Lake Opening – Ross V

History of level management

April 1875 W. B. Bray report to the Canterbury Provincial Government

"*The Maoris used to let the lake out every two or three years and since the arrival of the Canterbury Colonists, they are known to have let it out in the years 1852, 1854, 1861, 1863, 1865 and 1867. In 1868 it was let out by Chapman and since then it has been let out every year by white man*.

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Figure 1.2 Historic opening 1886

(A.W. Hands, collection, Canterbury Museum

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History of level management

- *1875 Bray report (3 options)*
- Use of horse drawn scoops from 1868 to 1904, 1925-1931
- 1904 Dobson's culvert
- 1907 Pannets culvert
- 1931- Ellesmere Drainage Board purchased power scoops
- 1947- North Canterbury Catchment Board took responsibility
- *1975 draft report (2 options)*
- *1981 Morris & Wilson report (3 options)*
- Currently managed by ECan

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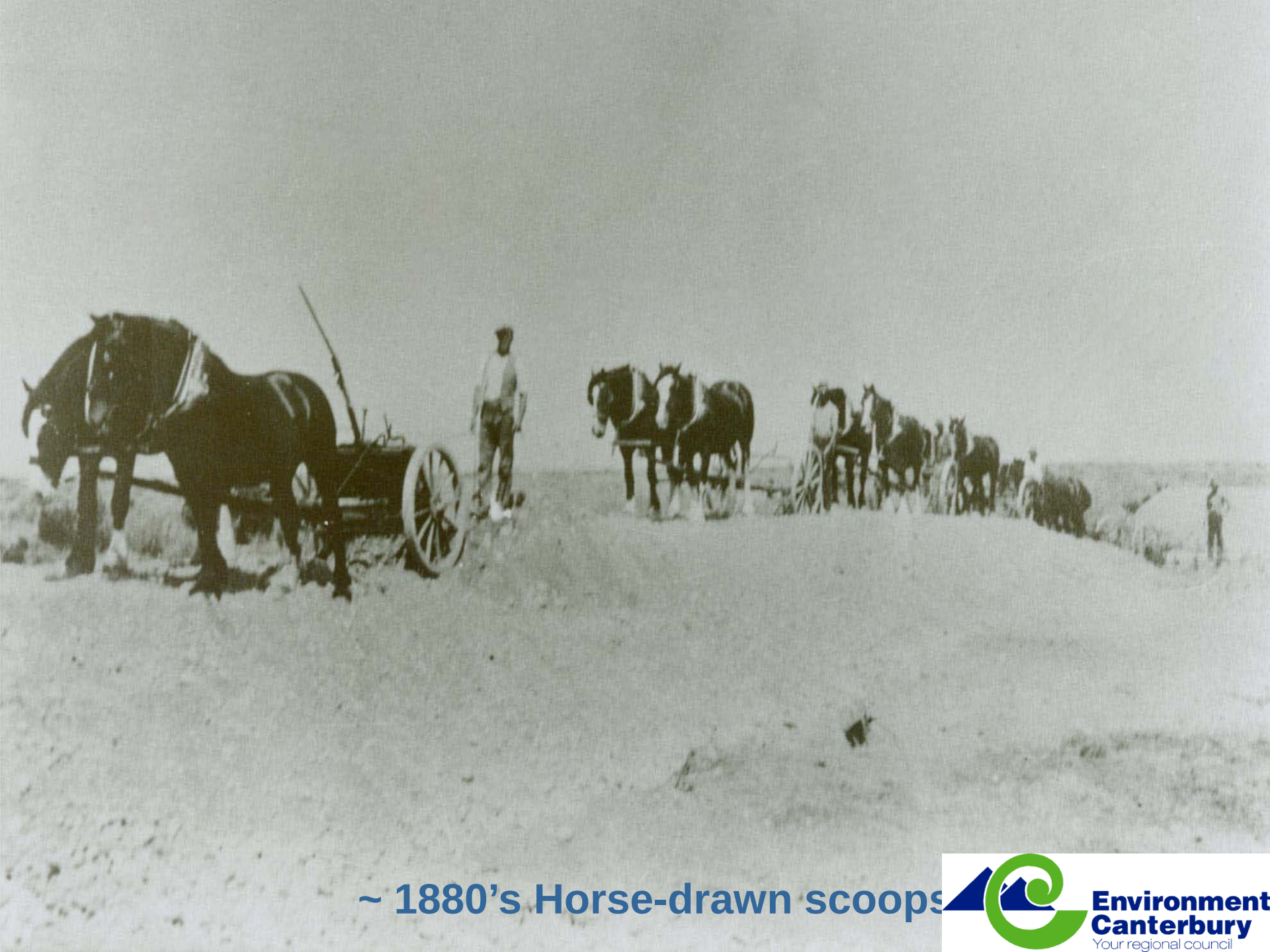

~ 1880’s Horse-drawn scoops

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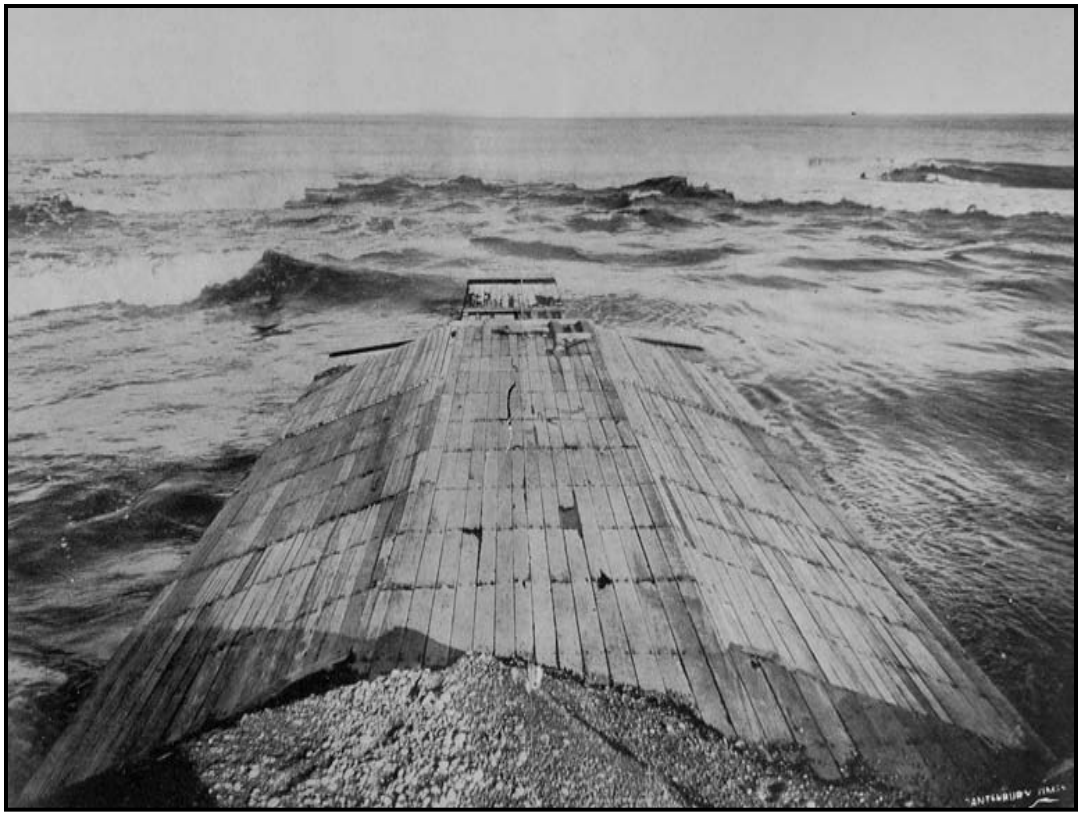
Permanent Opening Structure

- Culvert type structure
- Higher lake level
- Utilised greater head to scour out gravel
- Installed in 1904 but destroyed within 7 months
- Redesigned and upgraded in 1908
- Destroyed by successive storms in 1925
- Failed to alleviate problems associated with fluctuating lake levels



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Mechanical Openings

- 1.05m ASL — Summer months August – March inclusive
- 1.13m ASL — Winter months April – July inclusive

- Achieved by making a temporary cut through the beach at Taumutu
  - 1.5-2.0m deep
  - 15m wide
  - up to 300m long.

- Using
  - D9 Bulldozer
  - D7 Bulldozers
  - 22t Dragline
  - 20t Excavator

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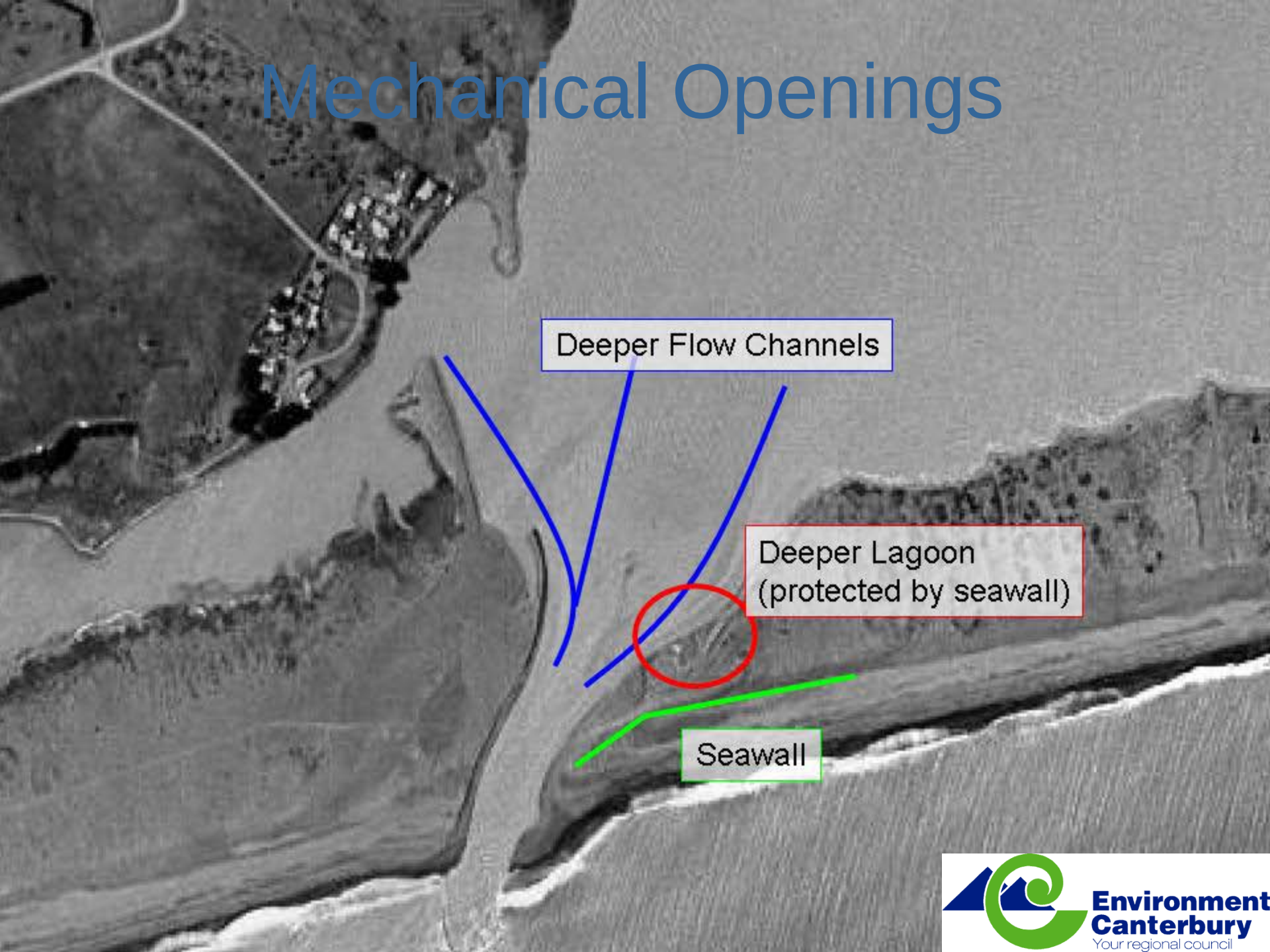
Mechanical Openings



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RESOURCE CONSENT CRC042860
Commenced: 31 July 2006
Expires: 31 July 2011

2 conditions (with prior agreement) required further investigation and monitoring

- **Coastal Erosion Monitoring**

  ($10,000 over 5 years)

- **Cultural Health Index Study**

  ($13,000 over 5 years)

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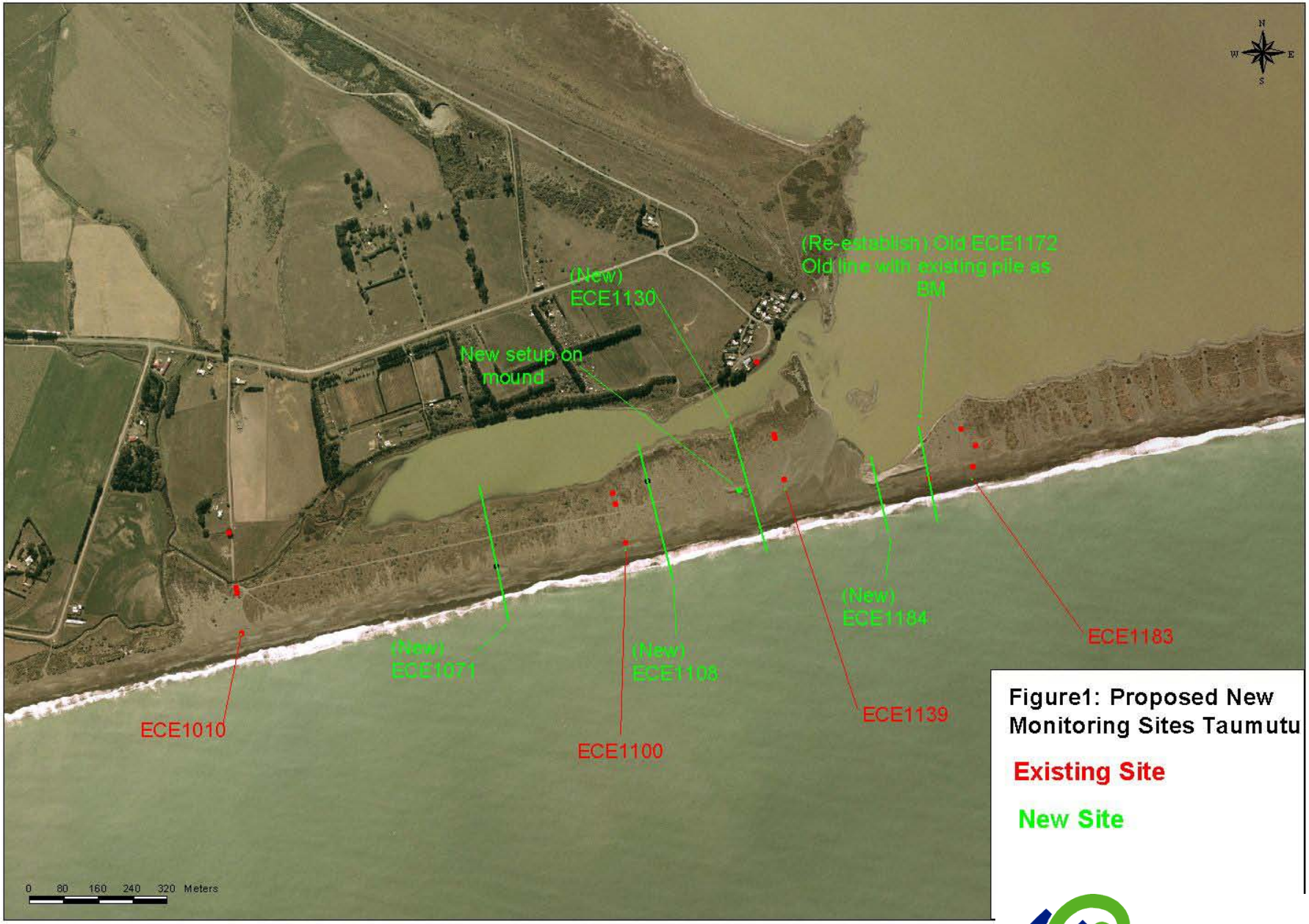

Figure1: Proposed New Monitoring Sites Taumutu

Existing Site

New Site

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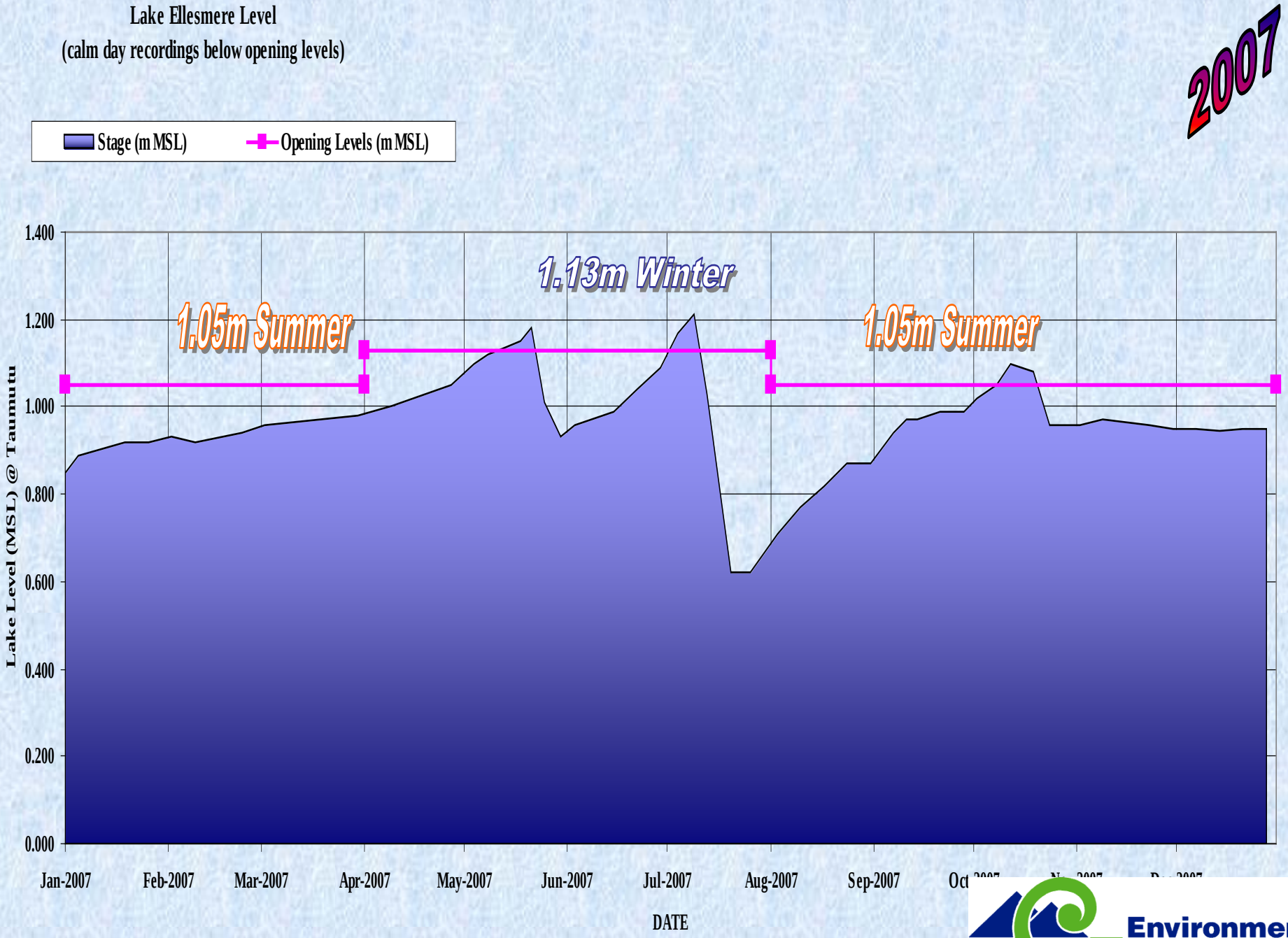

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Factors affecting openings

- Wind
- Swells and wave action
- Tides and hydraulic gradients
- Beach material
  - unstable, poorly graded gravels.
  - Eroding coastline

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Wind

- Strong NE can raise calm level at Taumutu by 0.6m.
- SW gale can lower Taumutu level by 0.6m.
- Wind direction and speed critical factors for successful opening
- Ideal for opening = NE

Percentage of wind direction at Taumutu

Taumutu Wind Direction Frequency	
Direction	Percent Occuring
N	**30**
NW	11
W	13
SW	**10**
S	**14**
SE	4
E	4
NE	**8**
CALM	5

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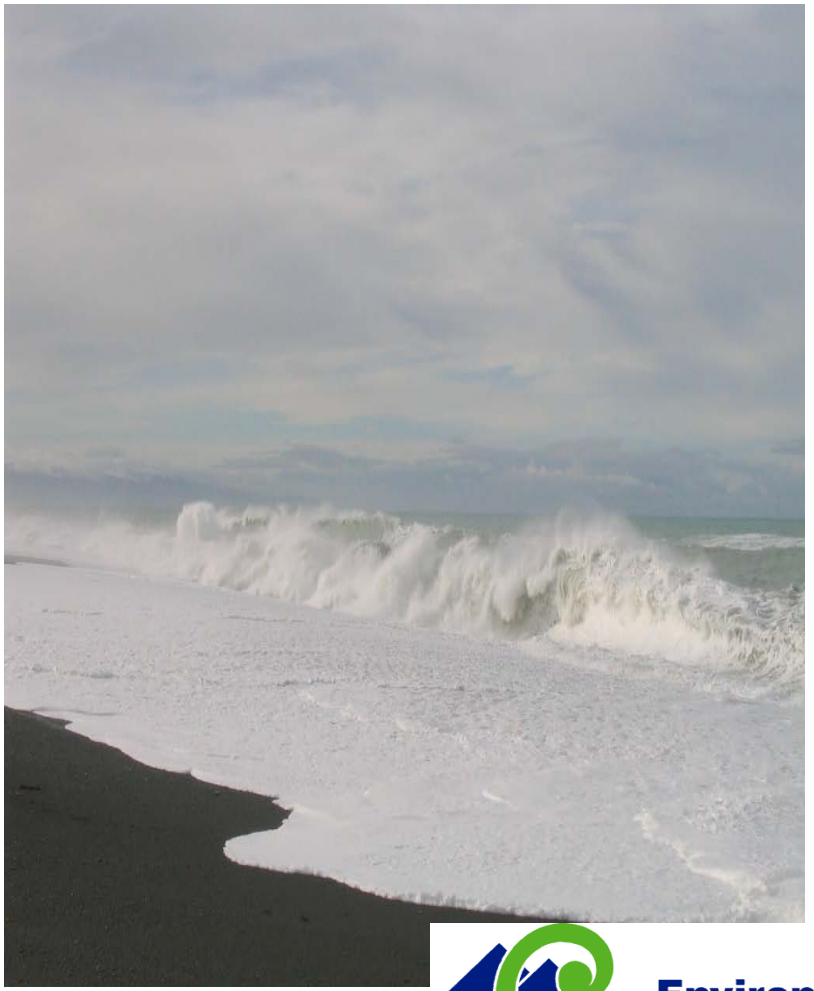
Swells and Wave Action

- Swells 1-2m very common
- Swells up to 10m been recorded in the past
- More recently, swells of 6m recorded during opening attempt.
- Swell < 1m for opening
- Large swells close openings, cause seawater intrusions
- Damage permanent outlets along the coast



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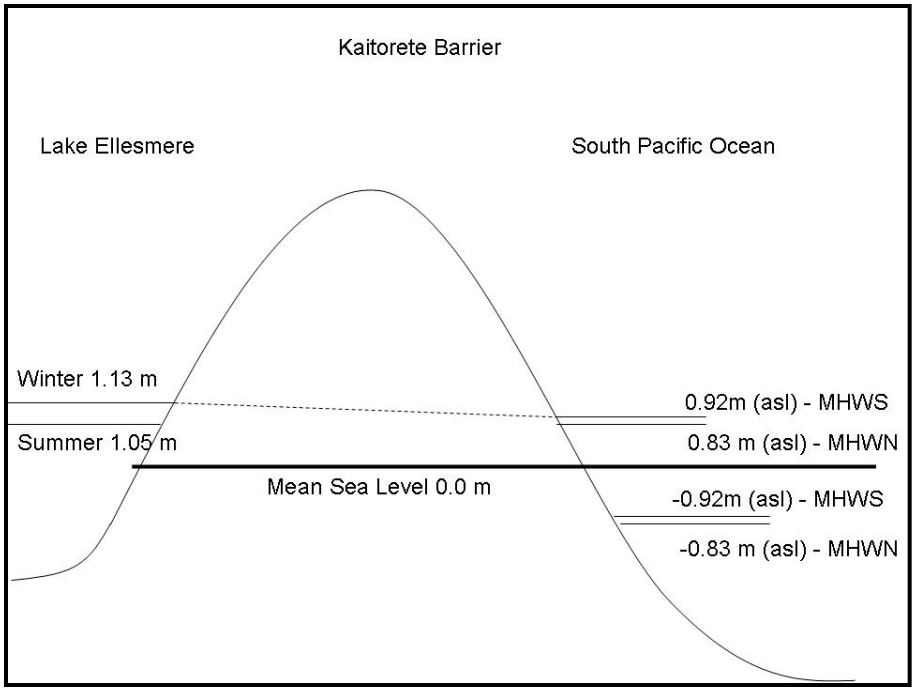
Tides

- significant effect on hydraulic gradient driving an opening
- Small hydraulic gradient prevents successful opening of lake lower than current levels
  - 1.05m August-March
  - 1.13m April-July
- Combined with wind lash and large swells, lake will close and/or flow will reverse.
- Open just after high tide on falling limb



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Forced Closing

- Width of channel(s) and lowered beach
- Material availability
- Sea conditions/tide (forecast)
- Lake level
- Natural closure imminent
- Gain =?
- Cost =?

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Contract	**118 LKE 036**	
	#272 since 1901	
Length of Cut	160m	
Physical Works Commenced on site	Tuesday 9 October 2007	
Physical Works Ceased on site	Monday 22 October 2007	
Total Time on site to open lake	14 days	
Lake Opened	Saturday 20 October @ 12pm	
Opening Level	1.09m MSL	
Lake Closed	Tuesday 23 October at 1pm (on high tide)	
Closing Level	0.96mMSL	
Drop in Lake Level	0.13m	
Total time Lake remained Open	3 days	
As-Built Cost to open	**$**	**43,205.00**
Average Cost/working day	$	3,086.07
Average Cost/each day remaining open	$	14,401.67
Average Cost/day from starting to lake closing	$	2,880.33
Average Cost/10cm level drop	$	33,234.62
Average cost/length cut	$	270.03
Comment	Operate under Health & Safety Plan #109, Revision 5 Tuesday 9 - Dozers begin cleaning bell-mouth; Excavator starts reinstating seawall Wednesday 10 - complete pilot channel to within 40m of high tide mark Thursday 11 - swell increasing to 2m, begin erecting sea wall in front of cut Saturday 13 - sea wall in tact, but requires strengthening with D9 Monday 15 - 3m breakers demolish sea wall pushing shingle 80m back into bell mouth. Dozers begin cleaning out channel and reinstating sea wall Tuesday 16 - sea wall removed. Lake opened at 12.30pm (1.18mMSL with 20kNW); by 9.30pm cut is 35m wide and developing well Wednesday 17 - 4pm cut is 60m wide	

OPENING STATS

1901 - present day

Openings		
Total Openings	***278***	
Average / Year	**2.57**	
Max. / Year	7	1975
Min. / Year	1	1955 / 1971 / 1973 / 1988 / 2004
Days Open		
Average	**24.88**	
Max.	123	September 18th, 1935
Min.	1	few hours
Levels		
Max. Opened	2.16	September 29, 1941
Min. Opened	0.85	December 21, 1948
Average Level Opened	**1.27**	
Max. Closed	1.48	June 28, 1975
Min. Closed	0.15	February 17, 1952
Average Level Closed	**0.62**	

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OPENING STATS

…since 1901…

Openings per month	No.	%
Jan	4	1.44
Feb	4	1.44
Mar	9	3.24
Apr	11	3.96
May	17	6.12
Jun	35	12.59
Jul	55	19.78
Aug	49	17.63
Sep	36	12.95
Oct	28	10.07
Nov	15	5.40
Dec	15	5.40
Summer	160	57.55
Winter	118	42.45

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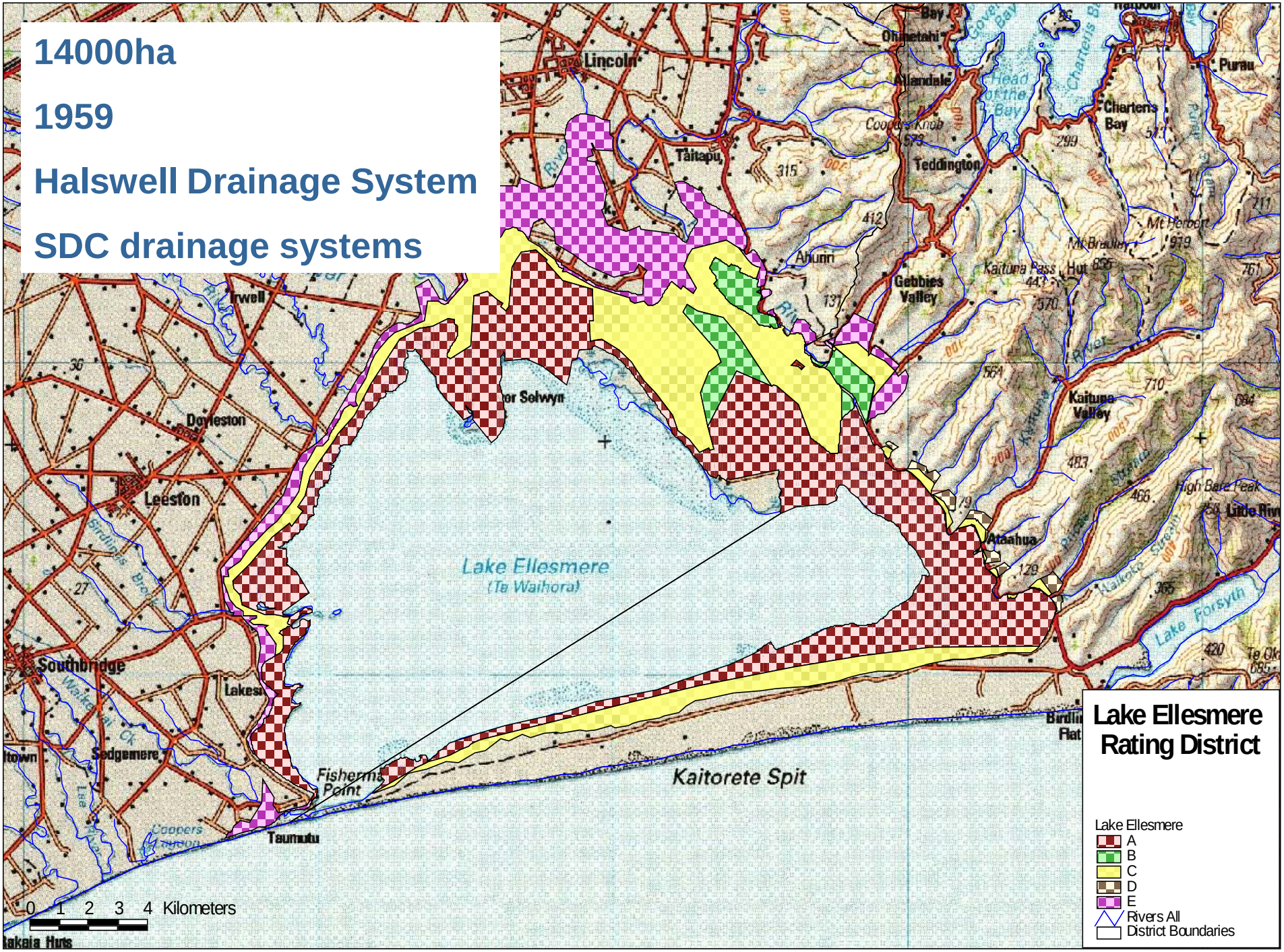
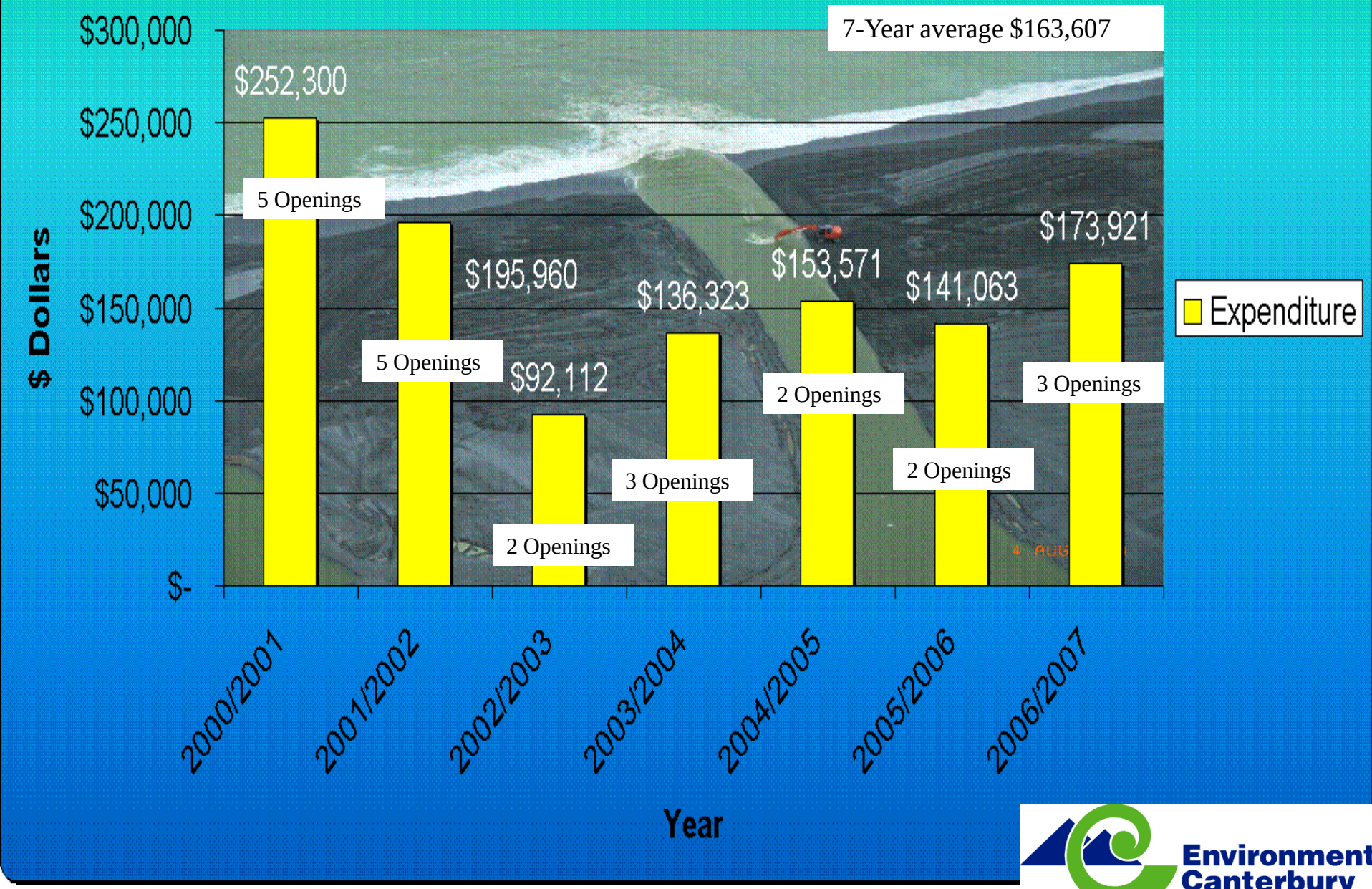

14000ha
1959
Halswell Drainage System
SDC drainage systems
Lincoln
Taitapu
Teddington
Gebbies Valley
Kaituna Valley
Irwell
Doyleston
Leeston
Lake Ellesmere
(Te Waihora)
Kaitorete Spit
Southbridge
Lakes
Sedgemere
Taumutu
Atoahua
Purau
Charteris Bay
Mt Herbert
Kaituna Pass Hut
Lake Forsyth
0 1 2 3 4 Kilometers
Lake Ellesmere Rating District
Lake Ellesmere
A
B
C
D
E
Rivers All
District Boundaries

Lake Ellesmere / Te Waihora Historical Expenditure 2000-2007



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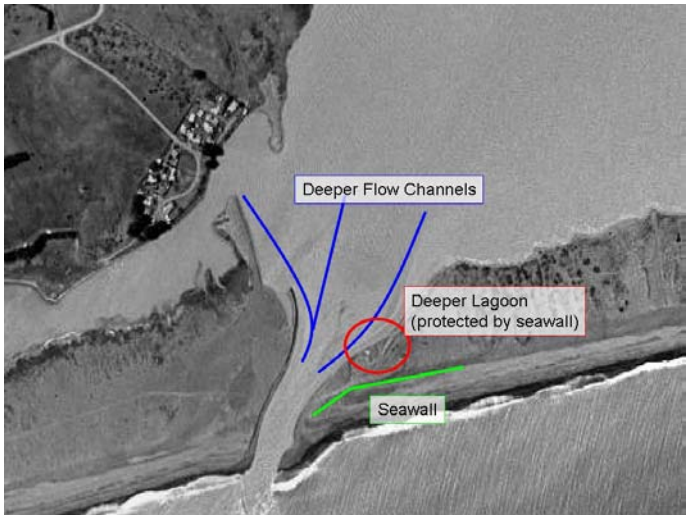
Future of current opening regime

- More difficult to find material for sea wall
- Beach monitoring programme doesn't yet show this
- Recession of crest
- Could loose deep pool and feeder channels
- New consent conditions
- Long term sea level rise
- Funding base



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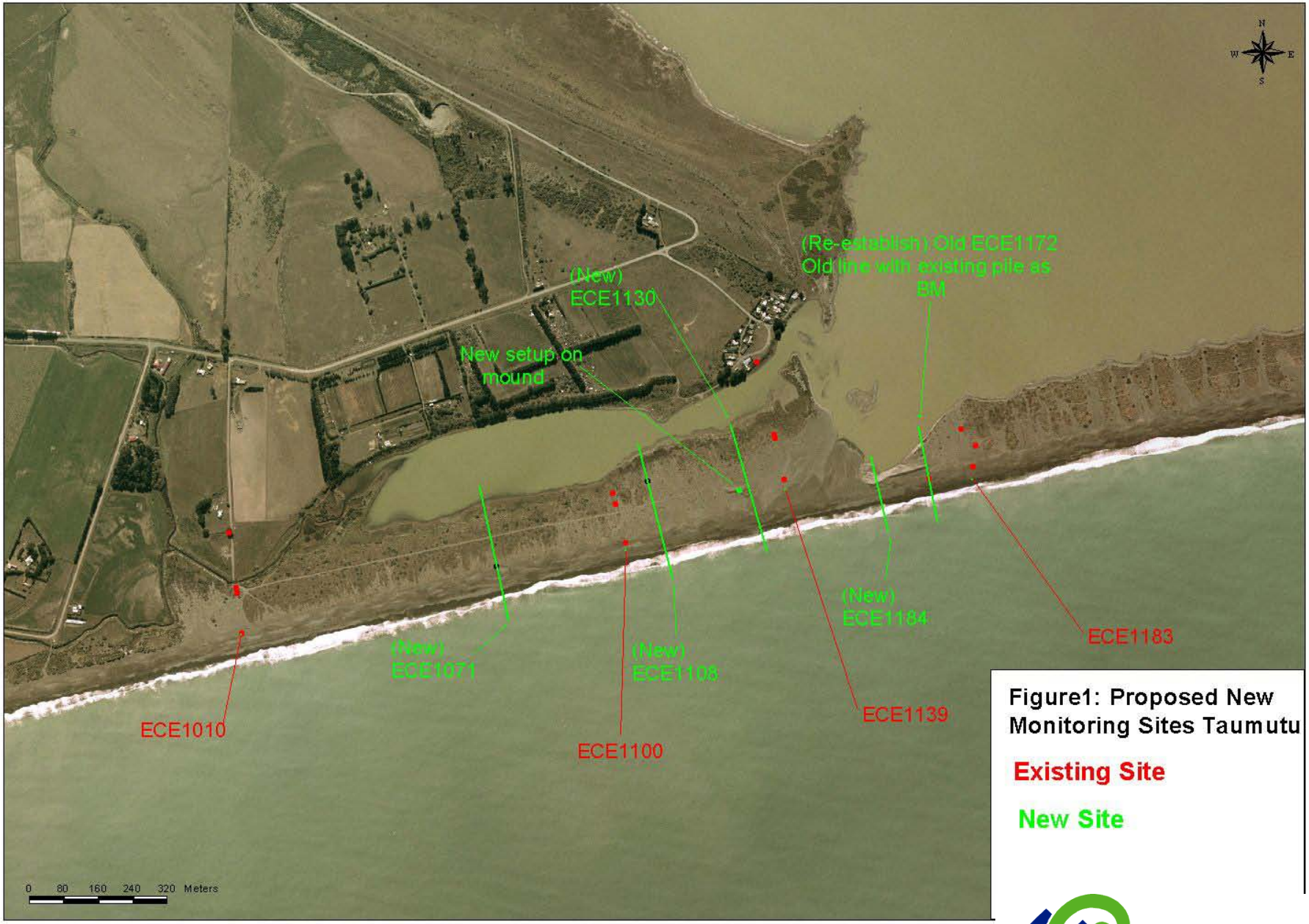

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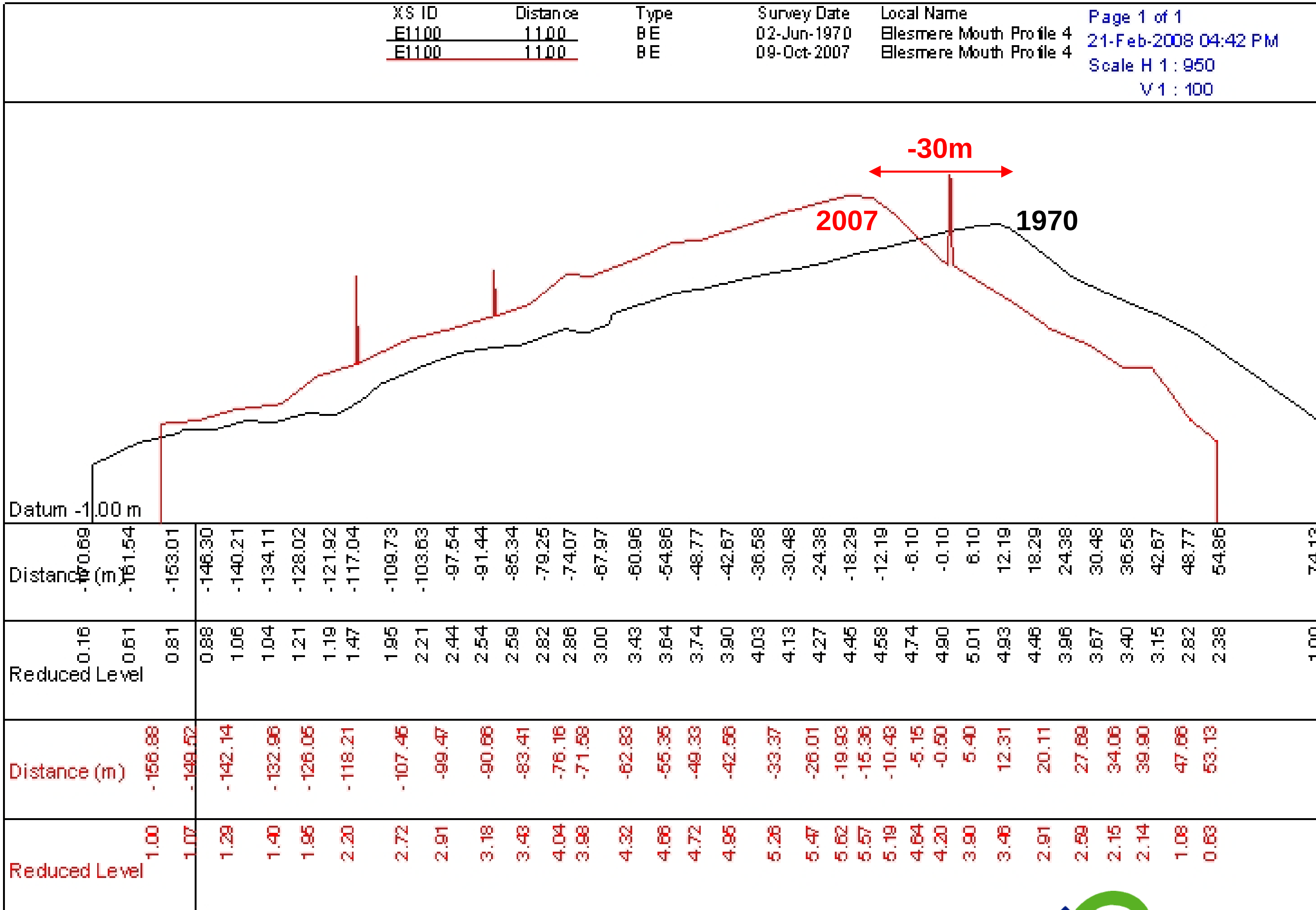

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Opening options

Bray report

1. Canal through Halswell to Sumner
2. Connect to Lake Forsyth + tunnel
3. Connect to Rakaia lagoon

Morris & Wilson Report

1. Canal
2. Piped
3. Stopbanking

Previous attempts

1. Dobsons culvert 1904
2. Pannets culvert 1907 (Similar = Waihao box – very narrow beach, higher head)

Previous investigations show option costs significantly higher than mechanical openings

Funding source needed for further investigations

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Permanent Opening Objectives

- Reduce fluctuations in lake level
- More control over minimum lake levels
- Fish passage
- Funding/affordability

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