Adaptation to Water Shortage in Western Victoria, Australia

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GWMWater Service Area

Comparison CZ: area 79 000 km^2, 10 mil. people

Characteristics of the Region

Landcape:
- Semi arid

Annual rainfall:
- 300 mm (north)
- 800 mm (south)

Land use:
- Dryland agriculture (grazing, cropping)

Water resources:
- Limited

Groundwater:
- Saline

1890s →

Growing agricultural industry and population

1.

Reservoirs in Grampians (1890s – 1970s)

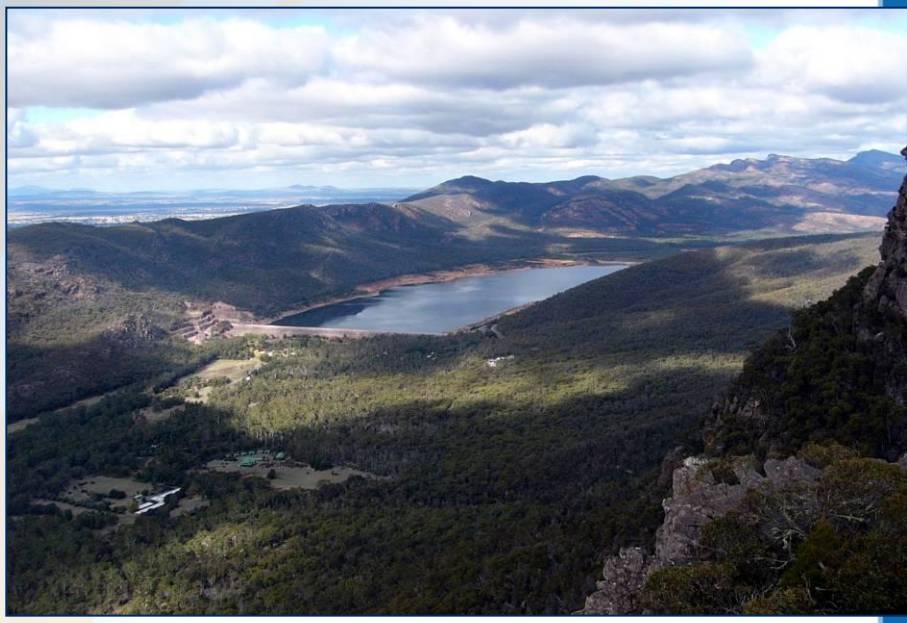
Total capacity 747 mil. m^3

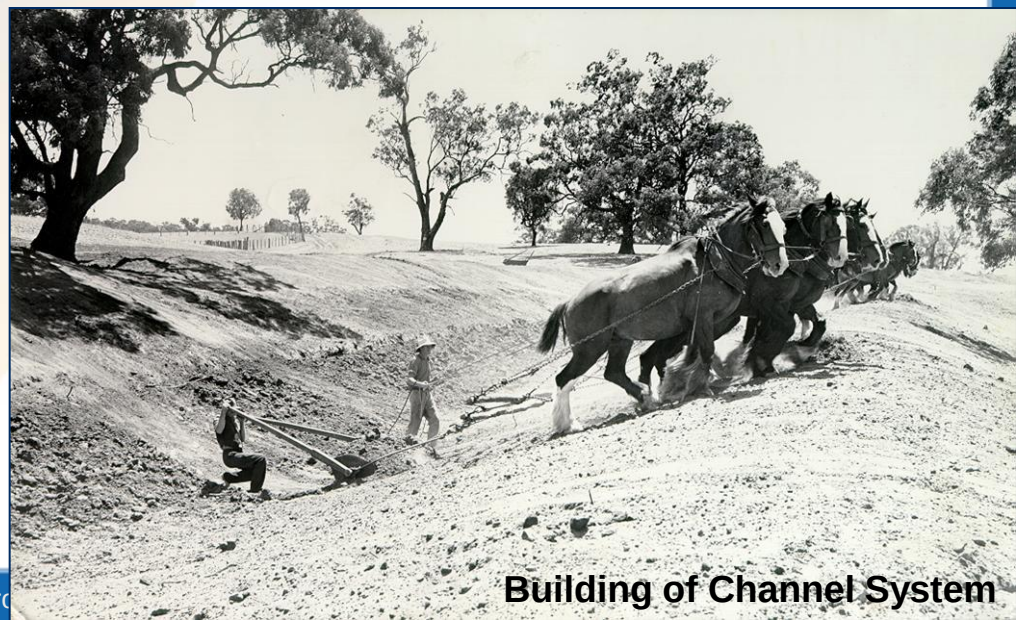
2.

Open earthen gravity channel (1890s – 1940s)

Area of 28 500 km^2

Bellfield Reservoir



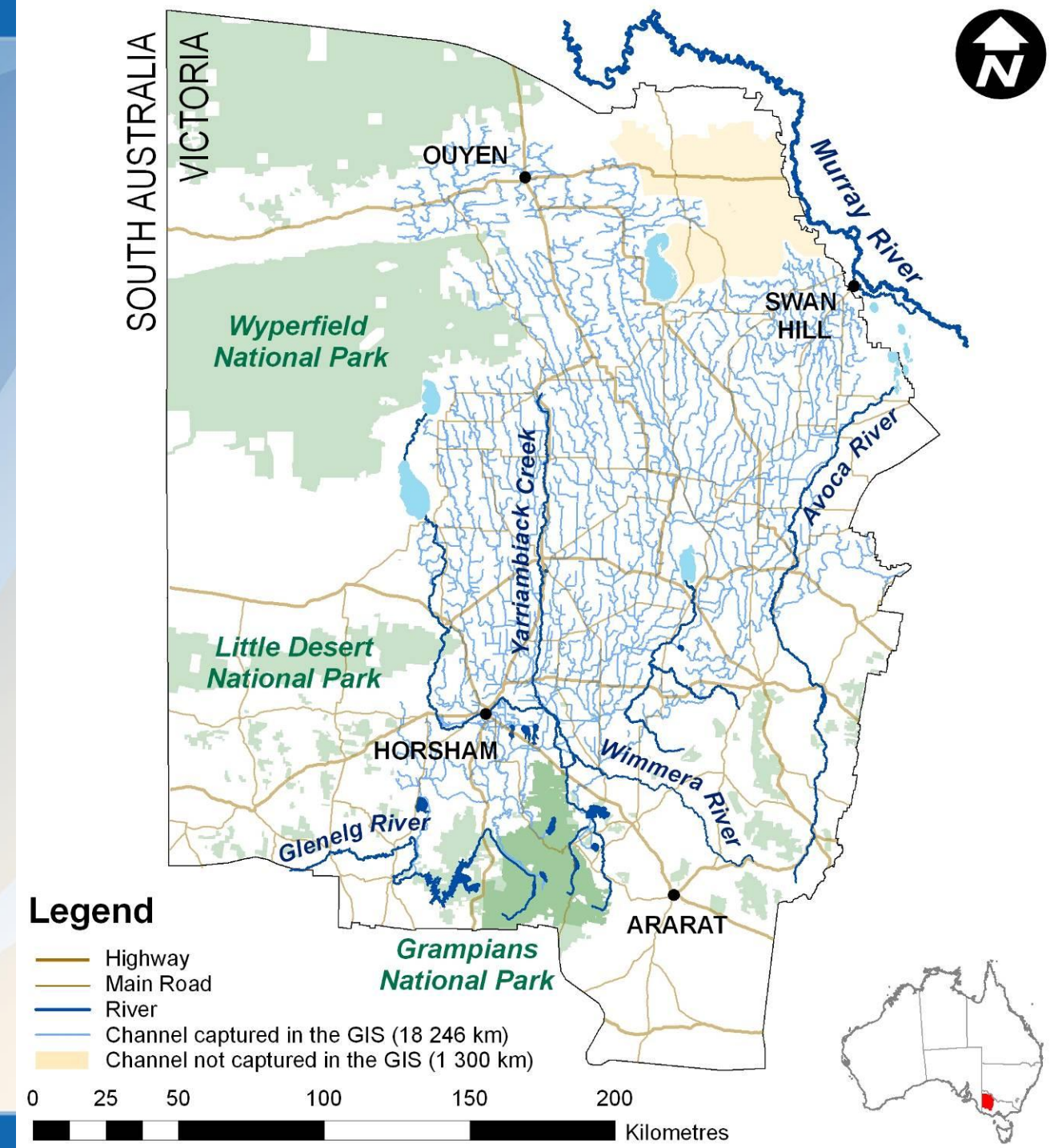


Building of Channel System

Channel System

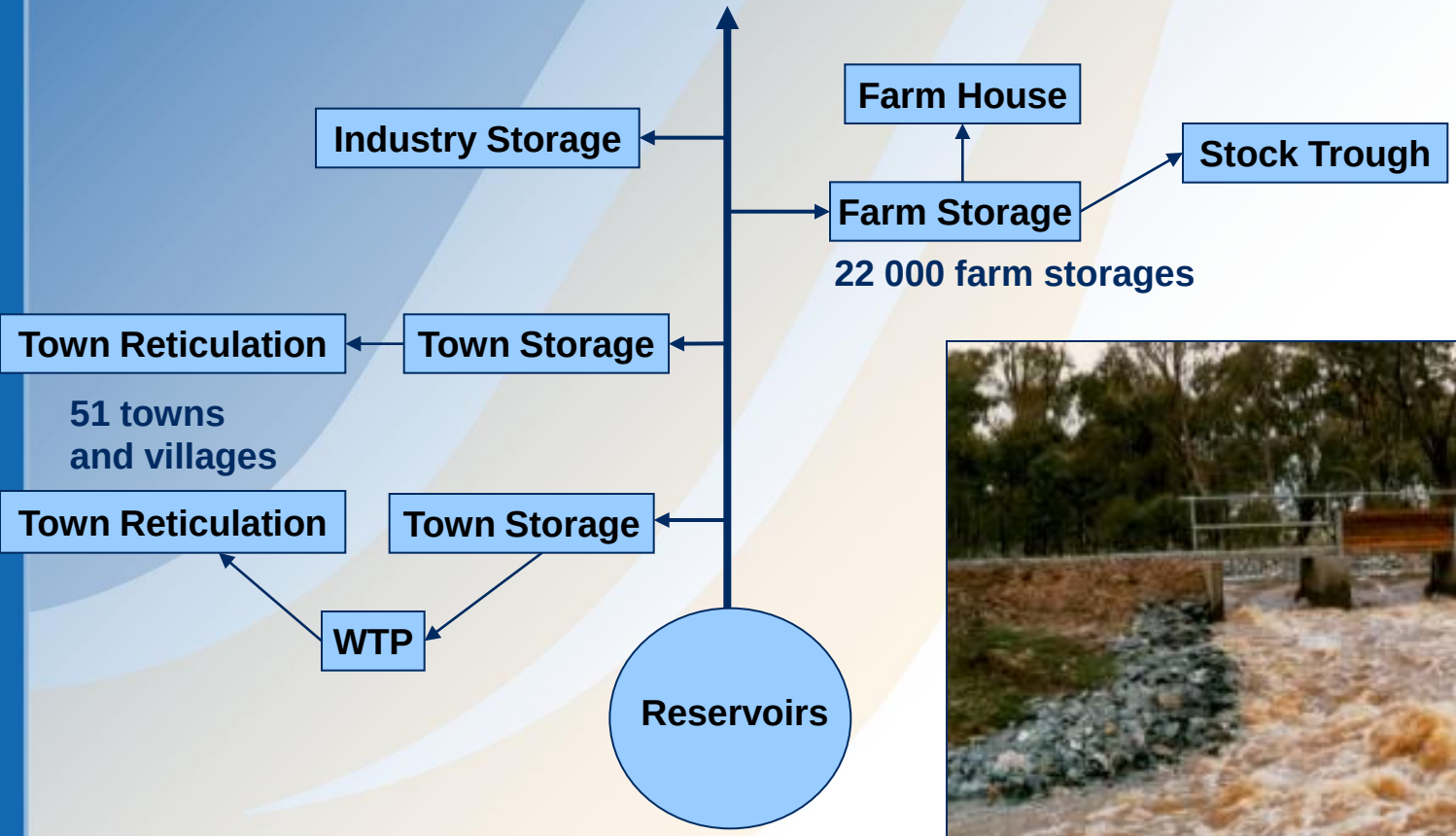
Area:
28 500 km^2

Length:
19 500 km



Water Distribution

Reservoirs into channels once a year - “Channel Run”
End users - one year storage

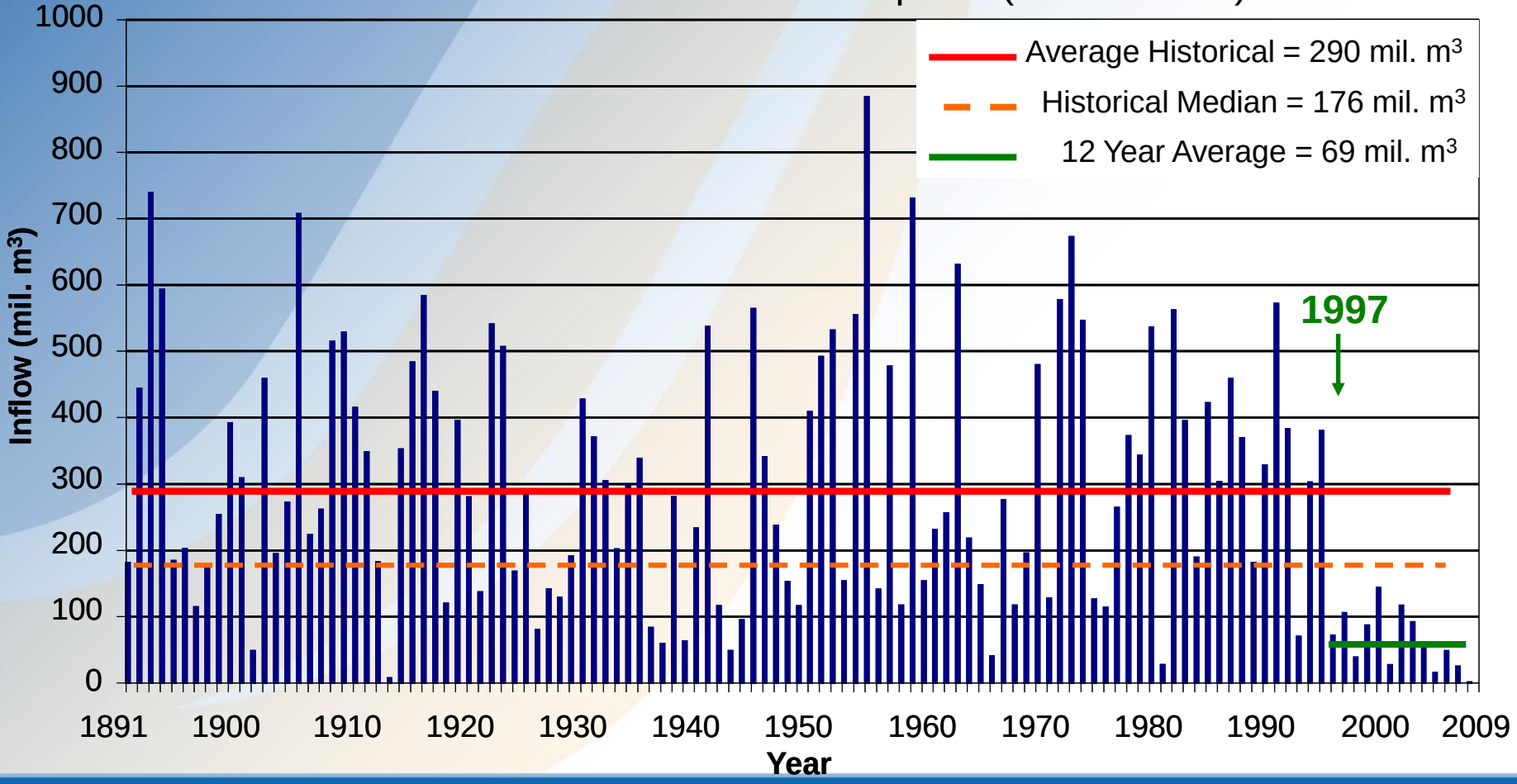


Channel Run

Water Balance

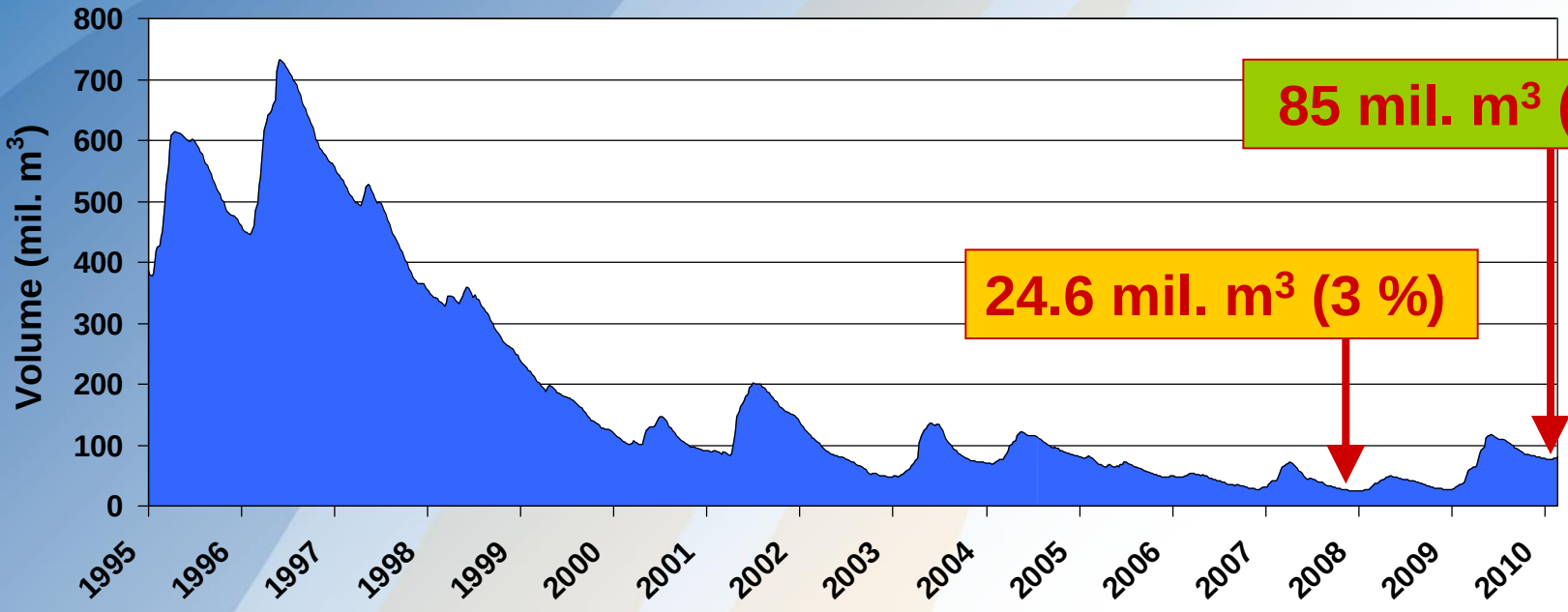
Yearly requirement of 120 mil. m^3 = water consumption + channel losses (up to 85 %)

Annual Inflow into Reservoirs in the Grampians (1891 – 2009)



1997 →

Volume in Reservoirs May 1995 - July 2010



Rocklands Reservoir in 2006

Bellfield Reservoir in 2008

Actions

1/ Water Restrictions

2/ Water Rights

3/ Water Carting

4/ Replacement of channels with pipelines

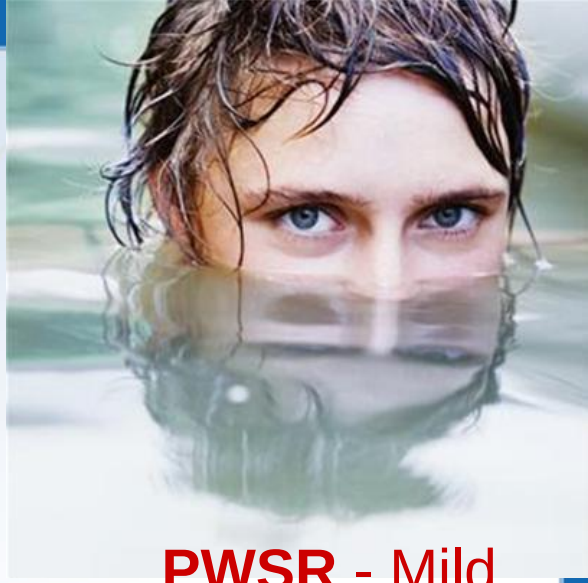
5/ Groundwater where possible

6/ Evaporation control

7/ Balancing storages operating levels

8/ Operating procedures

1999 Water Restrictions



Aim: Restriction of water consumption

Level:

- Permanent Water Savings Rules (PWSR)
- Stage 1 restrictions
- Stage 2 restrictions
- Stage 3 restrictions
- Stage 4 restrictions

PWSR - Mild

Stage 4 - Strong

Defined water use for:

- Watering of gardens
- Filling of pools, ponds, storages and tanks
- Washing of vehicles
- Cleaning of paved areas
- Cleaning of windows

Water Restrictions

From 1999: restrictions introduced to 38 towns

In 2007: 59 of 74 towns managed by GWMWater on Stage 4 restrictions.

Stage 4:
- Internal water use only, no external water use allowed
- Water consumption halved

Customers:
- Understood seriousness of situation
- Commended for levels of compliance

Level of Restriction	PWSR	Stage 1	Stage 2	Stage 3	Stage 4
Anticipated Demand	100 %	95 %	88 %	75 %	50 %

2004 Water Rights

Rights to water:
Minister for Water - June 2004

All water resources for both consumptive and environmental purposes

Four bulk entitlement holders

1. GWMWater
2. Coliban Water
3. Wannon Water
4. Minister of Environment

"Resource sharing" approach
Agreed set of rules

SHARING ARRANGEMENTS	A	B	C	D	E	F	G	H	I	J	K	L
AVAILABLE WATER (mil. m^3) →	125.550	119.950	109.510	103.790	92.180	69.500	63.656	58.142	53.011	37.979	30.223	0
GWMWATER												
System operating water - irrigation losses	9.000	7.200	5.400	4.500	2.250	0	0	0	0	0	0	0
System operating water - pipeline and balancing storage losses	2.960	2.960	2.960	2.960	2.960	2.960	2.960	2.960	2.960	2.960	2.960	0
Urban demand off pipeline & headworks	13.820	13.820	13.820	13.820	13.820	13.820	13.213	12.435	11.234	7.950	7.950	0
Rural demand supplied by pipeline	6.580	6.580	6.580	6.580	6.580	6.580	6.291	5.921	5.349	3.785	3.785	0
Supply by agreement (for industry)	6.670	6.670	6.670	6.670	6.670	6.670	6.377	6.002	5.422	3.837	3.070	0
Irrigation supplied by channel	19.000	15.200	11.400	9.500	4.750	0	0	0	0	0	0	0
Glenelg compensation flow	3.300	3.300	3.300	3.300	3.300	3.300	0.050	0.050	0.050	0.050	0.050	0
Recreation water delivered by pipeline	2.590	2.590	2.590	2.590	2.590	2.590	2.476	2.330	2.105	1.490	0	0
Wetland water delivered by pipeline	1.000	1.000	1.000	1.000	1.000	1.000	0.956	0.900	0.813	0.575	0	0
Growth water (off headworks or by pipeline)	17.650	17.650	17.650	17.650	17.650	17.650	16.875	15.881	14.347	10.153	8.123	0
Total	**82.570**	**76.970**	**71.370**	**68.570**	**61.570**	**54.570**	**49.198**	**46.479**	**42.280**	**30.800**	**25.938**	**0**
COLIBAN WATER												
Total	**0.300**	**0.300**	**0.300**	**0.300**	**0.300**	**0.300**	**0.287**	**0.270**	**0.244**	**0.173**	**0.173**	**0**
WANNON WATER												
Balmoral	0.120	0.120	0.120	0.120	0.120	0.120	0.115	0.108	0.098	0.069	0.069	0
Hamilton	2.000	2.000	2.000	2.000	2.000	2.000	1.912	1.800	1.626	1.151	1.151	0
Total	**2.120**	**2.120**	**2.120**	**2.120**	**2.120**	**2.120**	**2.027**	**1.908**	**1.724**	**1.220**	**1.220**	**0**
ENVIRONMENT (regulated)												
Northern Mallee Pipeline (NMP)	32.240	32.240	27.400	24.480	19.870	4.190	4.190	2.000	2.000	1.000	0.500	0
Wimmera Mallee Pipeline (WMP)	8.320	8.320	8.320	8.320	8.320	8.320	7.955	7.486	6.763	4.786	2.393	0
Total	**40.560**	**40.560**	**35.720**	**32.800**	**28.190**	**12.510**	**12.145**	**9.486**	**8.763**	**5.786**	**2.893**	**0**

2006 Water Carting

No water for channel run and before pipeline is completed

2350 eligible rural households - 28 m^3/ house/ 60 days

$ 2.1 mil. AUD/year

Typical Tanker Used for Water Carting Purposes

Water Carting

Water delivered into tank near house

Satisfy typical household of 5 people for 60 days

Stage 4 restrictions (internal water use only)

Water for stock and other needs:

- Carted by landowners from nearby storages

Domestic Tank Being Filled

2006 Wimmera Mallee Pipeline

Replace channels

Savings 103 mil. m^3/year

Supply to:

- 38 towns and villages
- Thousands of rural residences (farms)
- Rural stock, agricultural and industrial customers
- Recreational lakes and environmental water bodies

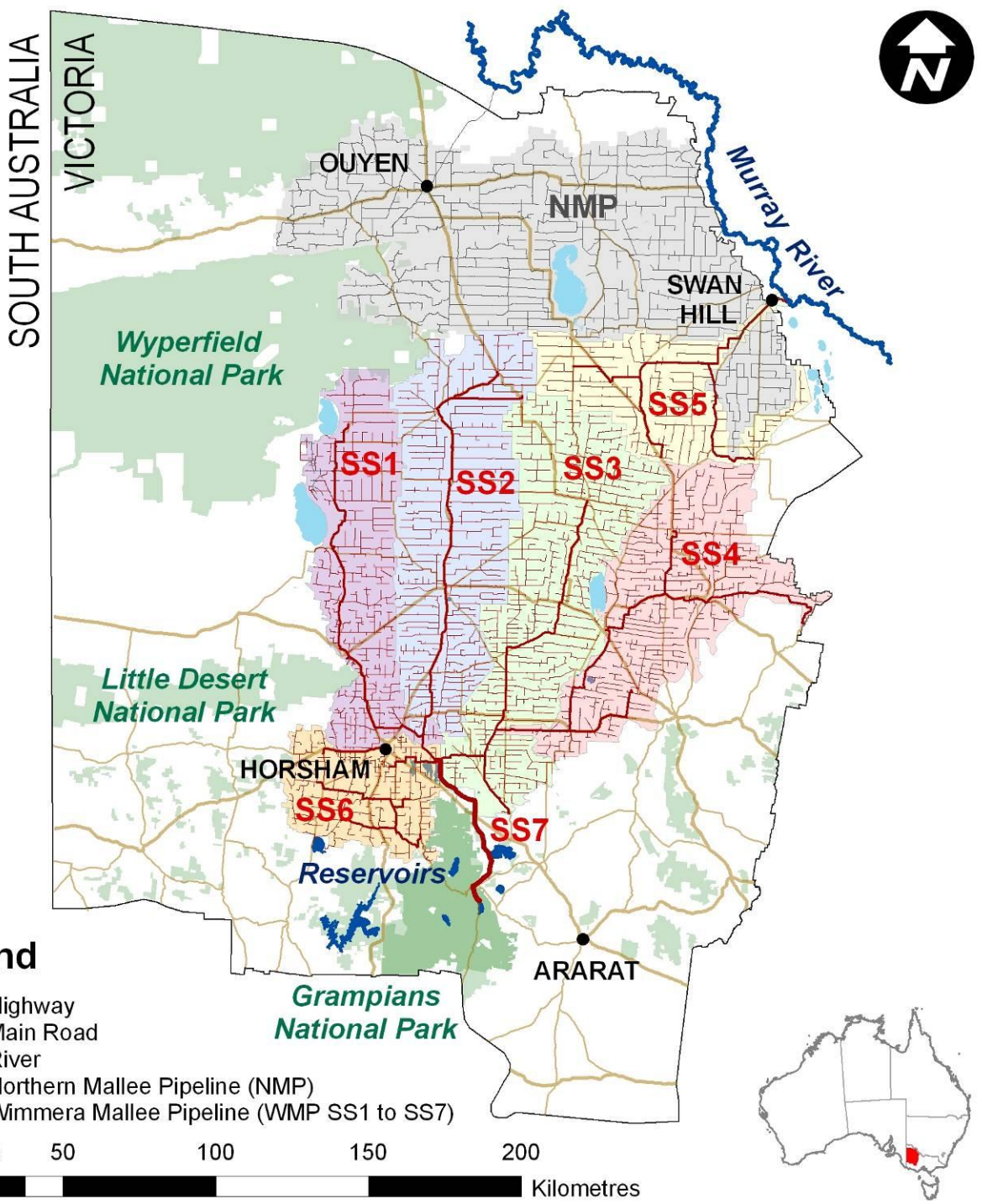
Construction start:

- November 2006

Wimmera Mallee Pipeline

Area:
20 000 km^2

Demand	mil. m^3/year
Peak	22.6
Off peak	9.0
Total	31.6




CAT

Wimmera Mallee Pipeline

8 800 km of pipes:
- 1 200 km trunk mains
- 7 600 km distribution mains

32 pump stations (45 pump sets)
22 lined open earthen balancing storages
29 covered steel tanks

$ 688 mil. AUD

Typical Pump Station

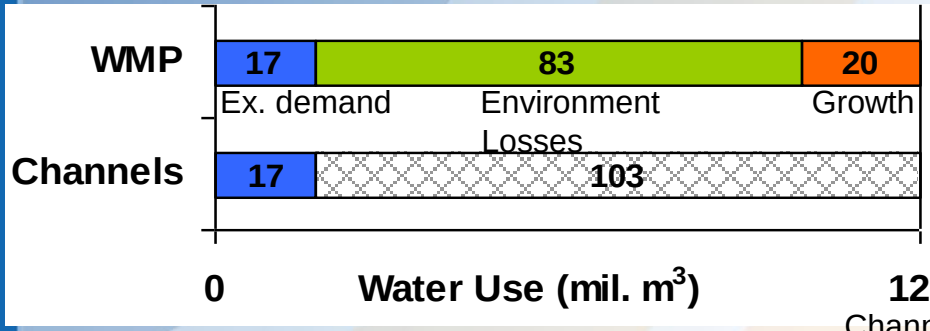
Typical Storage

Typical Tank

2010 Outcomes ?

Pipeline:
- Completed in 3.5 years in April 2010
- Fully operational.

Last channel run 2007/2008.
Water restriction eased 2009 & 2010.
Water carting finished 2010.



Reservoirs current contents 204 mil. m³

Water quality improved.
Security of supply improved.
Cost of water increased.

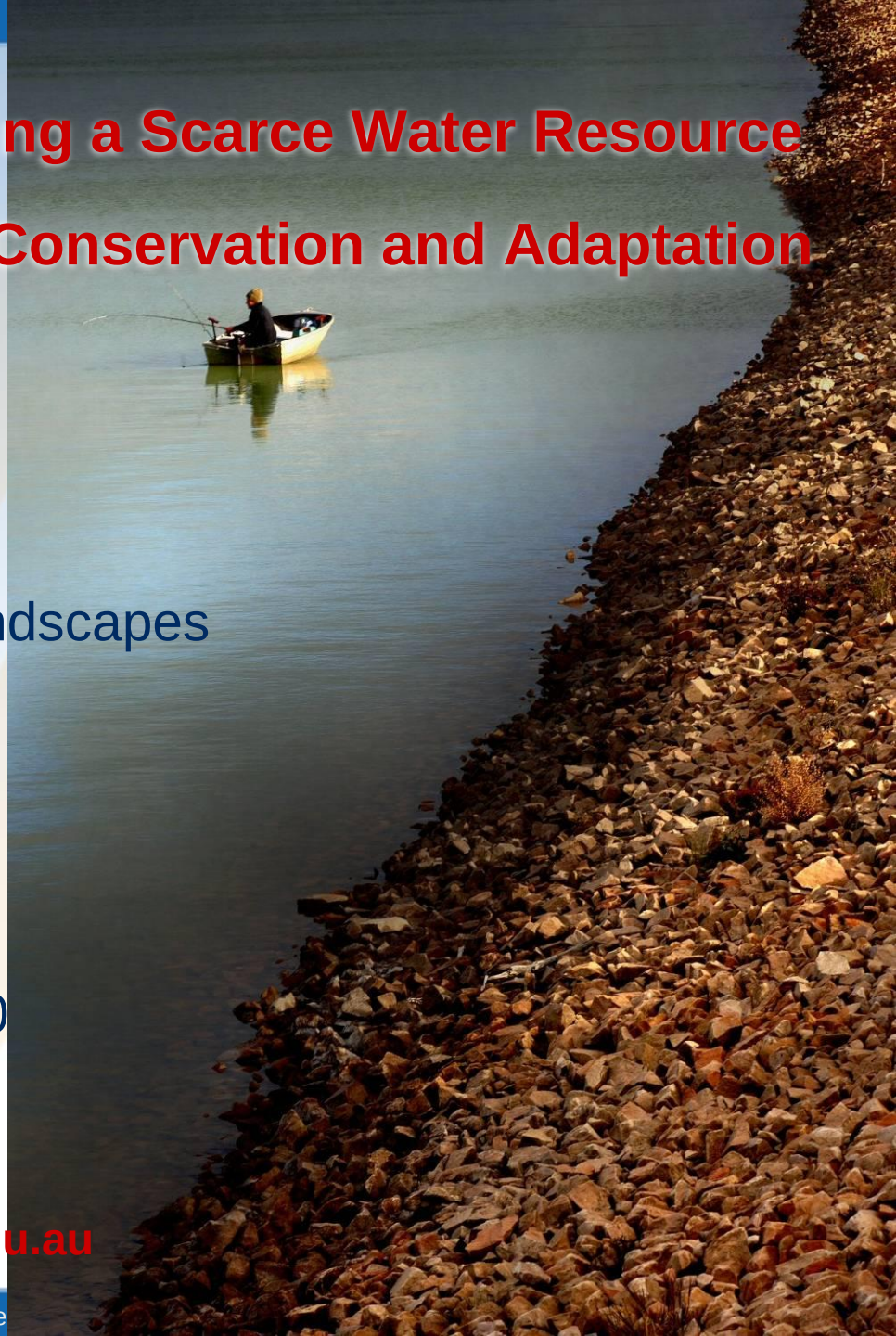
Public react positively on pipeline.


Wimmera weir pool filled by pipeline savings in 2009


Happy sheep


Happy people

Book: Managing a Scarce Water Resource through Reform, Conservation and Adaptation



Topics:

- Value of water
- Adaptation to changing water landscapes
- Pipelines
- Sustainable water management

Publish: E-book in December 2010 by WIDCORP (Water in Drylands Collaborative Research Program)

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Thank you for your attention ☺

Questions?