



# Constraints Management Strategy

## Costs and benefits for private agricultural land

Goulburn River

**GHD** | Joe Lane

January 2016



# Agenda items

1. Introduction
2. Location
  - Sub-reaches
3. Model use
  - Inundation
  - Properties affected
4. Methodology and impacts overview
5. Costing and mitigation assumptions
6. Other

# Location of Upper and Mid Goulburn



# **Sub-reaches along the Goulburn River**

## **Pre-feasibility**

- A – Eildon to Alexandra
- B – Alexandra to Ghin Ghin
- C – Ghin Ghin to Kerrisdale
- D – Kerrisdale to Mitchellstown
- E – Mitchellstown to Wahring
- F – Wahring to Kialla
- G – Kialla to Bunbartha
- H – Bunbartha to Murray River

## **Feasibility**

- Mid Goulburn – Eildon to Killingworth (A and B)
- Mid Goulburn – Killingworth to Goulburn Weir (C, D, E)
- Lower Goulburn – Downstream of Goulburn Weir (F, G, H)

## Flow rates investigated

A & B	C, D & E
12,500 ML/day	25,000 ML/day
15,000 ML/day	30,000 ML/day
17,500 ML/day	35,000 ML/day

# Inundation - modelling

Bank full flows to 15,000 ML/day

Land use	Sub-reach A (ha)	Sub-reach B (ha)
Grazing tolerant pasture	145	354
Grazing vulnerable pasture	127	371
Cropping & horticulture	0	0
Agricultural land affected	<b>272</b>	<b>725</b>

Bank full flows to 35,000 ML/day

Land use	Sub-reach C (ha)	Sub-reach D (ha)	Sub-reach E (ha)
Grazing tolerant pasture	284	529	668
Grazing vulnerable pasture	131	430	94
Cropping & horticulture	0	0	5
Agricultural land affected	<b>415</b>	<b>959</b>	<b>767</b>

# Affected properties

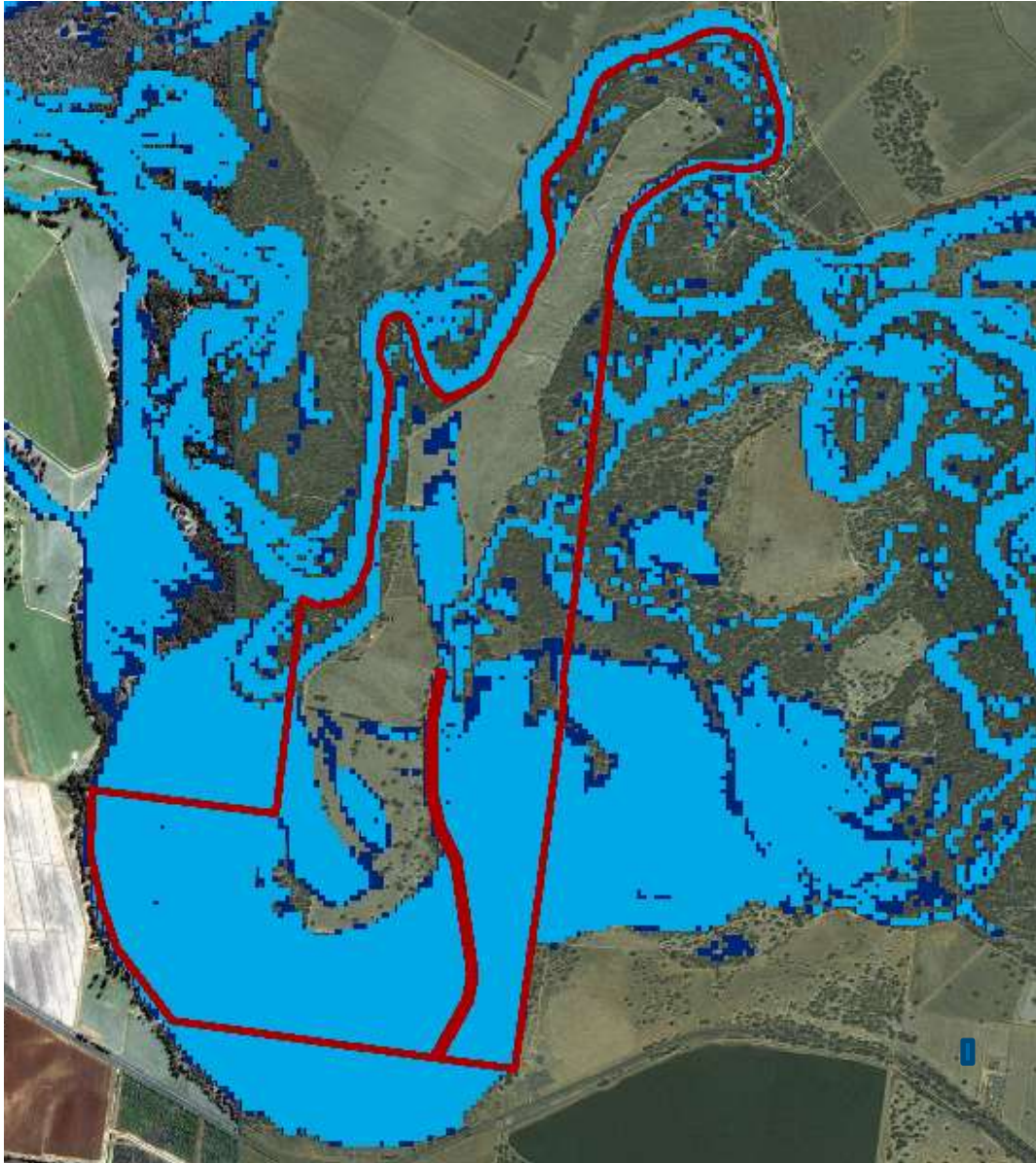
**15,000 ML/day for A & B**

**35,000 ML/day for C, D & E**

Area of inundation on property	A	B	C	D	E
Less than 1 ha	13	19	10	15	40
1 ha to 10 ha	25	28	11	37	23
10 ha to 50 ha	5	21	20	17	10
50 ha to 100 ha	1	1	1	4	1
100 to 200 ha	0	1	0	1	0
> 200 ha	0	0	0	0	1
<b>Total</b>	<b>44</b>	<b>70</b>	<b>42</b>	<b>74</b>	<b>75</b>



# Modelled flow





# **Impacts overview**

## **Inundation**

- **Pasture and crop yields**
- **Fence damage**
- **Weeds – gum suckers, lippia**
- **Infrastructure**
- **Farm management**

## **Interrupted access**

# Fence damage





# Drop-down fence



# Red gum suckers





# Lippia





# Lift pumps?





# Raise tank height?





# Interrupted access



# Interrupted access





# Methodology

1. Establishing indicative gross margins (GM/ha) under current flow regime for each type of land use
2. Establish GMs under changed flow regime
3. Determine the degree of affectation on GM (ie percentage change in GM)
4. Apply to agricultural land worth
5. Add other costs – eg erosion etc.

**Assumption** – there is a direct correlation between GM/ha and agricultural land.

**Example:** GM \$25/DSE, Stocking rate 12 DSE/ha: GM = \$300/ha

Agricultural land worth: \$5,500/ha (\$2,226/ac)

Degree of affectation on GM: 50%

Cost impact of proposed flows:  $50\% \times \$5,500/\text{ha} = \$2,750/\text{ha}$

# Change in frequency, timing, duration

For all reaches and flow levels assume three extra flood events that exceed 7 days in every ten year period relative to the pre-Basin plan flood scenario.

	Duration $\geq 1$ day & $\leq 7$ days			Duration $> 7$ days		
	Jun-Jul	Aug-Sep	Oct-Nov	Jun-Jul	Aug-Sep	Oct-Nov
	0	0	0	0.10	0.10	0.10

# Impact costing assumptions

	Duration	Season	Foregone Grazing (days)	Pasture restoration (\$/ha)	Crop damages (\$/ha)	Clean up and additional management costs (\$/ha)
Inundation	< 7 days	Jun-Jul	30	Nil	\$45 (c) \$2000 (h)	\$40
		Aug-Sept	90	Nil	\$79 (c) \$2500 (h)	\$40
		Oct-Nov	120	\$60 (t)* \$100 (v)	\$114 (c) \$3000 (h)	\$40
	> 7 days	Jun-Jul	30	\$51 (t) \$51 (v)	\$112 (c) \$4000 (h)	\$40
		Aug-Sept	120	\$60 (t) \$210 (v)	\$226 (c) \$4500 (h)	\$40
		Oct-Nov	300	\$70 (t) \$420 (v)	\$250 (c) \$6000 (h)	\$40
Interrupted access	< 7 days	Jun-Jul	7	N/A	\$200 (h)	\$12
		Aug-Sept	7	N/A	\$10 (c) \$250 (h)	\$12
		Oct-Nov	7	N/A	\$19 (c) \$300 (h)	\$12
	> 7 days	Jun-Jul	14	N/A	\$10 (c) \$400 (h)	\$12
		Aug-Sept	14	N/A	\$10 (c) \$450 (h)	\$12
		Oct-Nov	14	N/A	\$38 (c) \$600 (h)	\$12

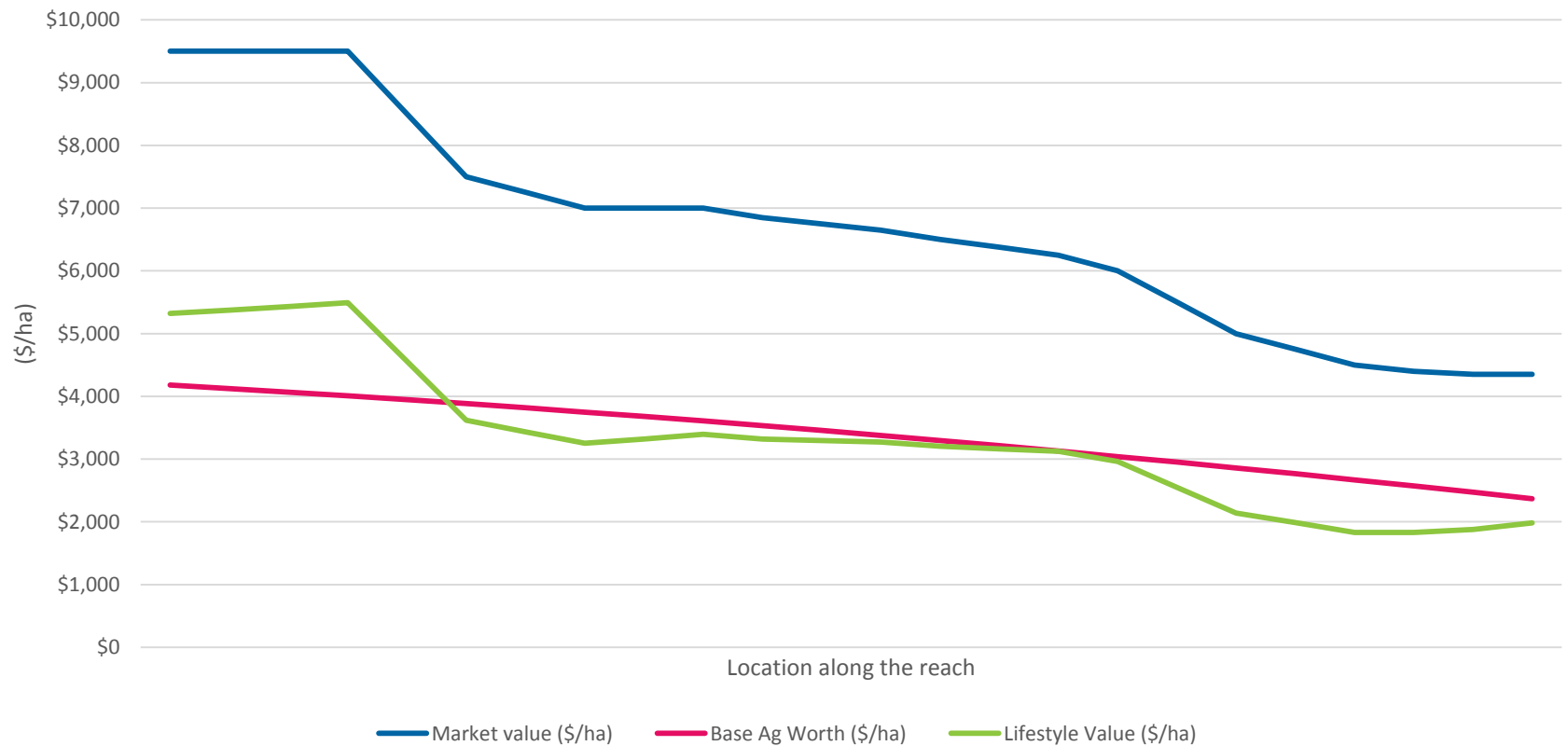


# Land worth

Value of floodplain land is a reflection of a combination of the following factors:

- inherent productive capacity of the land used for its most widely adopted enterprises
- the standard of infrastructure including the homestead, buildings and the livestock handling facilities
- the presence of the river and associated secure water supply
- the availability of water for irrigation including surface and ground water
- proximity to towns and services that provide lifestyle benefits
- the standard of access roads
- the aesthetic appeal of riparian land.

# Agricultural land worth - example



# Agricultural land worth - values

Locality	Sub-reach	Tolerant pasture	Vulnerable pasture	Cropping	Horticulture
Eildon	A	\$5,000	\$5,500	\$5,777	\$6,277
Alexandra	B	\$4,887	\$5,376	\$5,417	\$5,942
Ghin Ghin	C	\$3,875	\$4,263	\$4,998	\$5,498
Kerrisdale	D	\$4,125	\$4,538	\$4,716	\$5,466
Mitchellstown	E	\$3,500	\$3,850	\$4,561	\$5,061
Wahring	F	\$3,313	\$3,644	\$3,967	\$4,467
Kialla	G	\$3,000	\$3,300	\$4,407	\$5,157
Bunbartha/Echuca	H	\$2,000	\$2,200	\$3,661	\$4,161

# Infrastructure cost estimates

Type of infrastructure	Approximate cost
Pump raising	\$5,000
Raising of access tracks (0.2 - 0.5m)	\$20,000
Small farm track culverts (low flow culverts)	\$10,000
Erosion protection works (around culvert/bridge crossings and/or track batter slopes)	\$7,500
Large box culverts (higher flow culverts)	\$20,000
Bridge works (e.g. widening)	\$80,000

# Mitigation options

- Compensation via the purchase of easements
- Construction of or lifting the height of levees to reduce inundation extent
- Construction or upgrading of bridges, crossings and roads/tracks to reduce or eliminate the area of interrupted access
- Erosion protection works (on road surfaces including embankments and around drainage infrastructure)
- Re-siting or raising the height of pumps, pump houses, sheds, silos, yards etc.
- Organising alternative access, for example through a neighbouring property.

# Mitigation costs - calculation

Mitigation activity	Assumptions
Easements over inundated land	Compensate for reduced income from livestock and crops, damage to fences, increase in farm management
Easements over interrupted access land	Compensation as per items above for 50% of the assessed impacts. Remaining 50% mitigated by infrastructure upgrades (see item below)
Upgrades to infrastructure (pumps, bridges, crossings)	For feasibility, infrastructure upgrades assumed to average \$50,000 per property with inundation area >10ha. Assume upgrades will mitigate 50% of the assessed impacts.
Negotiation costs with individual landholders	MDBA/CMA cost
Farm management and legal advice for landholder representative groups	Assume 1 group per 200 landholders
Total cost of mitigation	



# Mitigation cost – examples

**Eildon to Killingworth at 15,000 ML/day, 114 properties**

**Killingworth to Goulburn Weir at 35,000 ML/day, 191 properties**

Mitigation activity	Assumptions	A & B	C, D & E
Easements over inundated land	Compensate for reduced income from livestock and crops, damage to fences, increase in farm management	\$1,784,424	\$3,077,665
Easements over interrupted access land	Compensation as per items above for 50% of the assessed impacts.	\$103,721	\$210,885
Infrastructure (pumps, bridges, crossings)	Assumed to average \$50,000 per property with inundation area >10ha	\$725,000	\$1,375,000
Negotiation costs with individual landholders	\$5,000 assumed for all properties affected by inundation	\$570,000	\$955,000
Farm management and legal advice for landholder representative groups	Assume 1 group	\$32,000	\$32,000
<b>Total cost of mitigation</b>		<b>\$3,215,145</b>	<b>\$5,650,540</b>



**[www.ghd.com](http://www.ghd.com)**