Economic Development, Jobs, Transport and Resources

Improving flow on border-check irrigation bays

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AGRICULTURE VICTORIA

Irrigation flow rate

Are there water savings in practice?

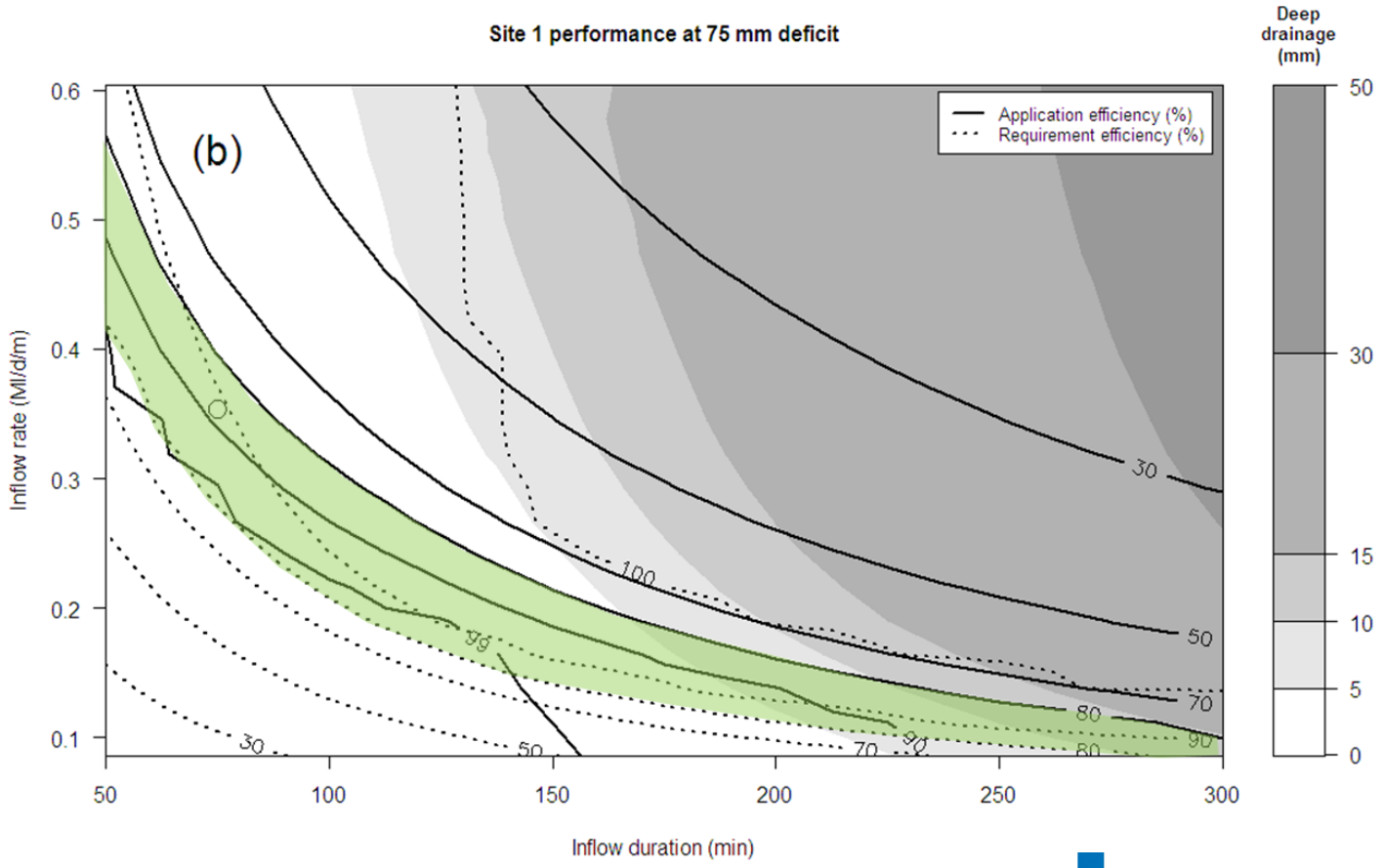
A range of GMID farms, soils and crops

No evidence of water savings

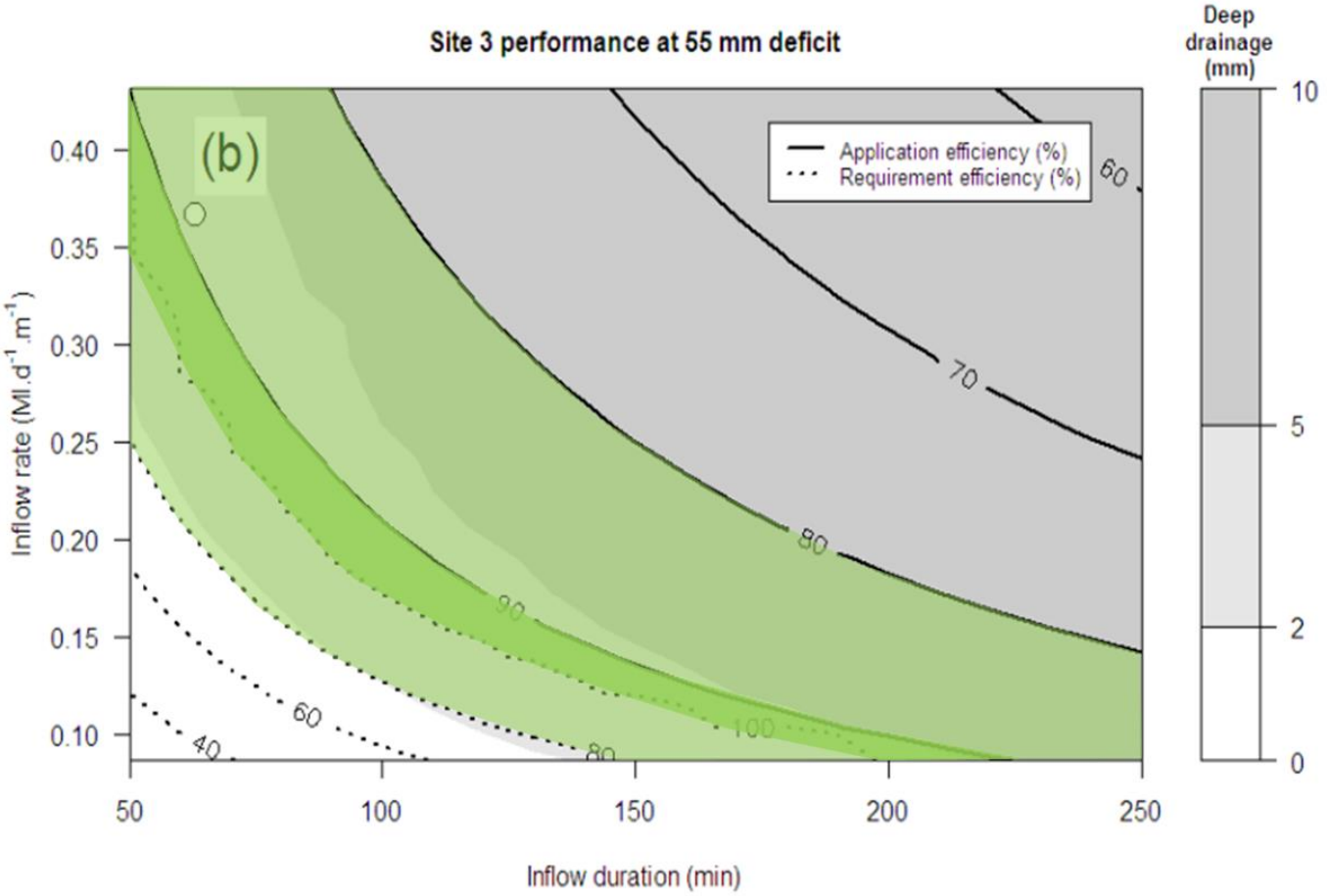
Site	Location	Soil Group	Soil type	Crop	Number of bays	Flow rate (ML/d/m)	Irrigations
1	Kyabram	3	Lemnos loam	Perennial pasture	2	0.08-0.11 0.12-0.16	10 10
2	Katunga	2	Cobram loam	Lucerne	2	0.16 0.36	11 11
3	Strathmerton	3	Moira loam	Perennial pasture	2	0.17 0.33	14 14
4	Waaia	3	Moira loam	Annual pasture	2	0.89 1.06	2 2
5	Katunga	2	Moira loam friable phase	Annual pasture	2	0.08-0.21 0.31	4 3
				Pre-emergence	2	0.28 0.30	1 1
6	Byrneside	2	Shepparton fine sandy loam	Annual pasture	2	0.37-0.61 0.41-0.50	3 3
7	Mooroopna	2	Shepparton fine sandy loam	Perennial pasture	2	0.10-0.17 0.29-0.30	4 4
8	Harston	3	Lemnos loam	Lucerne	2	0.14-0.16 0.14-0.26	2 3
				Pre-emergence	2	0.12 0.22	1 1

Are there water savings in theory?

Lucerne on a Group 2 soil



Perennial pasture on a Group 3 soil



Ponding duration

- Is dependant on surface drainage processes
- Is strongly influenced by bay surface topography

The issue

Long and spatially variable duration of surface ponding

- Plant stress
- Reduced productivity
- Imprecision

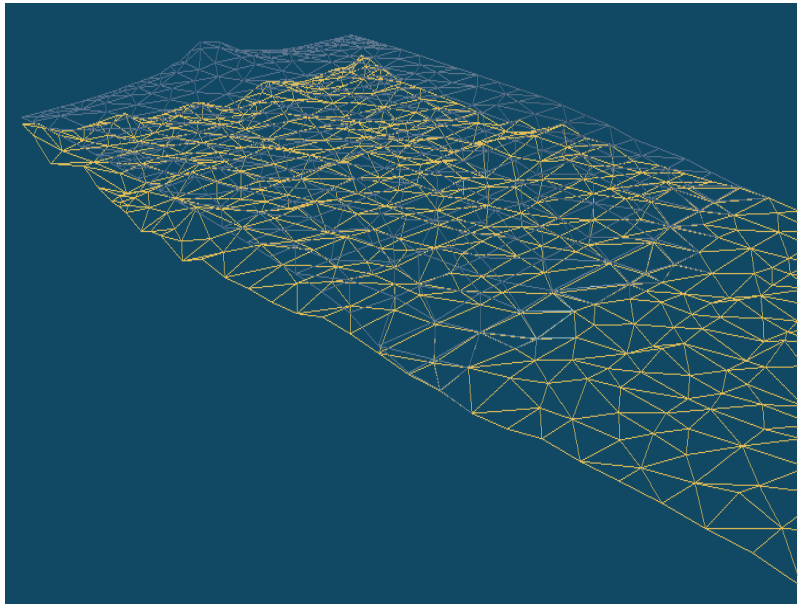
WUE (t DM/ha/ML)			
Ponding duration (h)	Irrigation frequency (mm ET_c-R)		
	50	80	120
4	2.4	1.6	1.3
12	1.5	1.5	1.3
24	1.6	1.1	1.1

Dunbabin, J.S., Hume, I.H., Ireson, M.E., 1997. Effects of irrigation frequency and transient waterlogging on the production of a perennial ryegrass–white clover pasture. Australian Journal of Experimental Agriculture 37, 165–171.

ANUGA adapted for surface irrigation

The ANUGA model:

- represents irregular surfaces with a triangular mesh
- propagates water depth and momentum through the mesh
- can simulate wetting and drying of the surface



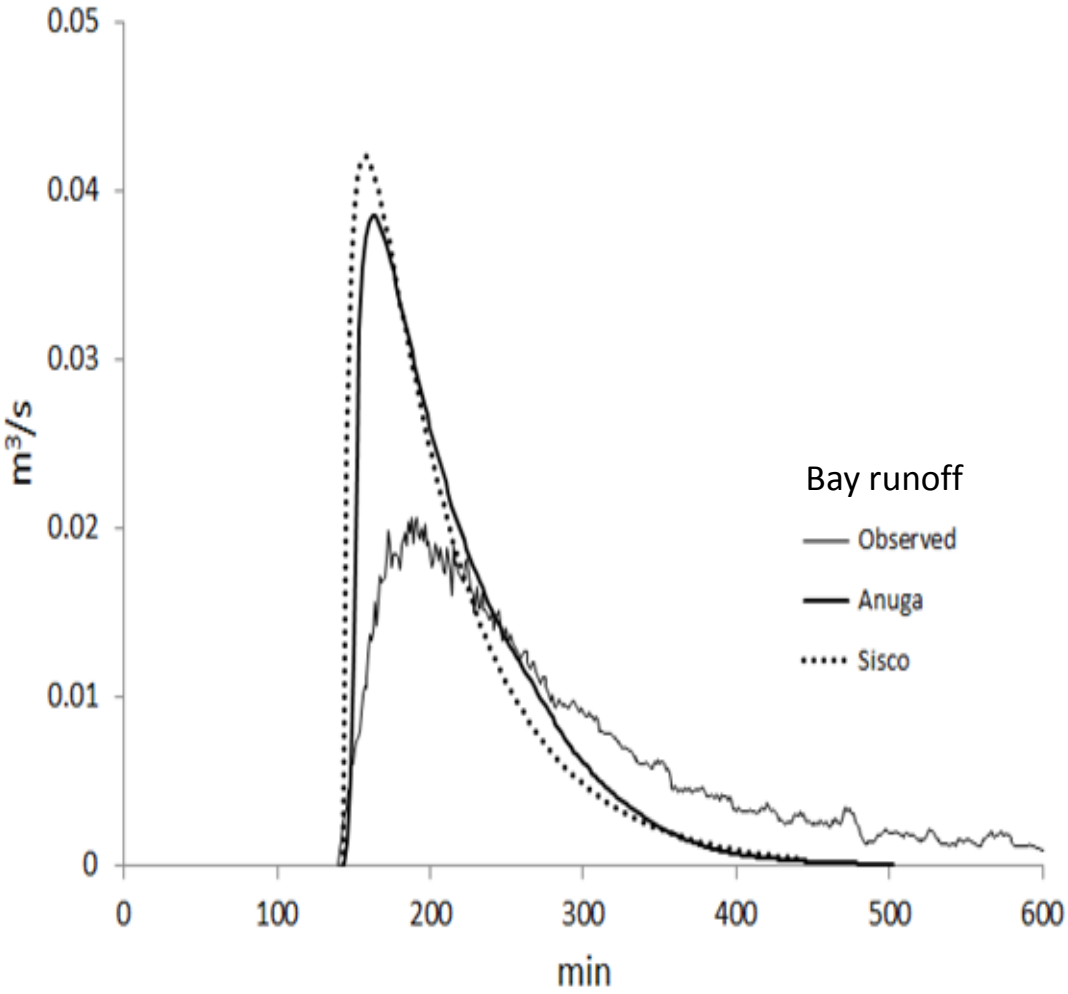
Our most important modification to ANUGA was implementation of an infiltration operator, based on the empirical Kostiakov-Lewis equation.

Model calibration

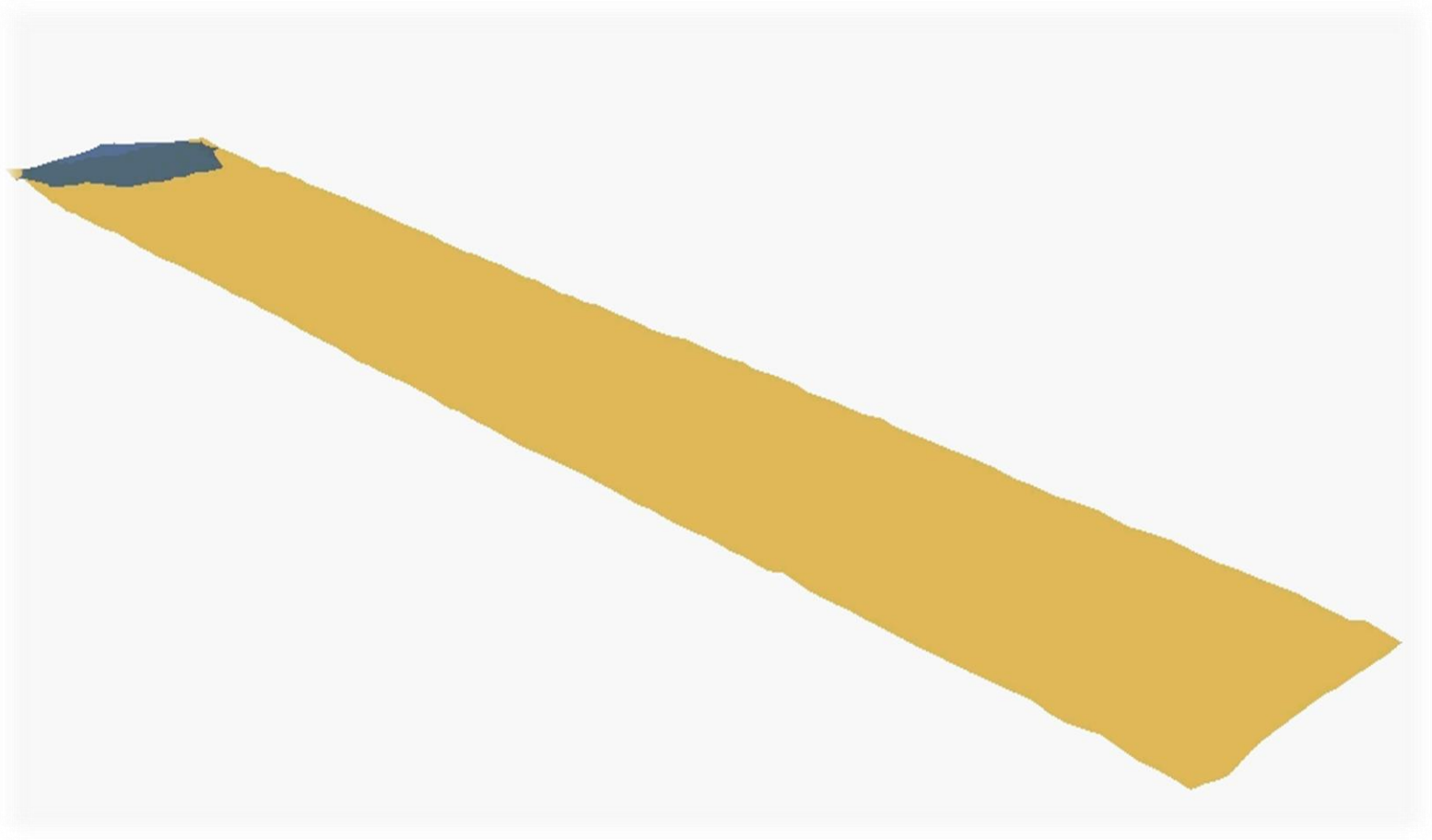
Comparisons of ANUGA against observed data from both unmodified and modified bay surfaces

Conclusions

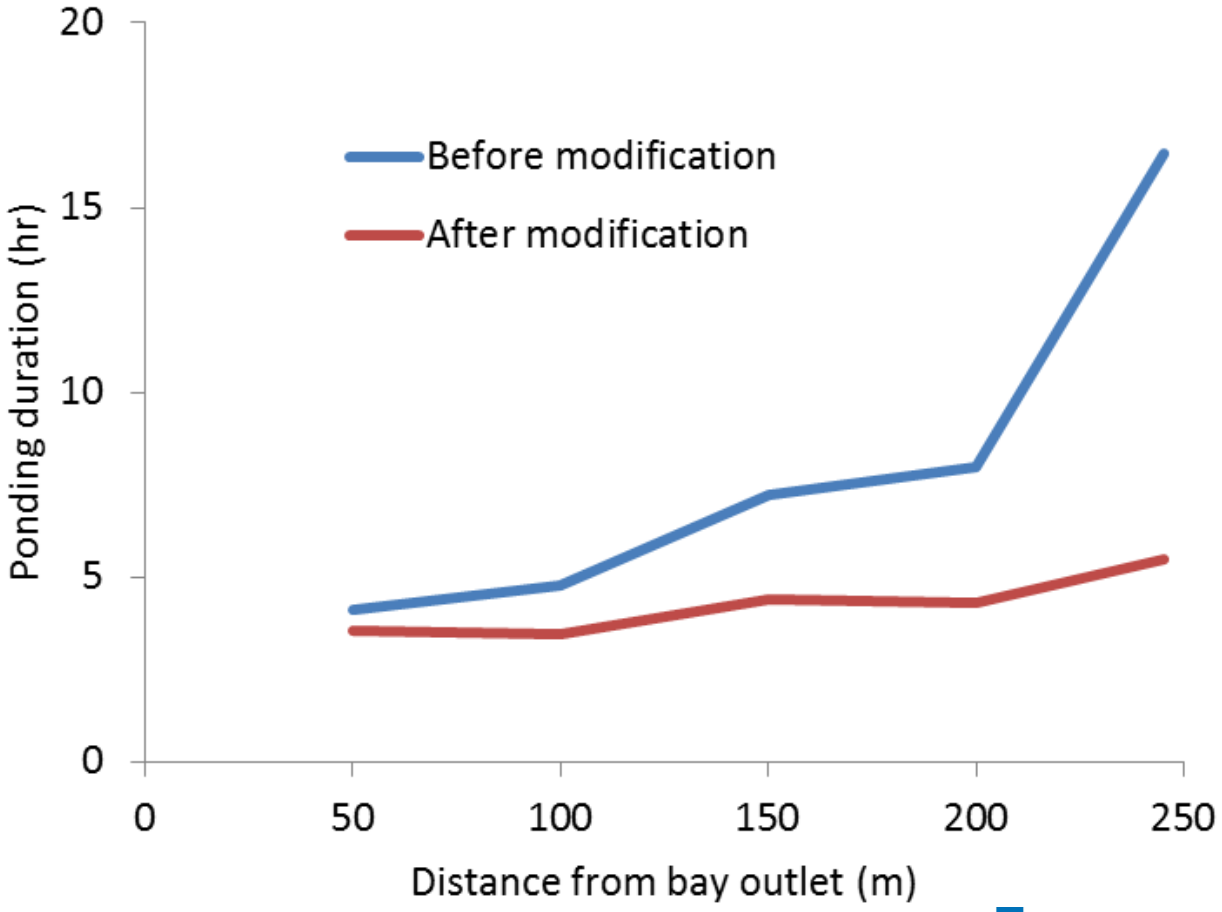
- Satisfactory performance
- Suitable for ranking bay surface designs



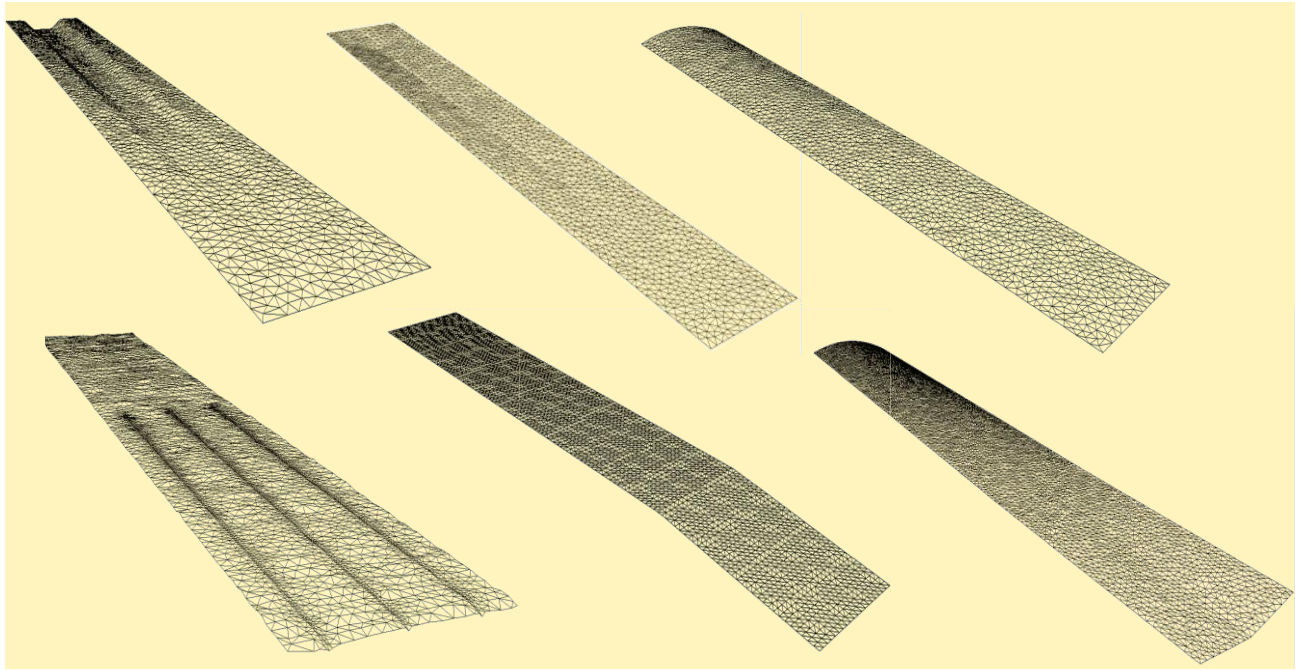
Example ANUGA output



Surface water ponding duration with bay surface modification



Bay surface design examples

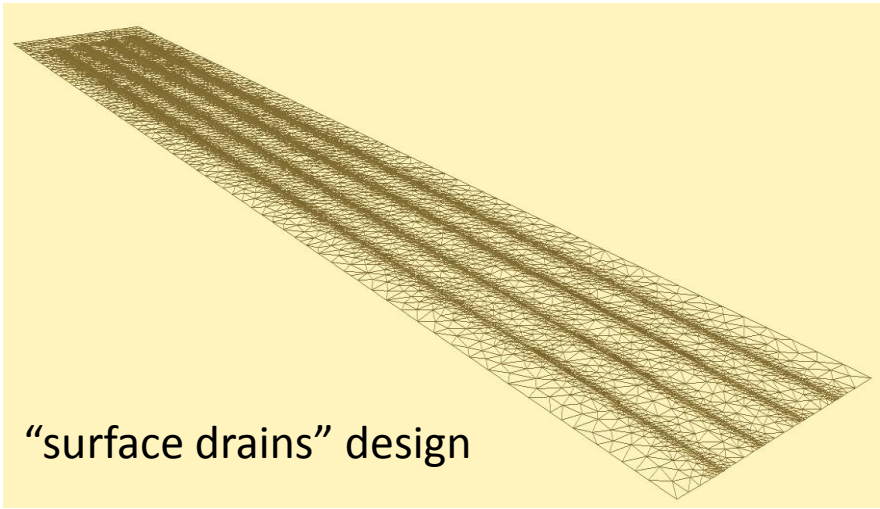


Criteria

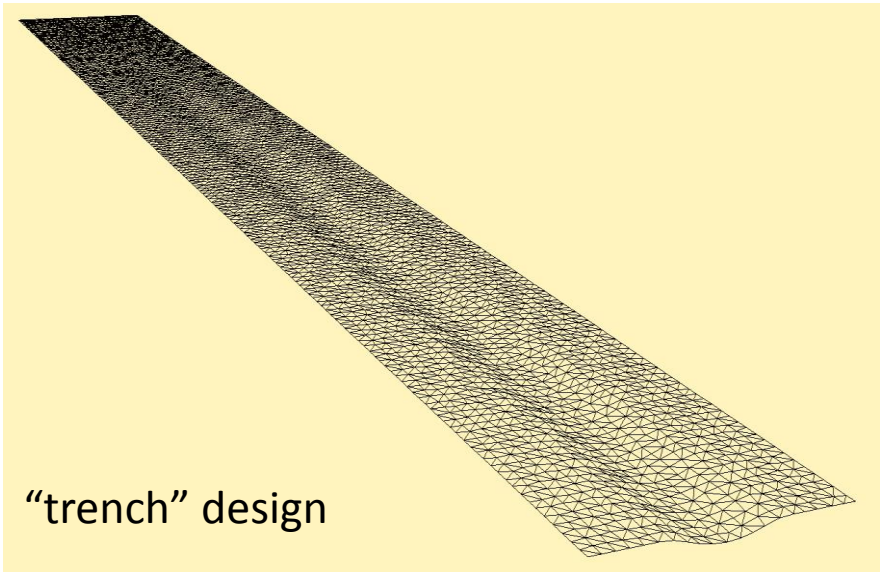
- Each surface was constrained to channel outlet and drain elevations
- Cut and fill volumes must balance

Conclusions

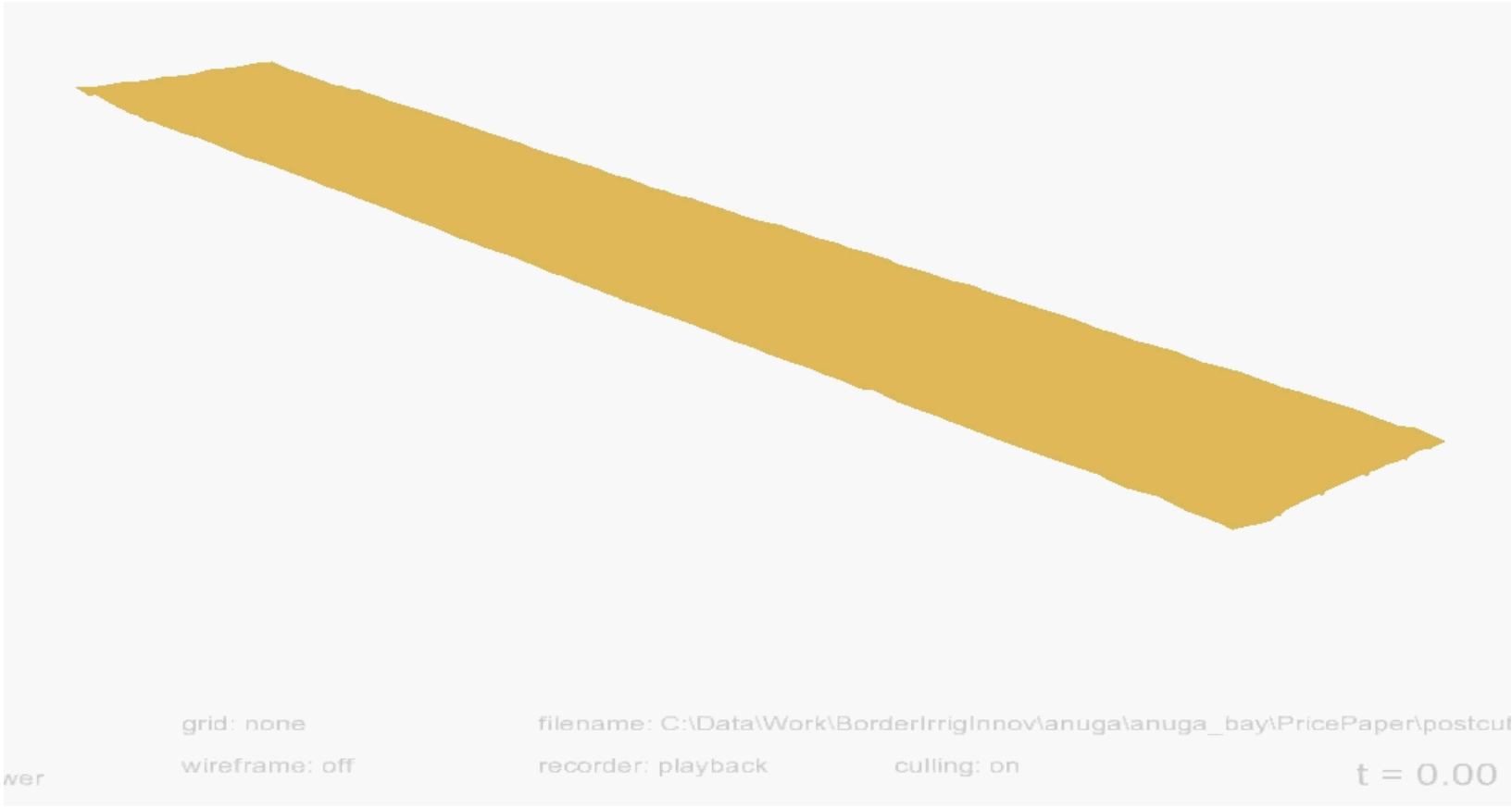
Shallow surface drains consistently outperformed other bay designs



The “trench” design improved on the unmodified bay without requiring shallow surface drains



A bay with surface drains



Next steps

- The important thing is whether modified bay surfaces can improve production per ML
- Establishment of field experiments to test bay modifications is now under way