1	**Sc. 2**	**Sc. 3**	**Sc. 4**
Dairy to S&B	5	5	5	3
Dairy to Forest	2	2	2	3
S&B to Forest	3	3	3	1
Hort. to S&B	2	2	1	2

Table 3

Change in production (%)

	Sc. 1	**Sc. 2**	**Sc. 3**	**Sc. 4**
Dairy	-22	-10	-10	-7
S&B	-4	2	1	3
Hort.	-43	-2	-10	-4
Timber	11	11	11	7

Table 4

Adoption of discrete mitigations (%)

	Sc. 1	Sc. 2	Sc. 3	Sc. 4
2-ponds	96	96	96	80
Low-rate	15	8	8	0
Fencing	29	34	25	2
Buffers	29	33	24	2
Stand-off	83	86	71	8
Sed. plans	21	15	16	0
IPM	36	36	36	25
Wetlands	61	59	61	9

Table 5

Breaches of limits (no. of sites)

Indicator	Scen. 1	Scen. 2	Scen. 3	Scen. 4	No. of sites
Median Chlorophyll *a*	4	0	0	0	9
Maximum Chlorophyll *a*	5	0	0	0	9
Total nitrogen	5	0	0	1	9
Total phosphorus	3	0	0	0	9
Median nitrate	2	0	1	1	61
95^{th} percentile nitrate	8	0	1	1	61
Median *E. coli*	0	0	1	0	61
95^{th} percentile *E. coli*	37	37	29	0	61
Black disc (clarity)	11	7	7	0	58

Table 6

Key insights: Unconstrained land-use change

Land use (hectares)

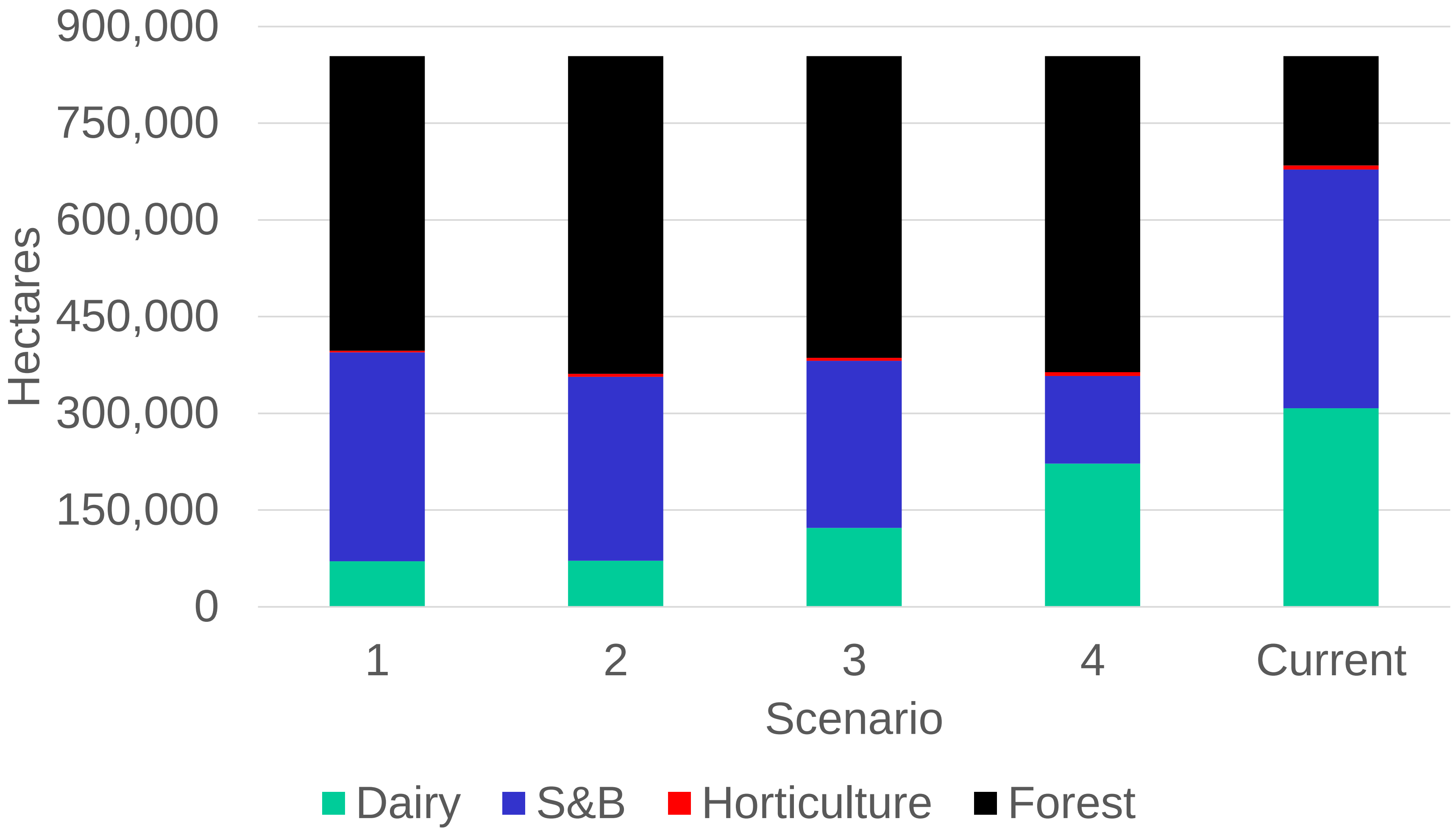


Table 7

Catchment-level profit

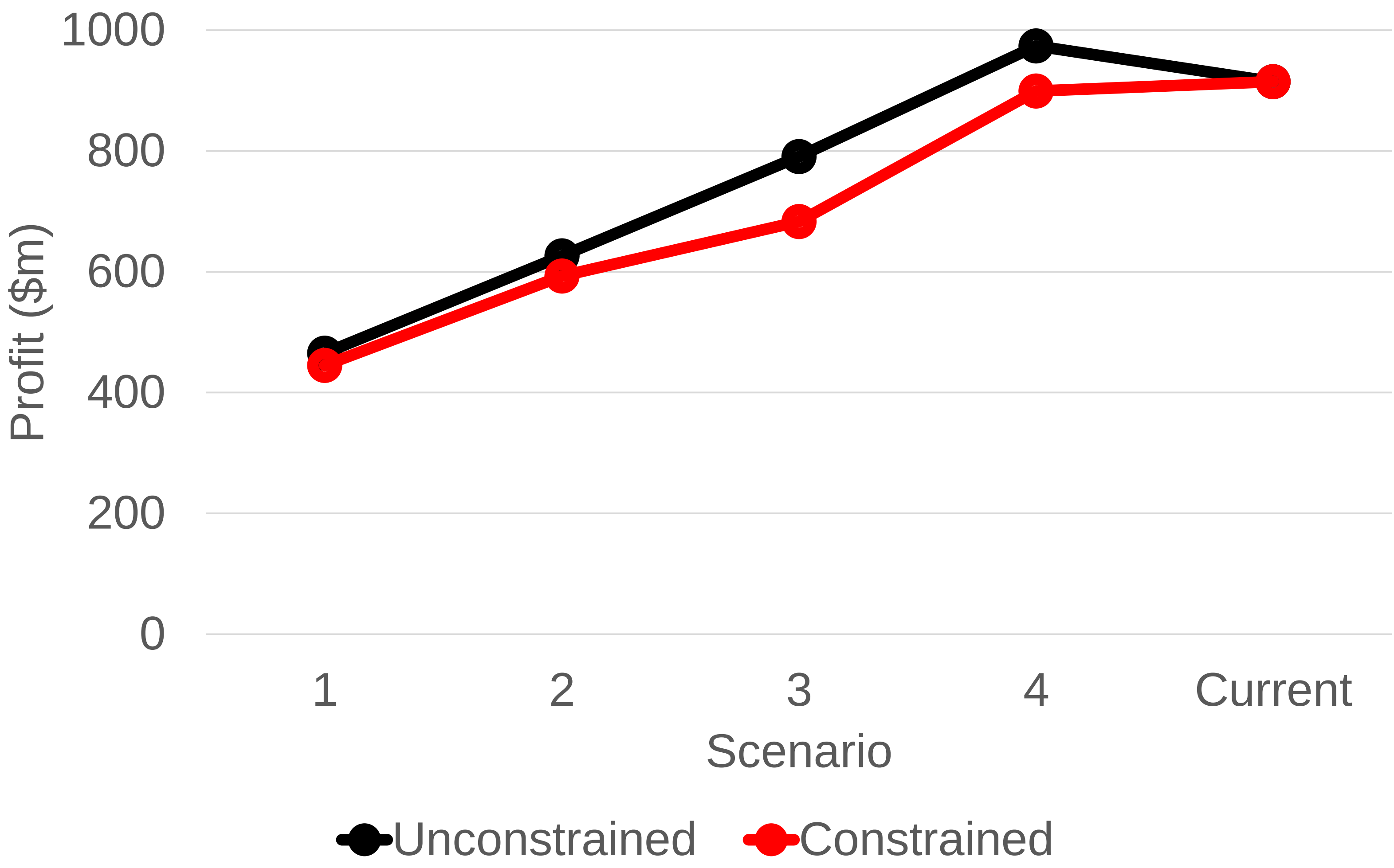


Table 8

Impacts on sector profit (% change)

	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Dairy	-81	-79	-58	-18
Drystock	-35	-4	-9	-35
Hort.	-106	-21	-14	4
Forest	203	227	207	231

Table 8

Cost of additional mitigations ($m)

	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Transition	+209	+223	+187	+111
Fencing	-7	-7	-4	0
Effluent	0	0	0	0
Plans	-5	-1	-1	0
Point source	-138	-130	-41	-3

Table 8

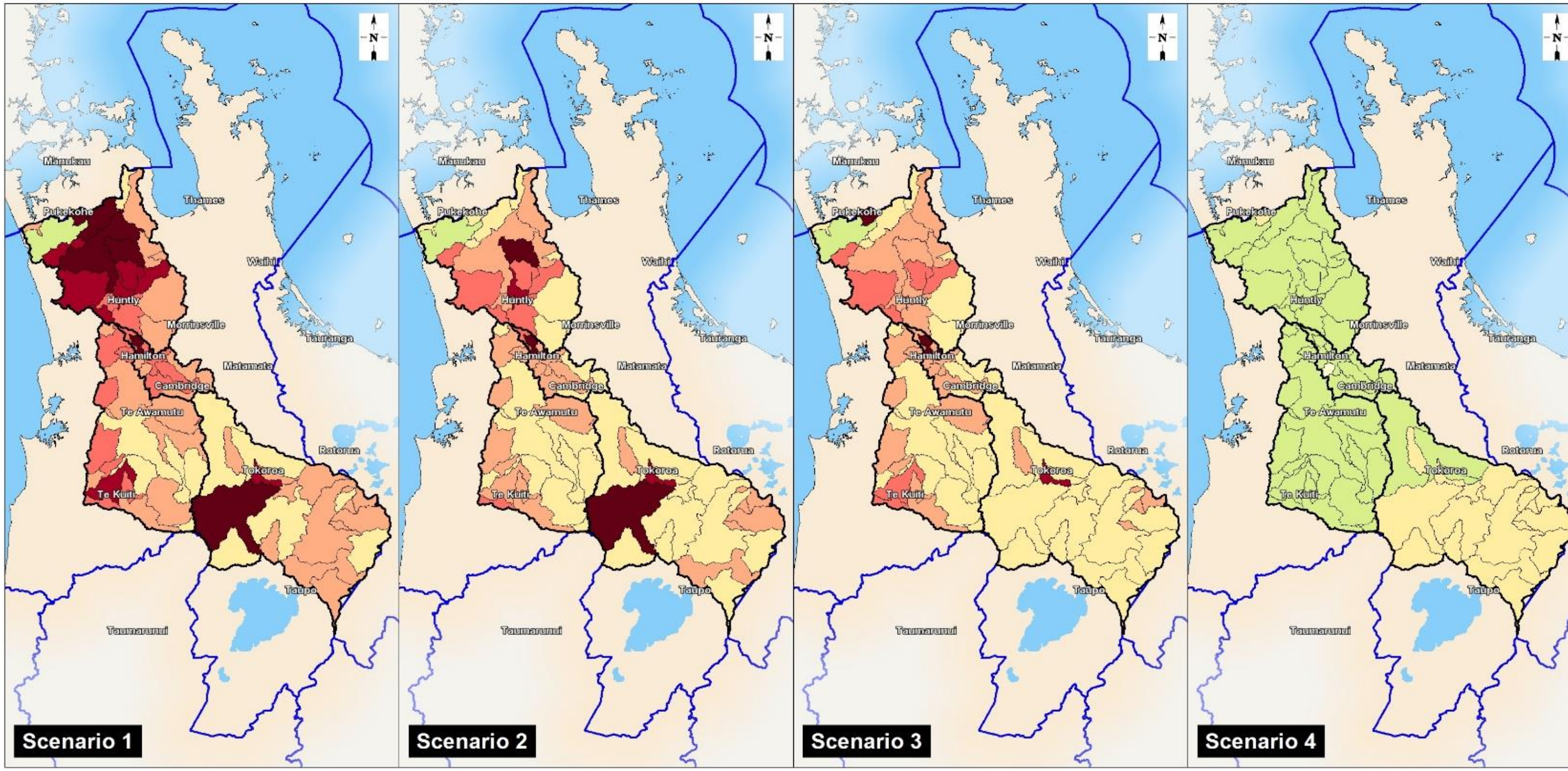
Change in production (%)

	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Dairy	-80	-78	-62	-25
S&B	-15	-10	-20	-59
Hort.	-72	-28	-23	-9
Timber	181	204	188	205

Table 9

Spatial impacts: Constrained land-use change

Change in profit across zones



Change in total profit within a sub-catchment (%)

Constrained land-use change

0 50 100 150 200
Kilometres
Scale - 1:1,700,000 at A3

A3

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Legend

Change in total profit within a sub-catchment (compared to current state)

- >100%
- >75% to 100%
- >50% to 75%
- >25% to 50%
- >0% to 25%
- 0%
- <0% to -25%
- <-25% to -50%
- <-50% to -75%
- <-75% to -100%
- <-100%
- Freshwater management unit boundary
- Waikato regional boundary

Created by: A Jeffries
Projection: NZTM
Map Date: 17/08/2015
Model Data Date: 16/08/2015

Map Status: Version 2
Request No.: 30616
Workspace name:
30608_Senario_Change_Profit.gws

Acknowledgements and Disclaimers

These preliminary results have been prepared by the Technical Leaders Group as a discussion document for the use by the Collaborative Stakeholder Group for the Healthy Rivers: Wai Ora project. Data should be considered draft only.

Digital Boundary Data sourced from Statistics New Zealand.

Figure 3

Reductions in nitrogen load (%)

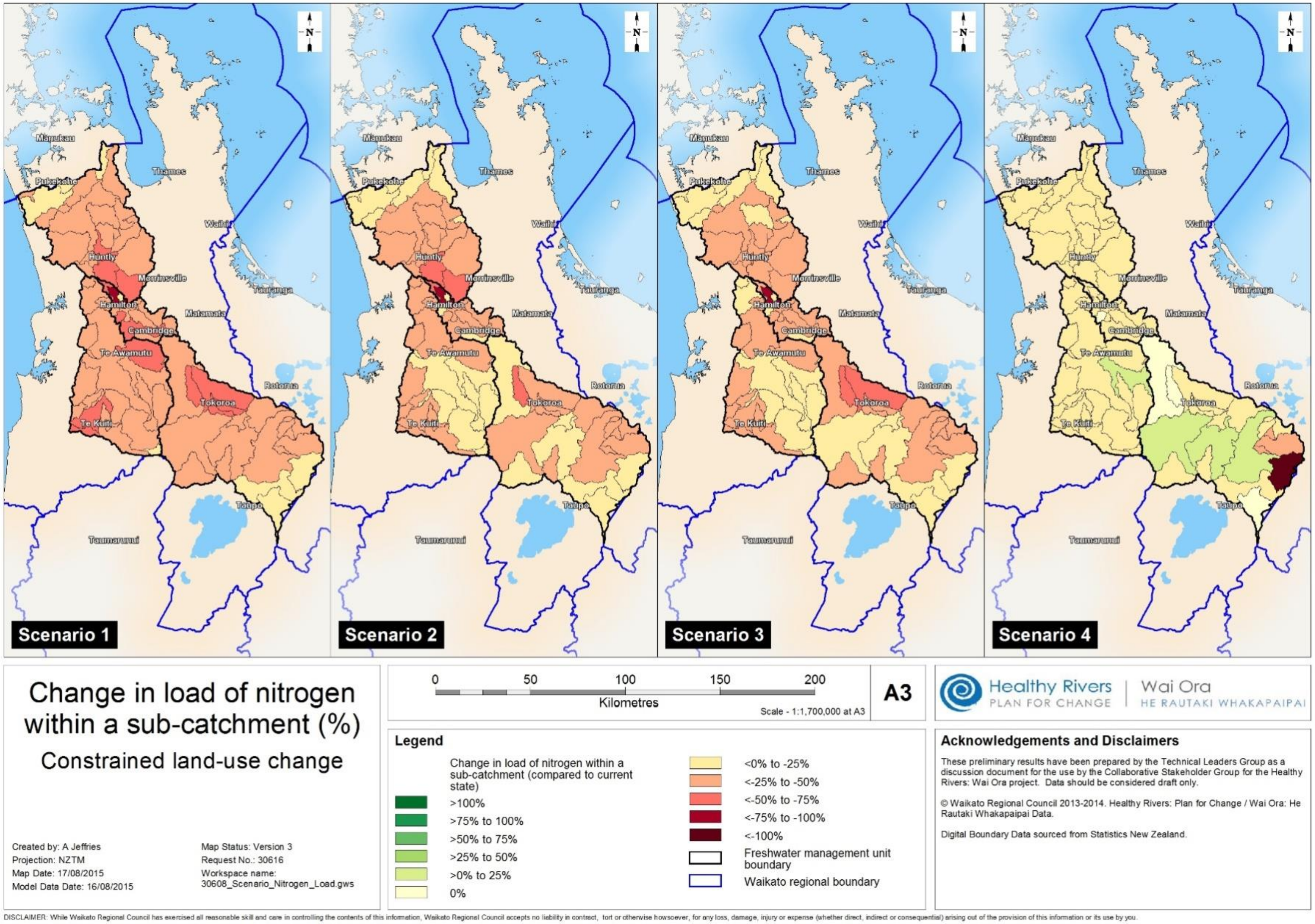

Figure 4

Reductions in phosphorus load (%)

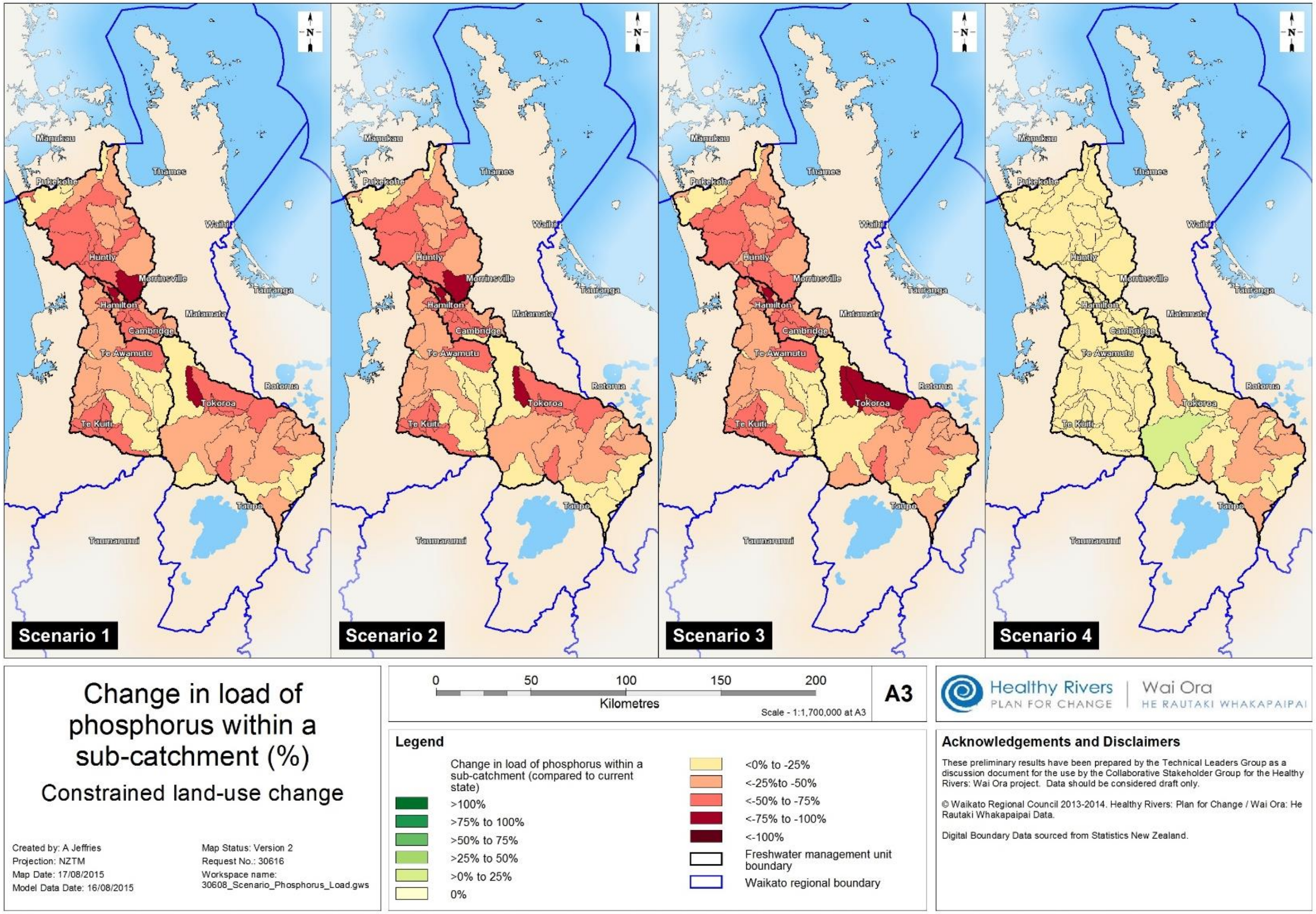

Figure 5

Reductions in sediment load (%)

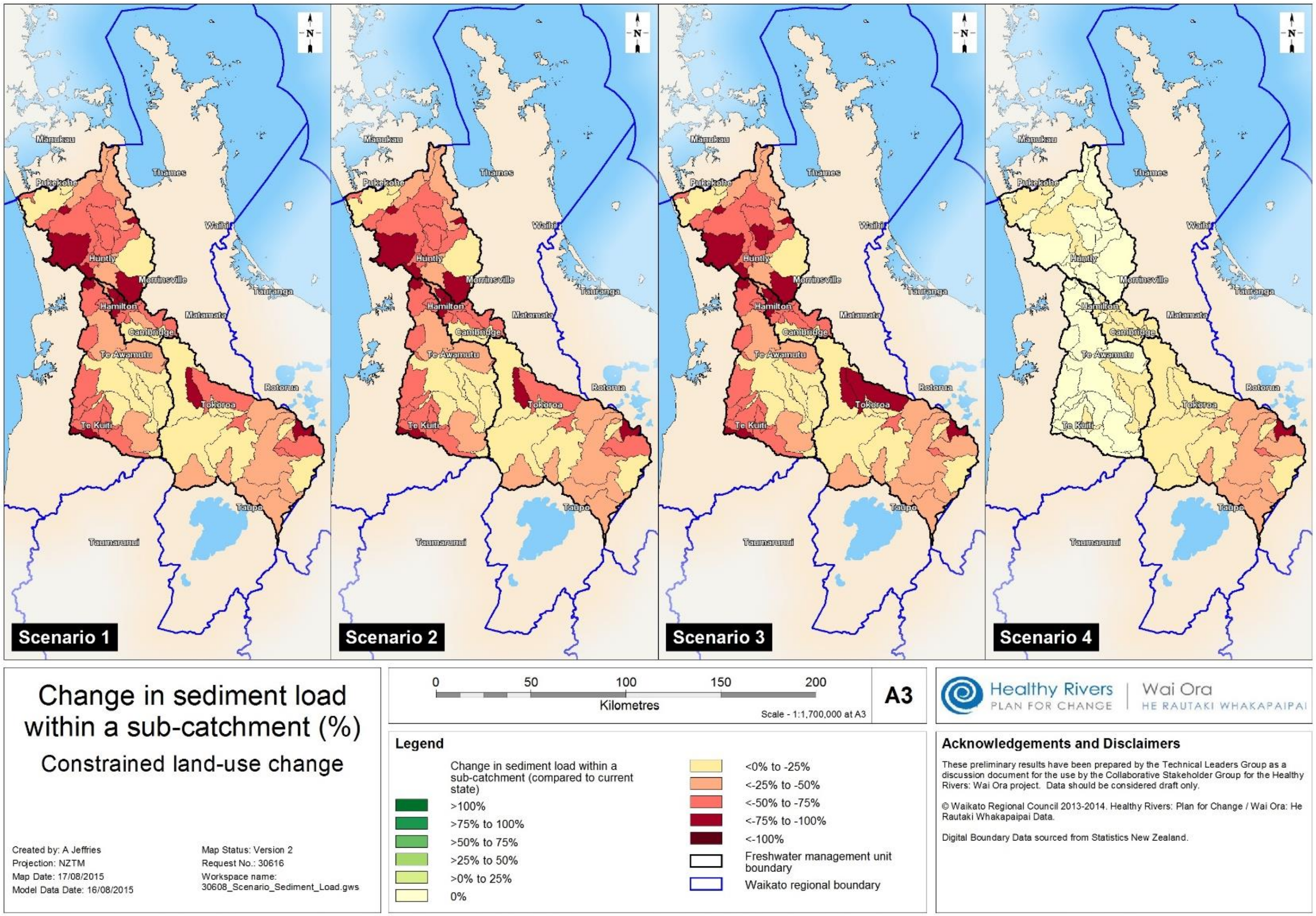

Figure 6

Reductions in microbial load (%)

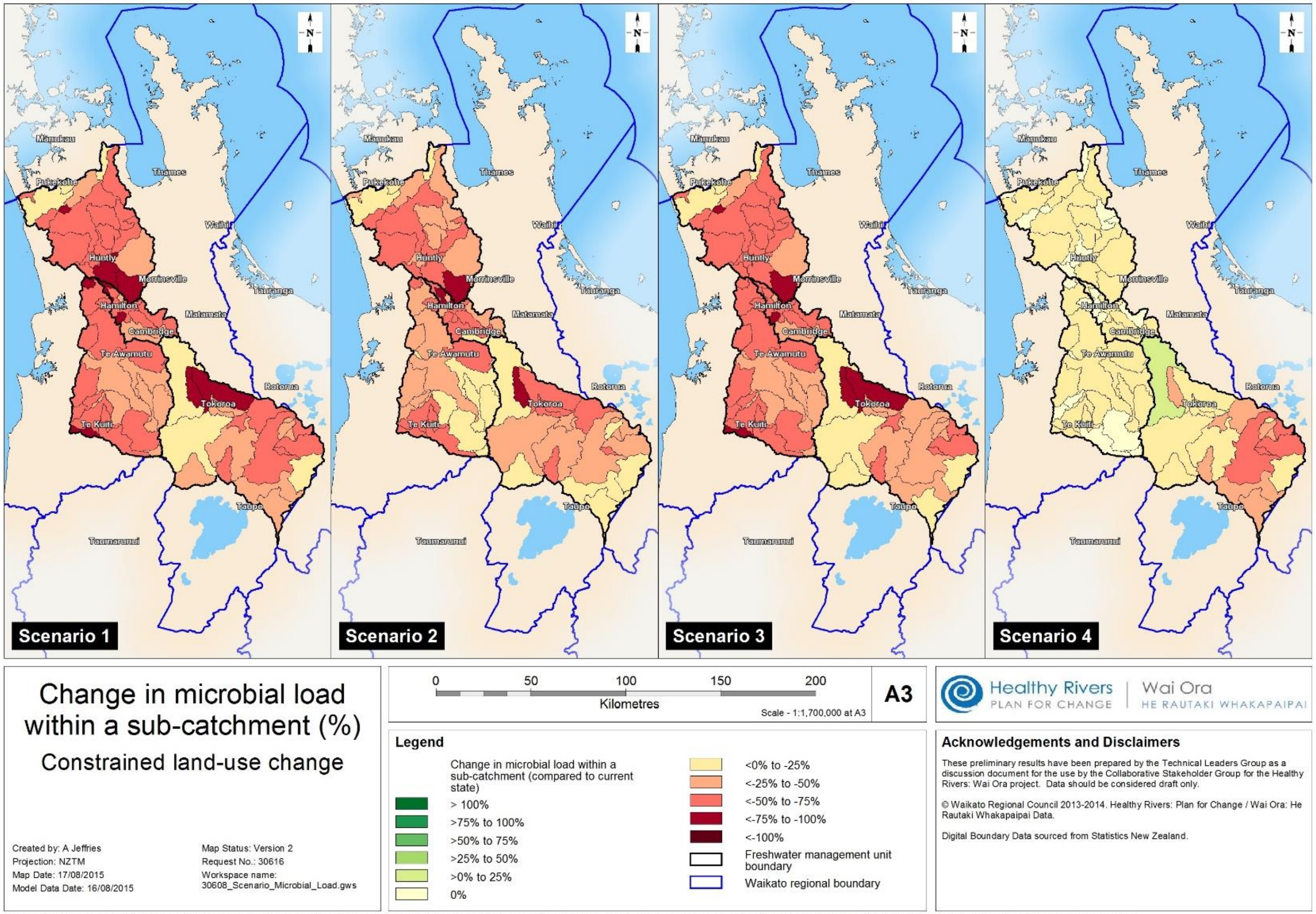

Figure 7

Breach of limits for 95th percentile EC

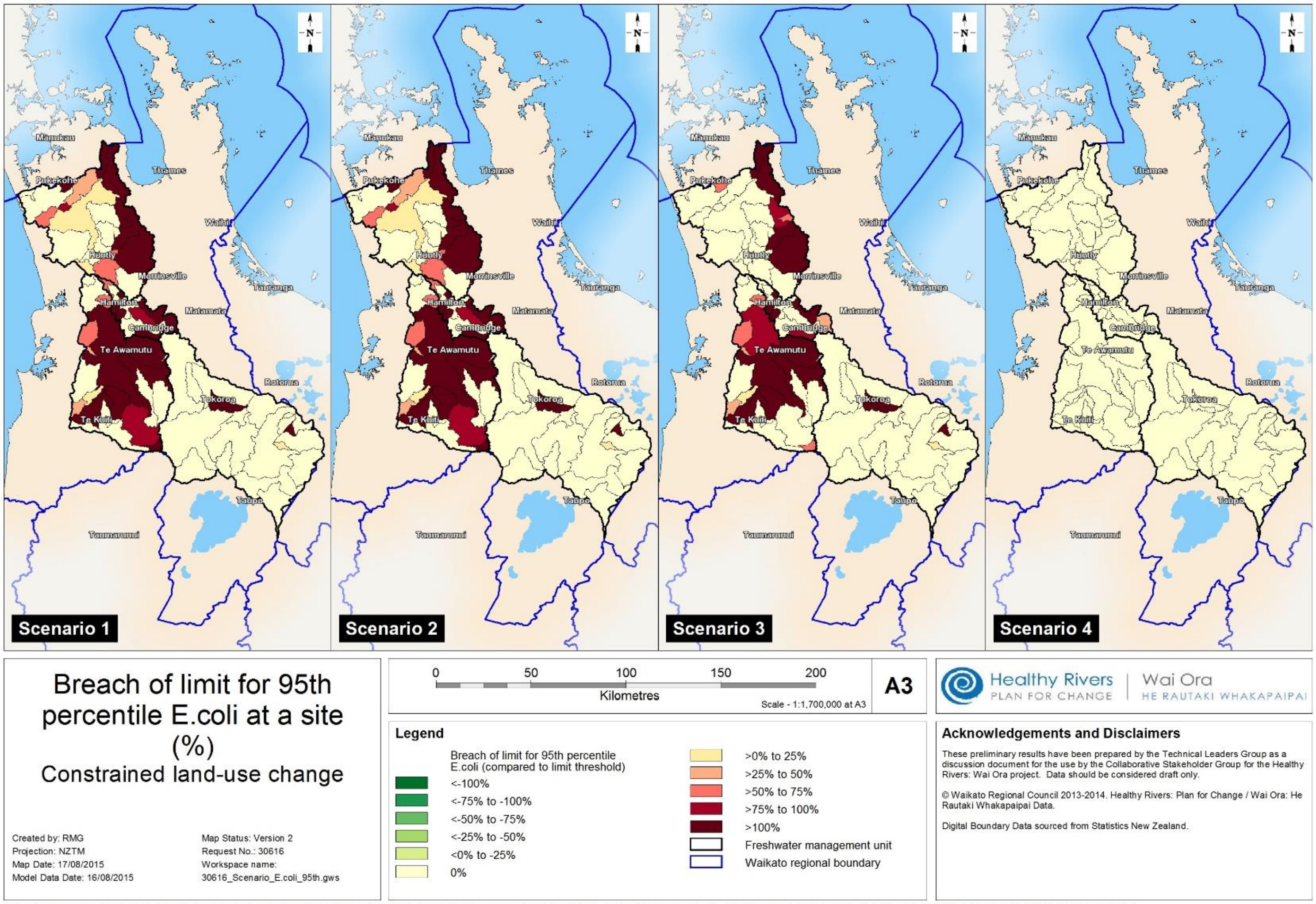

Figure 8

Breach of limits for clarity

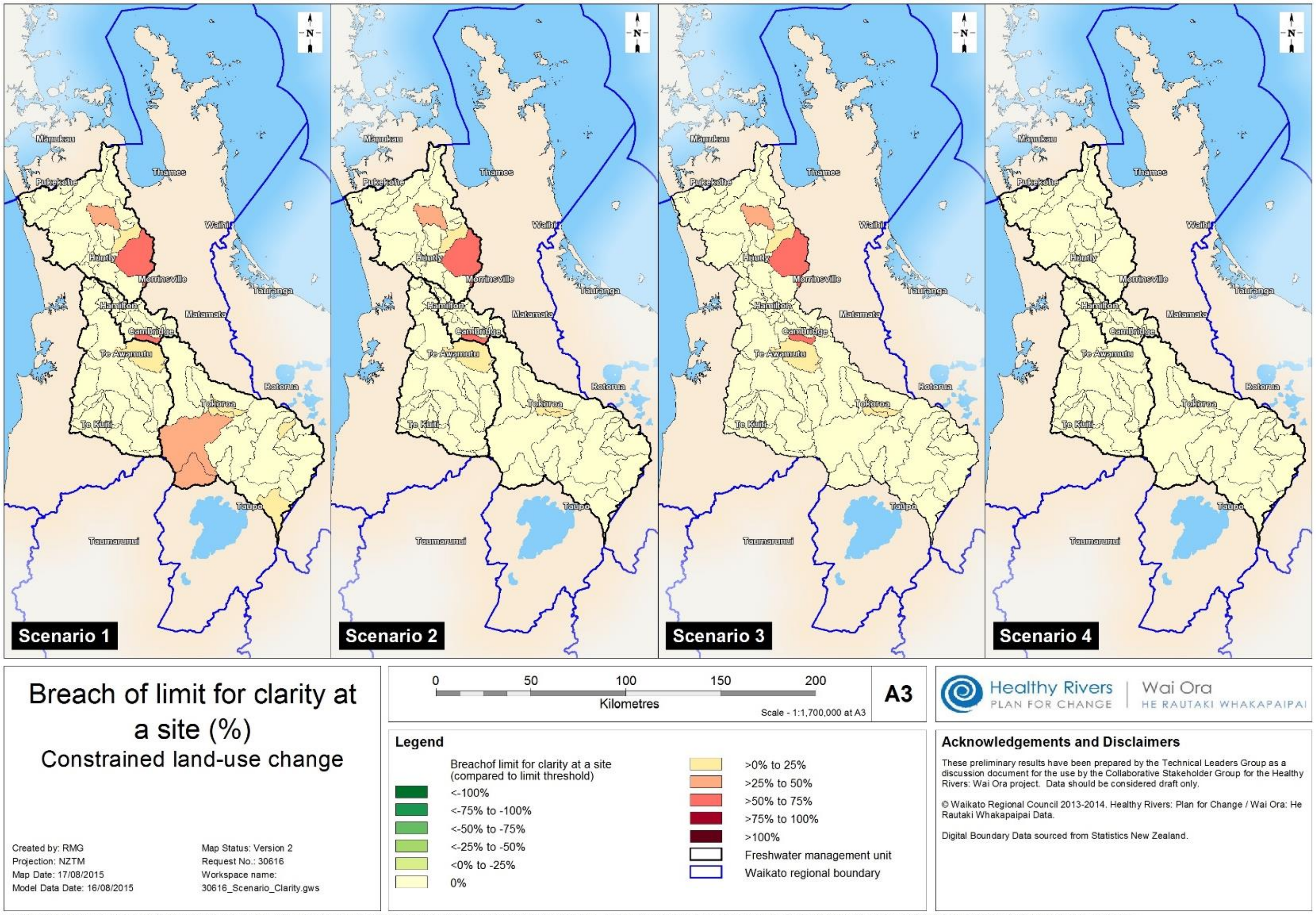

Figure 9

Regional economic impacts: Constrained land-use change

Regional economic model

- Catchment-level model estimates ‘direct’ impacts
- ‘Direct’ impacts include:
  - Changes to farm systems, land-owner incomes, and outputs to processors
  - Expenditures/ revenues for land conversion
  - Expenditures for land improvement e.g. wetlands, riparian fencing
  - Point-source upgrades
- Regional model shows how direct impacts ‘ripple’ through an economy
- Regional model includes supply-chain effects
- 107 key industries, aggregated to 16 for reporting

Regional economic assessment

- Measures flow-on impacts of mitigation costs and changes in sector profit
- Value Added and employment are *indicators* of economic wellbeing
- What is Value Added?
  - A measure of the ‘size’ of the economy
  - Sum of wages, salaries, gross operating profit
  - Often <1% difference between GDP and Value Added
  - Industry Value Added is like the share of GDP attributed to an industry

Reductions in Value Added (%)

Annual figures, change relative to current state

Spatial unit	Change in Value Added ($m)				Loss of Value Added (%)			
	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Lower Waikato FMU	-152	-82	-80	-6	-7.6	-4.1	-4	-0.3
Waipa FMU	-140	-69	-72	-3	-7.7	-3.8	-3.9	-0.1
Mid-Waikato FMU	-123	-51	-49	-17	-1.5	-0.6	-0.6	-0.2
Upper Waikato FMU	-103	-69	-72	-42	-6.4	-4.3	-4.5	-2.6
Rest of Waikato	-104	-38	-37	-30	-2.1	-0.8	-0.8	-0.6
Rest of New Zealand	-552	-179	-186	-131	-0.3	-0.1	-0.1	-0.1
Total New Zealand	-1,174	-487	-496	-229	-0.6	-0.2	-0.2	-0.1

Table 10

Regional impacts by industry

Industry	Value added ($m)				Employment (MECs)			
	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Sheep, beef, and grain	-96	-60	-62	2	-471	-19	-31	87
Dairy farming	-265	-174	-164	-63	-2,257	-1,166	-1,122	-844
Forestry	9	9	9	6	78	78	82	55
Other primary	-42	3	-5	-2	-582	-1	-143	-97
Agriculture and forestry support	-8	-1	-2	-3	-155	-23	-30	-63
Meat and meat product manufacturing	-31	-5	-5	-2	-255	-40	-37	-12
Dairy product manufacturing	-82	-38	-36	-26	-276	-126	-121	-87
Wood and paper manufacturing	10	10	11	7	61	61	63	43
Other manufacturing	-4	-1	0	-1	-50	-10	1	-15
Utilities	0	5	-1	-2	2	13	-2	-4
Construction	1	1	8	1	40	36	142	16
Wholesale and retail trade	-15	-8	-7	-2	-340	-188	-172	-42
Transport	-6	-2	-2	-1	-65	-21	-23	-15
Professional/administrative services	5	10	3	-1	58	138	36	-28
Local and central government	-5	-3	-3	0	-68	-40	-40	-6
Other services	-94	-56	-55	-10	-992	-581	-575	-100
Total loss relative to baseline	-623	-310	-311	-97	-5,272	-1,889	-1,972	-1,112

Table 15

National impacts by industry

Industry	Value added ($m)				Employment (MECs)				International exports ($m)			
	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Sheep, beef, and grain	-151	-70	-71	-4	-1,292	-163	-168	-6	-3	0	0	1
Dairy farming	-368	-217	-205	-97	-3,146	-1,534	-1,479	-1,136	-3	-2	-1	-1
Forestry	7	8	9	5	70	75	79	52	3	3	3	2
Other primary	-50	4	-4	-4	-833	-52	-192	-140	0	0	0	0
Agriculture and forestry support	-31	-7	-8	-11	-600	-142	-162	-210	0	0	0	0
Meat and meat product manufacturing	-70	-12	-11	-4	-709	-123	-114	-39	-191	-33	-30	-10
Dairy product manufacturing	-126	-58	-56	-41	-474	-219	-211	-153	-537	-247	-238	-173
Wood and paper manufacturing	10	12	13	9	61	79	83	57	6	7	7	5
Other manufacturing	-39	-12	-9	-10	-356	-113	-75	-90	-1	0	0	0
Utilities	-14	1	-6	-5	-25	4	-11	-11	0	0	0	0
Construction	-7	-3	8	0	-86	-32	132	2	0	0	0	0
Wholesale and retail trade	-55	-24	-21	-10	-980	-465	-421	-164	0	0	0	0
Transport	-38	-13	-13	-9	-437	-145	-151	-102	0	0	0	0
Professional/administrative services	-22	15	-8	-13	-407	169	-136	-198	0	0	0	0
Local and central government	-19	-11	-11	-2	-218	-124	-125	-27	0	0	0	0
Other services	-203	-102	-102	-33	-1,940	-1,009	-1,014	-283	0	0	0	0
Total loss relative to baseline	-1,176	-489	-495	-229	-11,372	-3,794	-3,965	-2,448	-726	-272	-259	-176

Table 16

Reductions in Value Added (%)

Annual figures for Scenario 1, change determined relative to current state

		Value added ($m)	Jobs	Exports ($m)
Waikato	Constrained land-use change	-623	-5,272	-462
	Unconstrained land-use change	-1,080	-13,856	-1,220
NZ	Constrained land-use change	-1,176	-11,372	-726
	Unconstrained land-use change	-2,167	-25,348	-1,857

Data not in report

Conclusions

- Integrated economic model used to assess four scenarios
- A broad range of mitigations are required
- Three of the four scenarios impose a significant economic cost
- Economic implications vary across subcatchments, FMUs, region, and NZ
- Economic implications vary according to assumptions regarding land-use change

Extra slides

Table 11

Lower Waikato FMU result by industry

Industry	Value added ($m)				Employment (MECs)				International exports ($m)			
	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Sheep, beef, and grain	-40	-30	-30	2	-89	43	30	40	-1	0	0	0
Dairy farming	-63	-43	-33	-5	-482	-250	-198	-118	-1	0	0	0
Forestry	1	1	1	0	2	2	2	2	0	0	0	0
Other primary	-28	0	-8	-1	-344	-23	-157	-52	0	0	0	0
Agriculture and forestry support	-1	0	0	0	-15	-2	-1	-6	0	0	0	0
Meat and meat product manufacturing	-1	0	0	0	-10	-1	-1	0	-4	-1	0	0
Dairy product manufacturing	0	0	0	0	-2	-1	-1	-1	-2	-1	-1	-1
Wood and paper manufacturing	0	0	0	0	3	3	3	2	0	0	0	0
Other manufacturing	0	0	0	0	-2	0	0	-1	0	0	0	0
Utilities	-4	-1	-2	-1	-3	-1	-1	-1	0	0	0	0
Construction	2	2	2	0	44	41	38	1	0	0	0	0
Wholesale and retail trade	-1	0	0	0	-18	-9	-8	-2	0	0	0	0
Transport	-1	0	0	0	-6	-2	-2	-1	0	0	0	0
Professional/administrative services	0	0	0	0	0	3	1	-1	0	0	0	0
Local and central government	0	0	0	0	-2	-1	-1	0	0	0	0	0
Other services	-15	-9	-8	0	-120	-67	-63	-3	0	0	0	0
Total change relative to current state	-151	-80	-78	-5	-1044	-265	-359	-141	-8	-2	-1	-1

Waipa FMU results by industry

Industry	Value added ($m)				Employment (MECs)				International exports ($m)			
	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Sheep, beef, and grain	-25	-16	-19	2	-114	-6	-6	24	-1	0	0	0
Dairy farming	-69	-39	-39	0	-447	-33	-33	0	-1	0	0	0
Forestry	0	0	0	0	0	0	0	0	0	0	0	0
Other primary	-6	0	0	0	-109	6	7	-1	0	0	0	0
Agriculture and forestry support	-2	0	0	0	-36	6	5	-9	0	0	0	0
Meat and meat product manufacturing	-6	-1	-1	0	-56	-7	-6	-2	-20	-2	-2	-1
Dairy product manufacturing	-12	-4	-4	-3	-41	-15	-14	-10	-55	-20	-19	-13
Wood and paper manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
Other manufacturing	0	0	0	0	-4	-1	-1	-1	0	0	0	0
Utilities	0	0	0	0	-2	-1	-1	-1	0	0	0	0
Construction	2	2	2	0	39	30	38	-1	0	0	0	0
Wholesale and retail trade	-2	-1	-1	0	-46	-25	-25	-2	0	0	0	0
Transport	-1	0	0	0	-8	-3	-3	-2	0	0	0	0
Professional/administrative services	0	0	0	0	2	6	2	-3	0	0	0	0
Local and central government	-1	0	0	0	-16	-9	-9	-1	0	0	0	0
Other services	-17	-10	-10	0	-153	-86	-89	-2	0	0	0	0
Total change relative to current state	-139	-69	-72	-1	-991	-138	-135	-11	-77	-22	-21	-14

Table 13

Mid-Waikato FMU results by industry

Industry	Value added ($m)				Employment (MECs)				International exports ($m)			
	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Sheep, beef, and grain	-4	-2	-2	0	-16	13	7	4	0	0	0	0
Dairy farming	-18	-11	-9	0	-174	-76	-38	-3	0	0	0	0
Forestry	0	0	0	0	0	0	0	0	0	0	0	0
Other primary	-5	0	0	0	-93	1	-2	-33	0	0	0	0
Agriculture and forestry support	-2	0	0	-1	-42	-5	-5	-14	0	0	0	0
Meat and meat product manufacturing	-8	-1	-1	0	-77	-11	-10	-3	-26	-4	-3	-1
Dairy product manufacturing	-33	-15	-14	-9	-113	-50	-46	-32	-145	-64	-59	-41
Wood and paper manufacturing	0	0	0	0	2	2	2	2	0	0	0	0
Other manufacturing	-2	0	0	-1	-28	-3	2	-10	0	0	0	0
Utilities	0	1	1	0	-2	1	0	-2	0	0	0	0
Construction	1	2	2	0	19	26	34	0	0	0	0	0
Wholesale and retail trade	-8	-4	-4	-1	-175	-93	-86	-17	0	0	0	0
Transport	-2	-1	-1	-1	-28	-9	-10	-6	0	0	0	0
Professional/administrative services	3	6	2	-1	23	83	28	-22	0	0	0	0
Local and central government	-4	-2	-2	0	-38	-23	-22	-2	0	0	0	0
Other services	-41	-24	-23	-3	-490	-283	-275	-31	0	0	0	0
Total change relative to current state	-123	-51	-51	-17	-1232	-427	-421	-169	-171	-68	-62	-42

Upper Waikato FMU results by industry

Industry	Value added ($m)				Employment (MECs)				International exports ($m)			
	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4	Sc. 1	Sc. 2	Sc. 3	Sc. 4
Sheep, beef, and grain	-22	-11	-10	-1	-167	-59	-53	31	-1	0	0	0
Dairy farming	-77	-66	-68	-45	-797	-673	-722	-602	-1	-1	-1	-1
Forestry	8	8	9	6	77	77	80	54	2	2	3	2
Other primary	-4	0	0	0	-43	-1	-10	-11	0	0	0	0
Agriculture and forestry support	-2	-1	-1	-1	-33	-15	-20	-21	0	0	0	0
Meat and meat product manufacturing	-1	0	0	0	-5	-1	-1	0	-2	-1	-1	0
Dairy product manufacturing	-6	-4	-4	-3	-20	-12	-12	-9	-27	-16	-16	-13
Wood and paper manufacturing	10	10	10	7	53	53	55	37	5	5	5	4
Other manufacturing	0	0	0	0	-3	-1	2	0	0	0	0	0
Utilities	5	6	0	0	12	13	0	0	0	0	0	0
Construction	-2	-3	1	1	-37	-40	26	13	0	0	0	0
Wholesale and retail trade	-1	-1	-1	0	-34	-23	-19	-10	0	0	0	0
Transport	-1	0	0	0	-6	-2	-2	-2	0	0	0	0
Professional/administrative services	1	2	0	0	25	27	5	2	0	0	0	0
Local and central government	0	0	0	0	-3	-2	-2	-1	0	0	0	0
Other services	-12	-8	-8	-5	-119	-81	-84	-44	0	0	0	0
Total change relative to current state	-104	-68	-72	-41	-1100	-740	-757	-563	-24	-11	-10	-8