Healthy Coorong, Healthy Basin

Coorong Infrastructure Investigations
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Hydrodynamic Modelling to Inform Infrastructure Options

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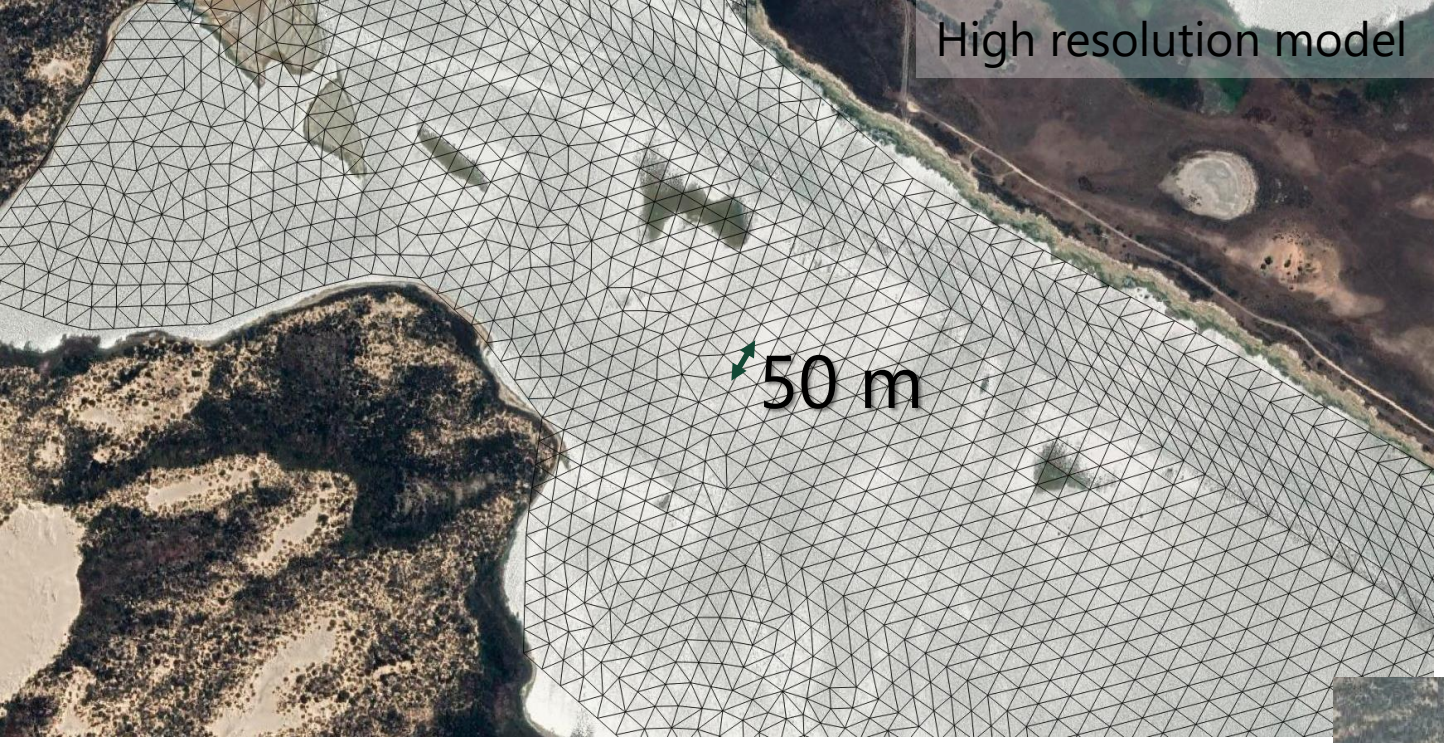
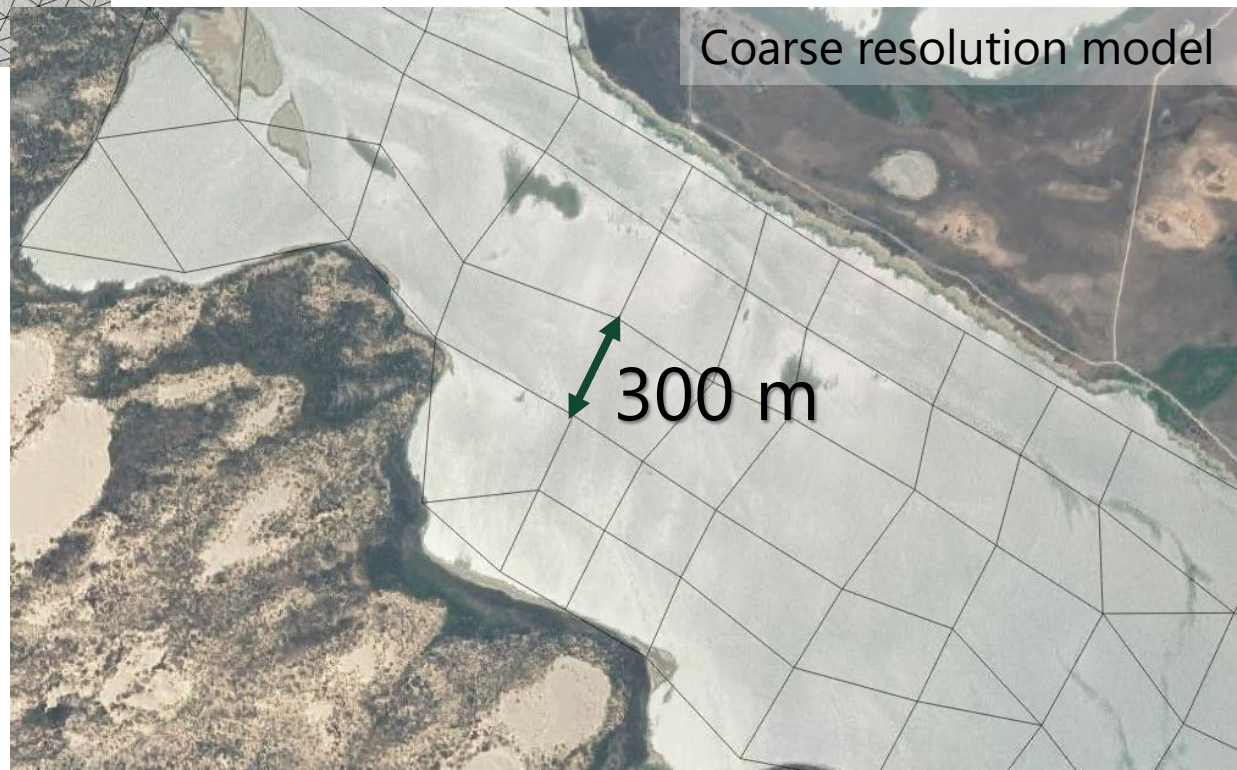
Australian Government

Government of South Australia

The next phase of two modelling projects

- DEW hydrodynamics
  - Water level, salinity, flow, velocity
  - 3 year period (2013-2016): Optimisation with fine resolution model
  - 30 year simulations (1990 – 2019): Assessment with coarse resolution model
- Water quality and ecosystem state (BMT and UWA)
  - Same base fine resolution TUFLOW model
  - Also add nutrients, sediment, turbidity/clarity, Ruppia, algae, fish
  - 6 year period (2017-2019 x 2)
  - 10 scenarios:
    - Two different base case conditions (dry and wet)
    - 9 infrastructure combinations





SOUTH AUSTRALIA

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Department for Environment and Water

Options refinement: Step 1

- Phase 1 ecological investigations identified options to investigate further to determine the appropriate scale of infrastructure

Group	ID	Description	Model used
Pump out trigger	*Out500_0.2m (Phase 1)*	*Pump out 500 ML/d from Policeman Point when water levels in CSL > 0.2m*	*Original BMT*
	Out500_0.3m (Phase 1)	*Pump out 500 ML/d from Policeman Point when water levels in CSL > 0.3m*	*Original BMT*
	Out1000_0.3m	Pump out 1,000 ML/d from Policeman Point when water levels in CSL > 0.3m	Original BMT
	Out500_0m	Pump out 500 ML/d from Policeman Point when water levels in CSL > 0.0m	Original BMT
	Out500_-0.2m	Pump out 500 ML/d from Policeman Point when water levels in CSL > -0.2m	Original BMT
	Out1500_0.3m	Pump out 1,500 ML/d from Policeman Point when water levels in CSL > 0.3m	Original BMT
Pump out + dredge	Out250_Dredge	As per Phase 1 Original BMT model run. Pump out 250 ML/d from Policeman Point, combined with dredging. Dredge alignment is approximately 200m wide, at -1.2mAHD. This scenario is not considered as a feasible option, but included to determine the impact of changing scale of dredge.	High-res
	Out250_DredgeLarge	Pump out 250 ML/d from Policeman Point, combined with dredging. Dredge profile is along the entire length of the Coorong to a width of 300m, and depth of -2.0mAHd. This scenario is not considered as a feasible option, but included to determine the impact of changing scale of dredge.	High-res
	Out250_NoDredge	Pump out 250 ML/d from Policeman Point. This scenario is not considered as a feasible option, but included to determine the impact of changing scale of dredge.	High-res
	Out250_Dredge_KBR01	Pump out at 250 ML/d from Policeman point, combined with dredging at Parnka. The dredge profile is alignment option 1 provided by KBR, weighted towards the natural channels of the lagoon, with dredge widths of 25-50 m, and elevations from -1.4 to -1.6 mAHD.	High-res
	Out250_Dredge_KBR01a	Pump out at 250 ML/d from Policeman point, combined with dredging at Parnka. The dredge profile is alignment option 1 provided by KBR, weighted towards the natural channels of the lagoon, with dredge widths of 50-100 m, and elevations from -1.2 to -1.4 mAHD.	High-res
	Out250_Dredge_KBR02	Pump out at 250 ML/d from Policeman point, combined with dredging at Parnka. The dredge profile is alignment option 2 provided by KBR, with the alignment along the natural channels, except where a more direct route is present. Dredge widths are of 25-50 m, and elevations from -1.4 to -1.6 mAHD.	High-res
	Out250_Dredge_KBR02a	Pump out at 250 ML/d from Policeman point, combined with dredging at Parnka. The dredge profile is alignment option 2 provided by KBR, with the alignment along the natural channels, except where a more direct route is present. Dredge widths are of 50-100 m, and elevations from -1.2 to -1.4 mAHD.	High-res
	Out250_Dredge_KBR02a_meshaligned	Pump out at 250 ML/d from Policeman point, combined with dredging (KBR option 2A). The alignment is as per the simulation above, but adjusted to tie in with the model mesh.	High-res
Pump in/out (one location)	*Out500_0.2m_In0.1m (Phase 1)*	*Pump out 500 ML/d from Policeman Pt when water levels in CSL > 0.2m, and in when water levels in CSL <0.1m*	*Original BMT*
	Out500_0.3m_In0.15m (Phase 1)	*Pump out 500 ML/d from Policeman Pt when water levels in CSL > 0.3m, and in when water levels in CSL <0.15m*	*Original BMT*
	Out250_0.3m_In0.15m (Phase 1)	*Pump out 250 ML/d from Policeman Pt when water levels in CSL > 0.3m, and in when water levels in CSL <0.15m*	*Original BMT*
	Out350_0.3m_In0.15m	Pump out 350 ML/d from Policeman Pt when water levels in CSL > 0.3m, and in when water levels in CSL <0.15m	Original BMT
	Out350_0.3m_InDeltaN-S	Pump out 350 ML/d from Policeman Pt when water levels in CSL > 0.3m, and in when water levels in CSL < CNL. Note that the modelling had limited functionality to embed this criteria, and as such, a time series of when water levels in CSL< CNL was produced from Basecase results. These conditions occur throughout the entire period of December to April (inclusive).	Original BMT
	Out350_0.3m_In0m	Pump out 350 ML/d from Policeman Pt when water levels in CSL > 0.3m, and in when water levels in CSL <0.0m	Original BMT
	Out350_In25dOut_23d_Seasonal	Pump out 350 ML/d from Policeman Pt from 1 May to 1 Oct; pump 350 ML/d in or out from 1 Dec – 1 May to fluctuate water levels. Note that the model had limited functionality to embed the water level fluctuation criteria, and as such, a time series of pump in/out over this period was developed by determining the volume of water between these levels, and accounting for evaporation. The result is to pump in at 350 ML/d for 25 days, and out 350 ML/d for 23 days.	Original BMT
	Out350_In25d_Out_5d_Seasonal	As above, however with different pumping fluctuation pattern of pumping. Pump out 350 ML/d from Policeman Point from 1 May to 1 Oct; pump in at 350 ML/d for 25 days and out 350 ML/d for 5 days, with 1 day between alternating pumping direction during 1 Dec – 1 May.	Original BMT
Circular location	*In250Rnd_Out250PolPt (Phase 1)*	*Pump in 250 ML/d at Round Is, and out 250 ML/d at Policeman Pt*	*Original BMT*
	In250PolPt_Out250Rnd	Pump in 250 ML/d at Policeman Pt, and out 250 ML/d at Round Is	Original BMT
	In250Parnka+2.5km_Out250Rnd	Pump in 250 ML/d at location 2.5km north of Parnka Point and out 250 ML/d at Round Is	Original BMT
	In250Parnka+0.95km_Out250Rnd	Pump in 250 ML/d at location 950 m north of Parnka Point and out 250 ML/d at Round Is	Original BMT
	In250_42MileX_Out250Rnd	Pump in 250 ML/d at Forty Two Mile Crossing and out 250 ML/d at Round Is	Original BMT
	Out250_42MileX_In250Rnd	Pump in 250 ML/d at Round Is and out 250 ML/d at 42 Mile Crossing	Original BMT

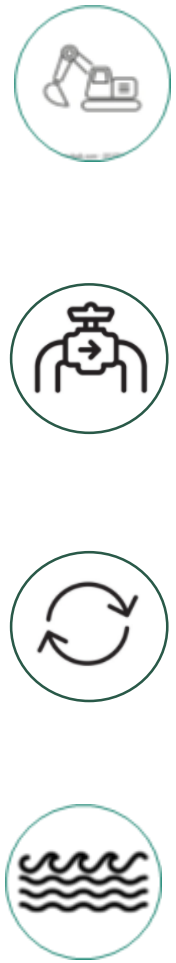
35 x 3 year scenarios testing:

- Pump out with water level trigger
- Pump out & dredge
- Pump in/out (one location)
- Pumping – circulation
- Passive connection – CSL and ocean

	Out250Parnka+0.95km_In250Rnd	Pump in 250 ML/d at Round Is and out 250 ML/d at 950 m north of Parnka Point	Original BMT
	Out350Parnka_In350WdsWell	Pump in 350 ML/d at Woods Well and out 350 ML/d at Parnka Point	High-Res
	Out350Parnka+1.5km_In350WdsWell	Pump in 350 ML/d at Woods Well and out 350 ML/d at 1.5km north Parnka Point	High-res
Passive connection	*Pipe2000x10 (Phase 1)*	*10 pipes of nominal 2m diameter from CSL (Policeman Pt) to Southern ocean*	*Original BMT*
	Pipe2000x15	15 pipes of nominal 2m diameter from CSL (Policeman Pt) to Southern ocean	Original BMT
	Pipe2000x10_IN	10 pipes of nominal 2m diameter from CSL (Policeman Pt) to Southern ocean, with valves to allow only sea water flow into CSL	Original BMT
	Pipe2000x10_OUT	10 pipes of nominal 2m diameter from CSL (Policeman Pt) to Southern ocean, with valves to allow only CSL water to southern ocean	Original BMT

Options adopted for long term simulations

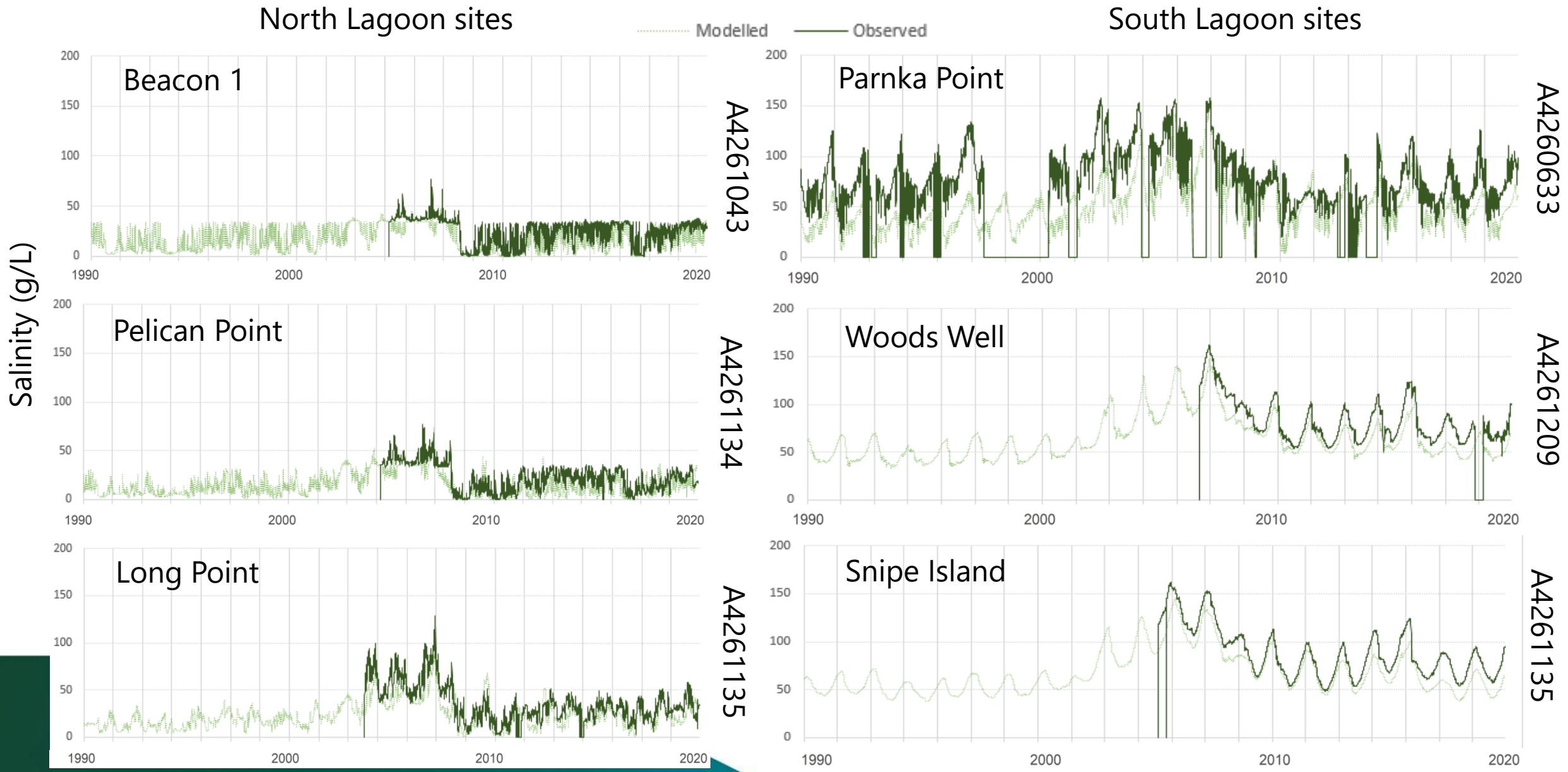
- Pumping water out of the CSL combined with dredging;
- Pumping water out of the CSL with water level triggers to minimise impacts on CSL water levels;
- Pumping water in and out from one location (i.e. pumping only one direction at a time);
- Circulation pumping, i.e. pumping water out from one location, while pumping water in at a second location;
- A passive connection between the CSL and southern ocean.



30 year coarse model scenarios

- Base case & 10 infrastructure scenarios
- Historical, current & climate change conditions

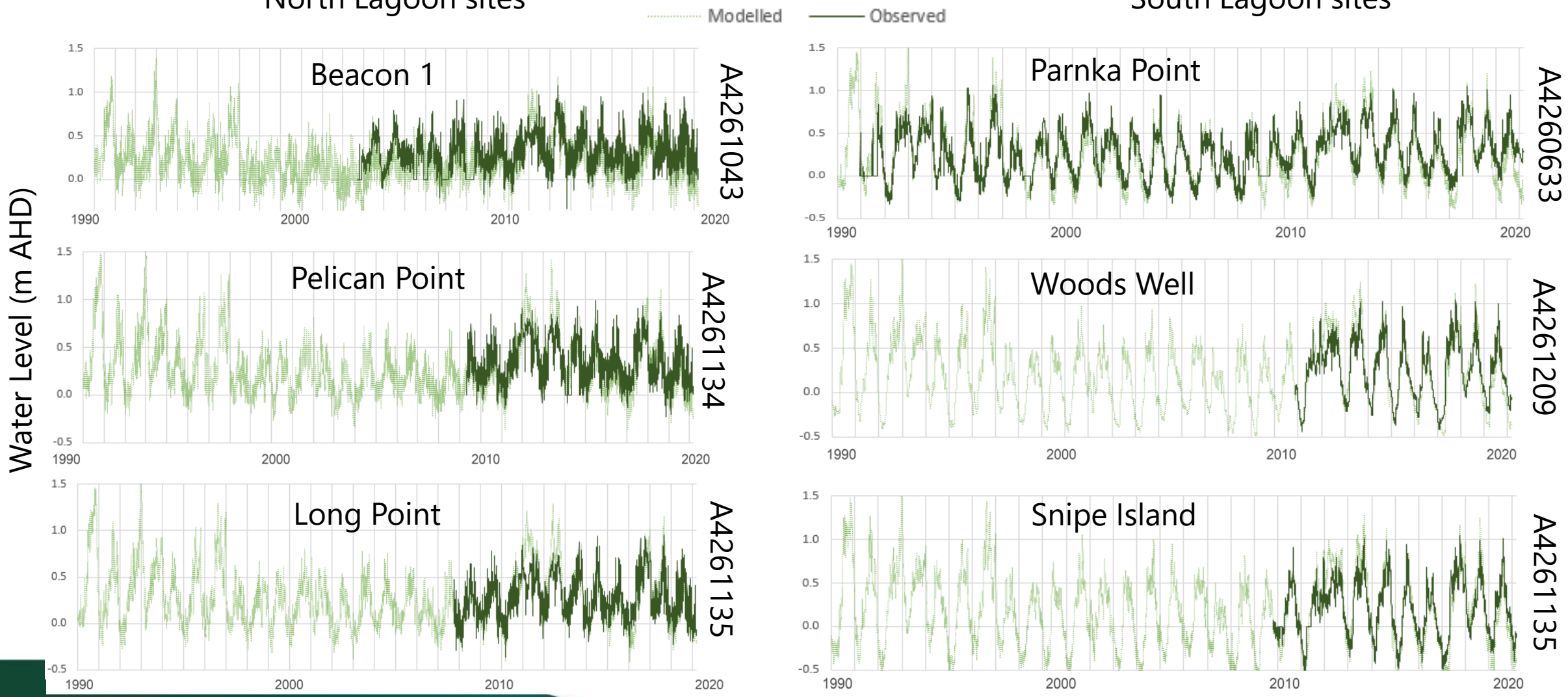
Coarse Model Confidence – salinity



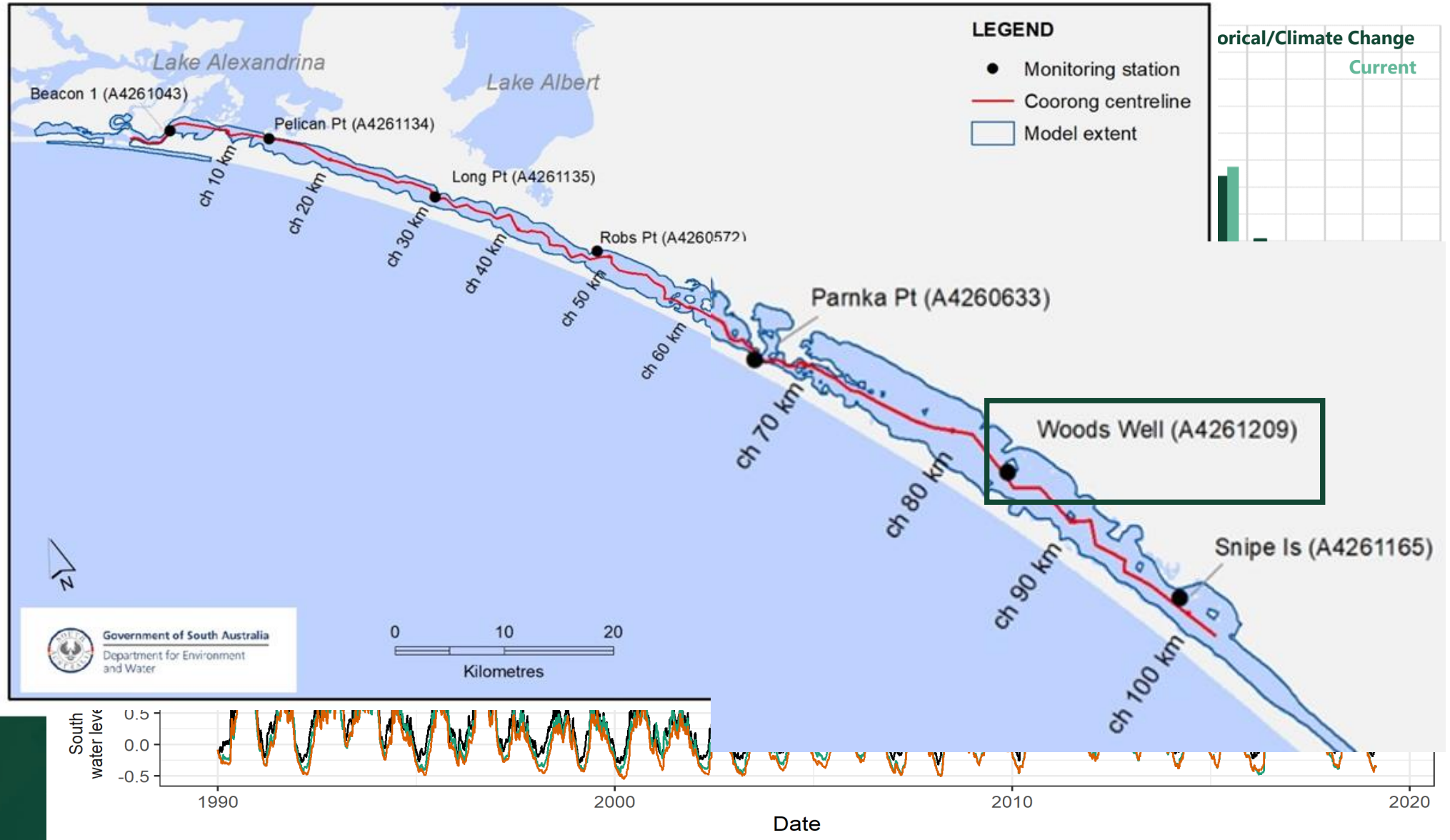
Coarse Model Confidence – water level

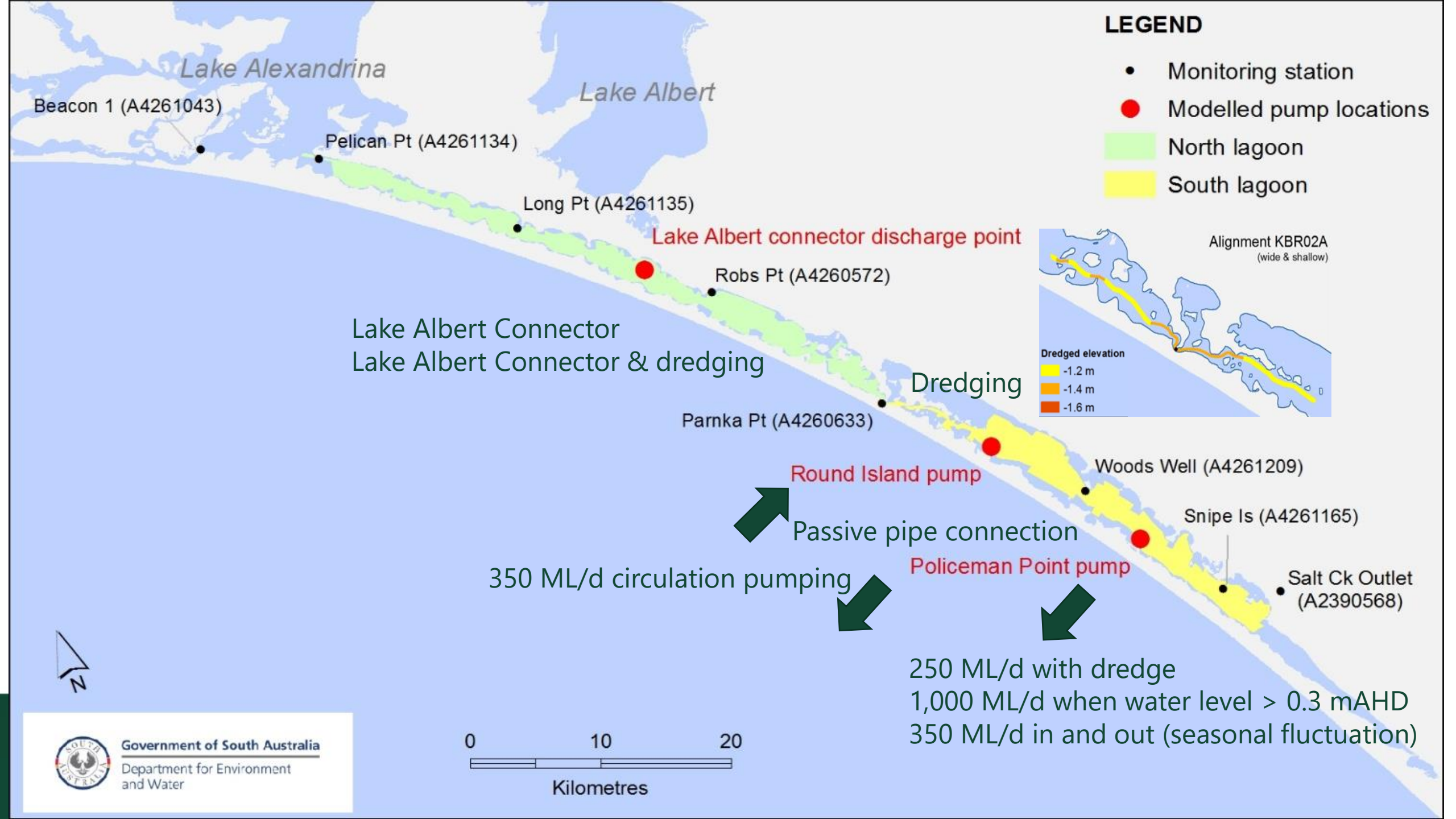
North Lagoon sites

South Lagoon sites

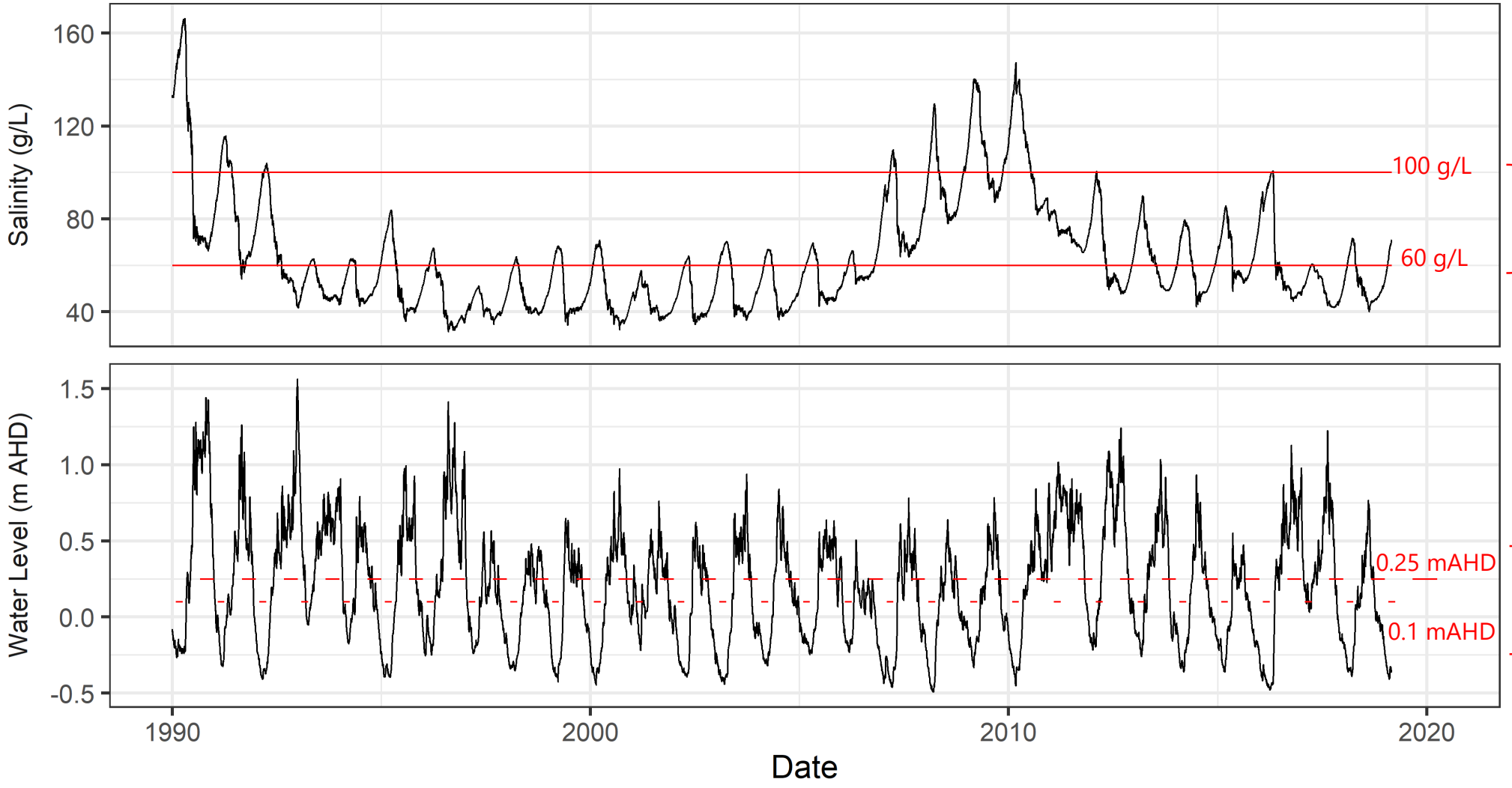


Modelling boundary conditions & outputs




LEGEND
Monitoring station
Modelled pump locations
North lagoon
South lagoon
Lake Alexandrina
Lake Albert
Beacon 1 (A4261043)
Pelican Pt (A4261134)
Long Pt (A4261135)
Lake Albert connector discharge point
Robs Pt (A4260572)
Lake Albert Connector
Lake Albert Connector & dredging
Dredging
Parnka Pt (A4260633)
Round Island pump
Passive pipe connection
350 ML/d circulation pumping
Policeman Point pump
Woods Well (A4261209)
Snipe Is (A4261165)
Salt Ck Outlet (A2390568)
250 ML/d with dredge
1,000 ML/d when water level > 0.3 mAHD
350 ML/d in and out (seasonal fluctuation)
Alignment KBR02A
(wide & shallow)
Dredged elevation
-1.2 m
-1.4 m
-1.6 m
N
0
10
20
Kilometres
Government of South Australia
Department for Environment and Water

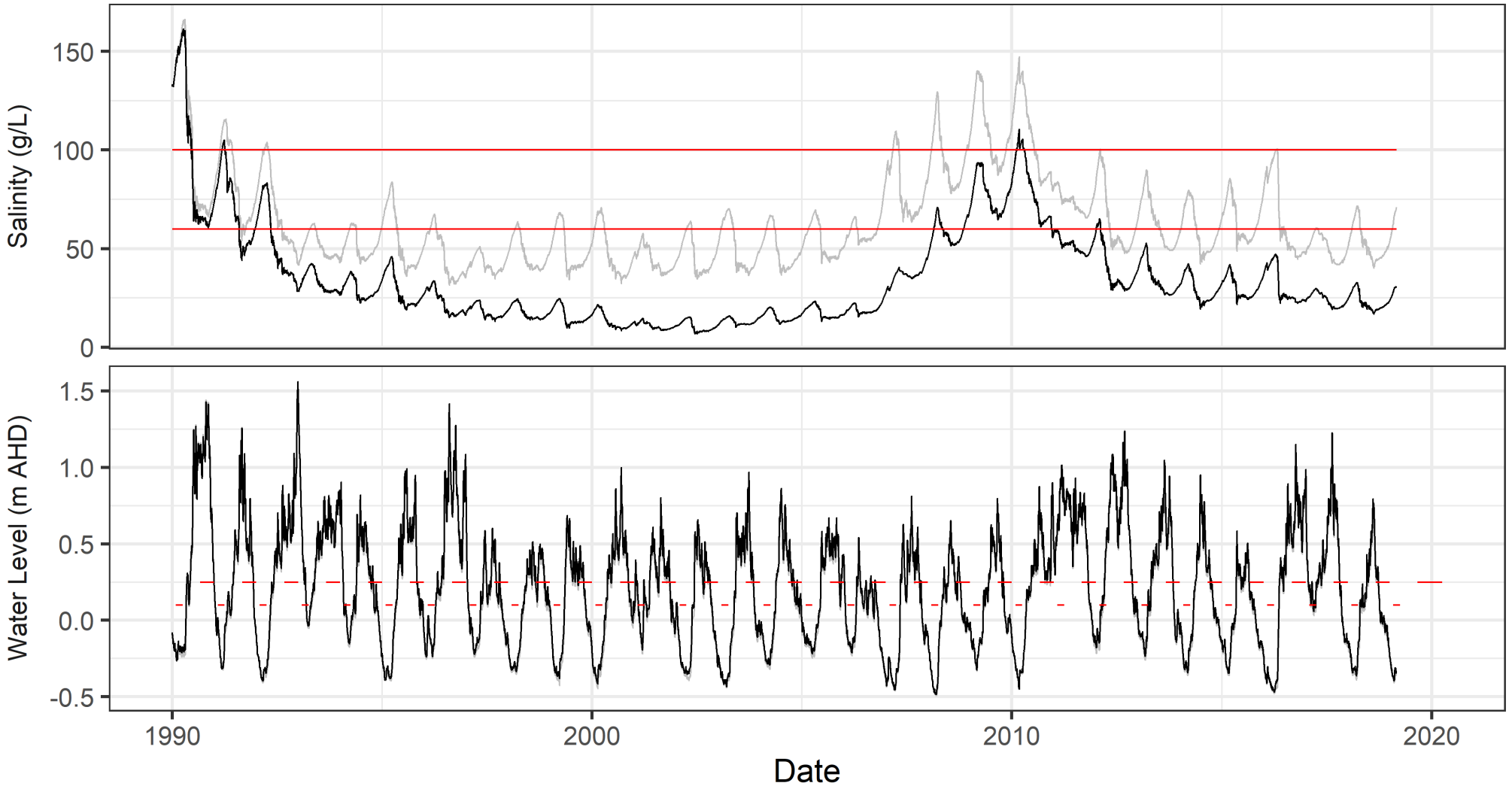
Base case



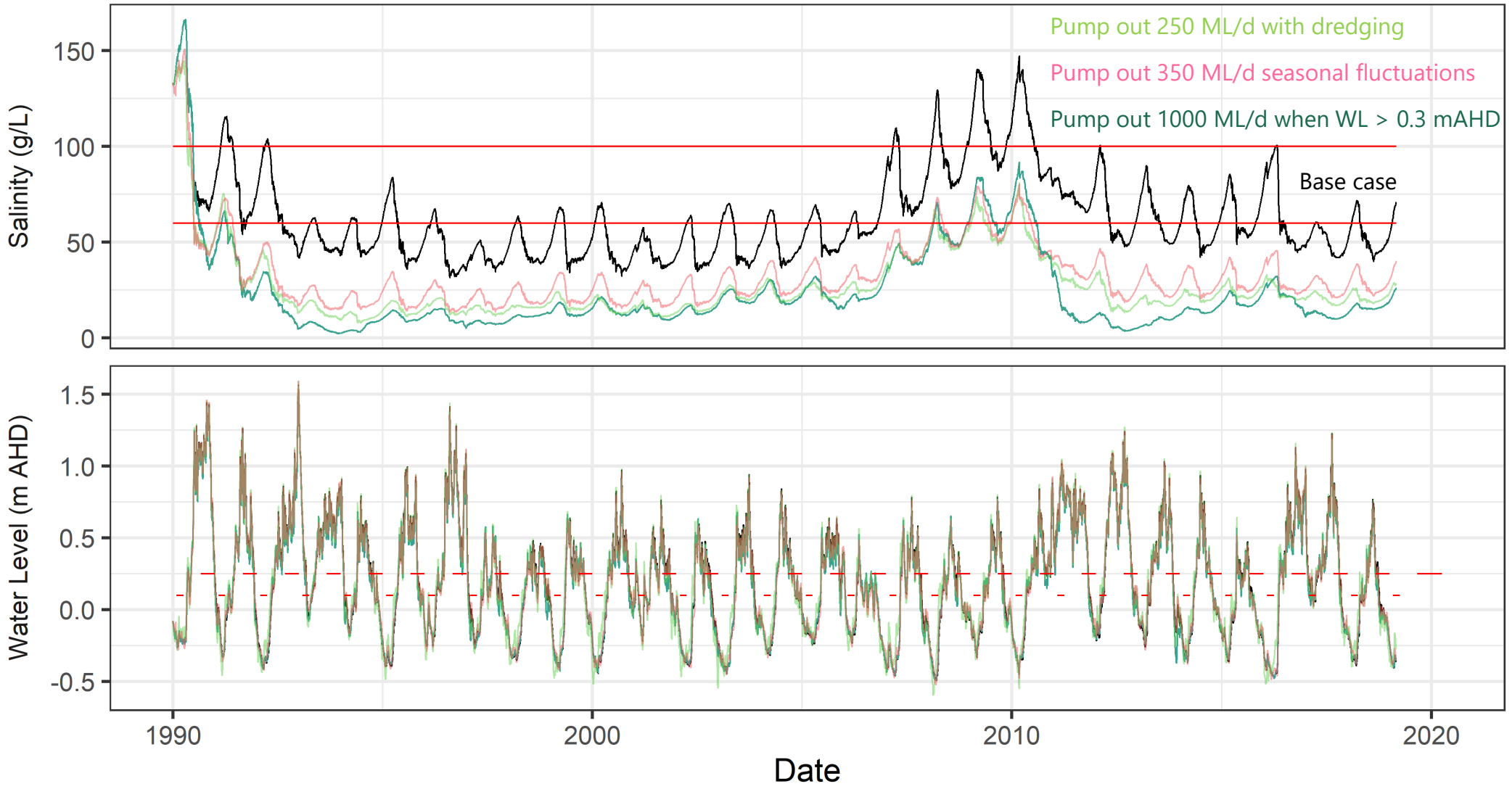
Ramsar Management Plan ecological targets

Critical water levels for Ruppia reproduction & waterbird foraging habitat availability

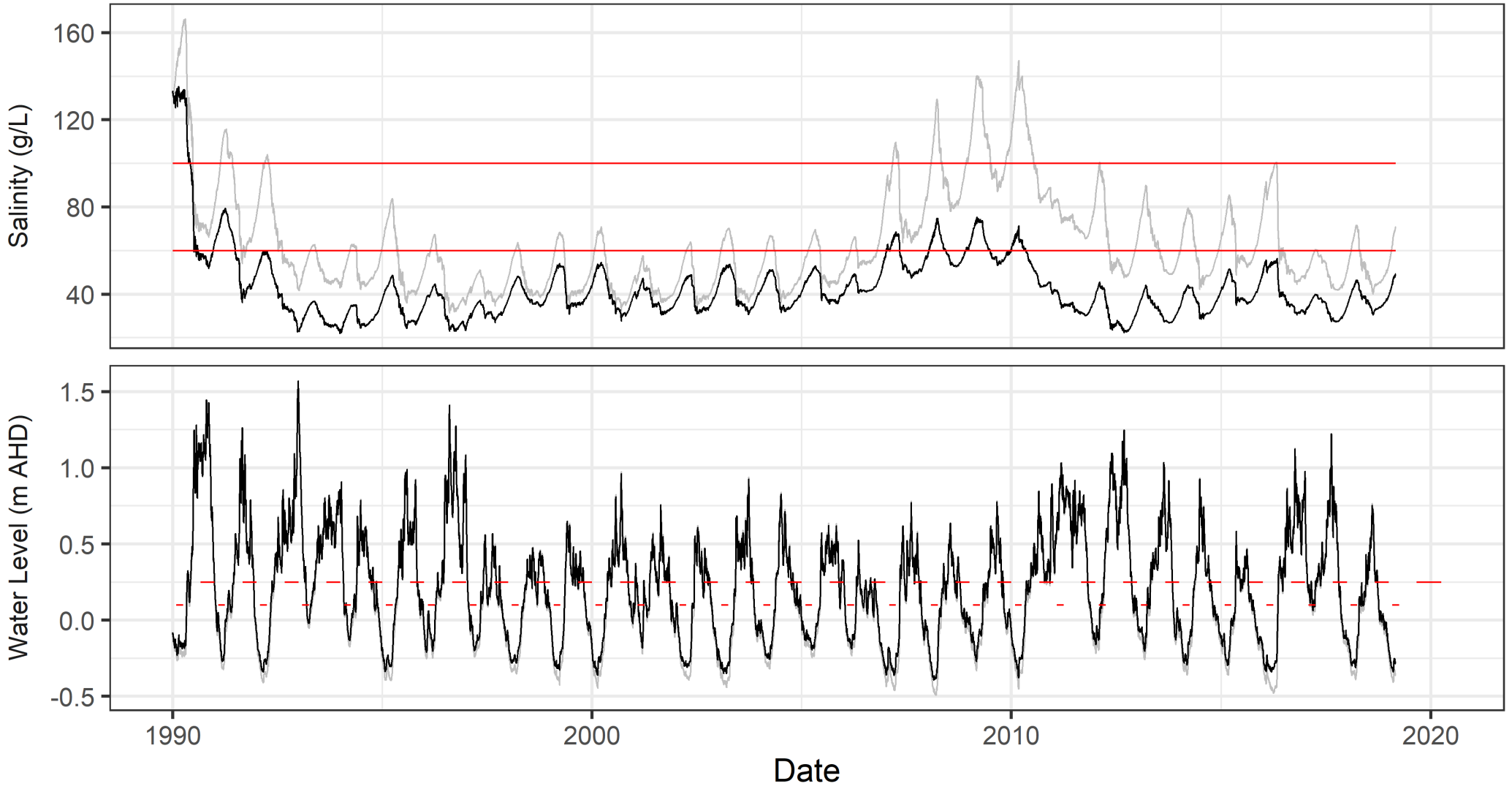
Lake Albert Connector



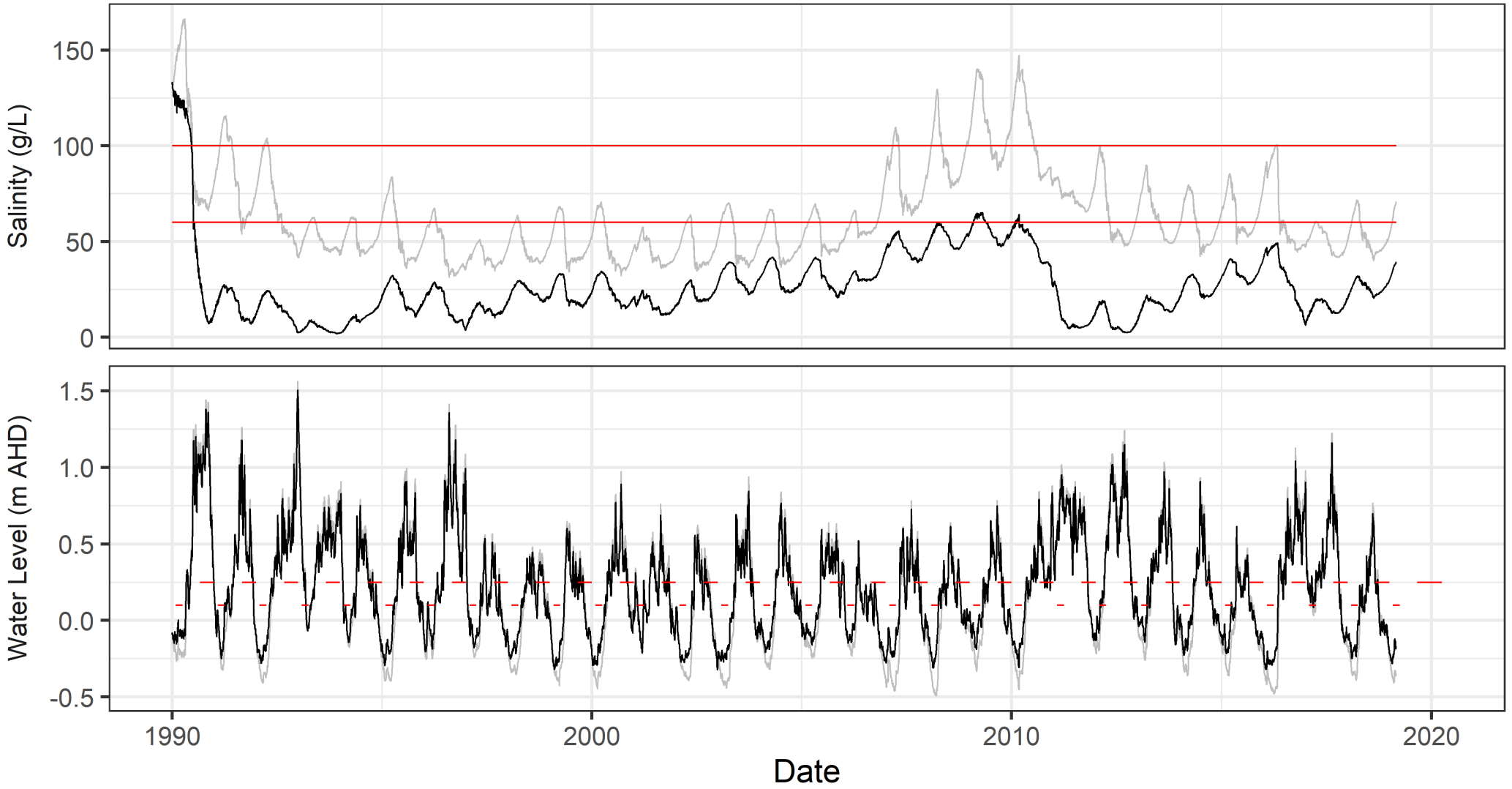
Pumping out scenarios



Pump out 350 ML/d Parnka South & in 350 ML/d PolicemanPt



10 x 2m diameter passive pipes connecting CSL to ocean



Summary

- Two model resolutions used for scenarios
  - 3 year high resolution - approx. 50,000 nodes 50 m apart
  - 30 year coarse resolution - approx. 2,200 nodes 300 m apart

- Both models perform very well against observed data
  - Particularly for hydrodynamics
  - Focused on Coorong South Lagoon

- Large number of scenarios undertaken to refine and optimise infrastructure options
  - Most promising also with water quality and ecological habitat

- Provide basis for ecological risk assessment

The South Australian Government's
Healthy Coorong, Healthy Basin Program
is jointly funded by the Australian and
South Australian governments.

Australian Government

Government of
South Australia