Securing low flows in the MLR – *Balancing economic & ecosystem needs*

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The Region - Mt Lofty Ranges



MLR Prescribed areas – Dam development



In-Scope dams (Licenced + Non-lic. => 5ML) 3,200 + + ~ 43 GL

<u>Non-Scope dams</u> (Non-Lic < 5 ML) 20,000 ++ ~ 20 GL

<u>All dams</u> 23,000 ++ ~ 63 GL

Mt Lofty Ranges – Current Landscape



Dam Inflow & Outflow Hydrographs Low flows captured



Low Flows and Ecology – No Dams



Low Flows and Ecology - Current



CURRENT – Flow & Ecosystem condition







CURRENT flow downstream of dams

- Starts when dams are full & start spilling in Mid to late winter.
- Continues during late winter.
- Stops late winter early to mid spring.
- Creek beds dry gradually through late spring, summer, autumn..... stay dry until middle of next winter when the dams fill and spill!

CURRENT condition of ecosystems



Temporary pools remain dry



Permanent pools in poor condition



Streams dry for extended periods, limiting connectivity



Aquatic and streamside vegetation restricted and in poor condition

MLR No-Low flows - Condition Summary

- Progressive increase in farm dam development (~ 40 years)
- Cumulative impacts on hydrology
- Flow regime alteration <u>low flow</u>
 <u>regime</u>.. Autumn and early Winter
- Extensive scientific evidence of impacts :
 - Security of supply on existing D/S dams
 - Health of Water Dependent Ecosystems..



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Water Management Drivers

- Water Allocation Plans: Regulatory framework to manage water resources for current and future economic, ecological and social needs
- Sustainable extraction limit: 25% of predam runoff, <u>if low flows are passed from all</u> <u>existing</u> in-scope sites (EWP target), if not, SEL = 5%
- **Scope sites:** Licensed dams, Non-Licensed dams => 5ML and Watercourse extractions
- Low flows: 20th %ile exceedance non-zero flow – Threshold Flow Rate (TFR)



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TFR Calculation



Dam Inflow & Outflow Hydrographs With & without low flows passed around dam



'CURRENT' & 'LOW FLOWS RETURNED' ecosys. condition



CURRENT Condition



Temporary pools remain dry





Permanent pools in poor condition

Streams dry for extended periods, limiting connectivity



Aquatic and streamside vegetation restricted and in poor condition



Medium/High Flows are still available to dams... Dams expected to fill and spill later

Duration of low flow season extended considerably, to benefit D/S WDEs

Low flows released from all scope dams?

• Why strategic releases?

- Total number of in-scope dams in the MLR~ 3200
- Could the same ecological outcome be achieved using less LFRs?
- Investigations by Alcorn (2013) at a Surface Water Management Zone (SWMZ) scale indicated this could be achieved
- Required testing at catchment scale and assessment of affect on downstream SWMZs
- Alternate options for returning low flows?
 - Of efficient ways of providing low flows,
 - While meeting EFP targets,
 - Rather than providing LFRs from all 'scope' dams that were constructed in an <u>unsystematic manner</u> across the landscape?







Low flows released from all scope dams? – Strategic?



- Devices to return low flows installed on some dams Water diverters will be required to pass
- ting
 - Iow flows
 High demand zones may require further actions (Eastern Mount Lofty Ranges)
 - R Reservoirs will be required to pass low flows

- Temporary pools will stay wetter for longer periods
- Permanent pools will improve in condition
- Improved waterway connectivity
- Aquatic and streamside vegetation improves



Research – Other areas?

Western Australia – Study published in 2009

- 'Investigation of strategies for targeting dams for low flow bypasses (Fowler. K.J.A, et. al., 2009)'
- South-west of WA, Lefroy Brook catchment, 178 farm dams / 4200 ML.
- Scenarios considered:
 - No bypass,
 - Bypass on all dams,
 - 5% of dams by volume (largest 9 dams),
 - 5% of dams by catchment area (largest contributing area),
 - *'tailored combination'*

Outcomes

- ✓ large <u>contributing catchment</u> areas
- ✓ Low flow <u>unimpeded area connected</u> to catchment outlet
- × <u>Dam volume</u> minimal impact



SEL



Figure 1: Different configurations for bypass networks, with dams chosen by (a) dam volume; (b) dam catchment area; and (c) tailored solution. Each option bypasses only 9 dams (out of 178 in the study catchment).



Path 1

 ✓ contributing catchment area with highest low flow <u>unimpeded area connected</u> to catchment outlet & <u>lowest</u> <u>number of LFRs</u>





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Modelling

- Flow routing model (Source):
 - 368 farm dams catchment; 4 watercourse extractions
 - Outlet of 12 surface water management zones

• Dam node inputs:

- Inflow 'No-dam' flow to dam nodes
- Rainfall and evaporation
- Threshold flow rate as in the WAP
- Scenarios: No-dams, Current, BaseWAP low flows released (LFR) from all scope dams, - Strategic LFR scenarios: LFRs ON/OFF from individual and combination of scope dams
- Outputs / Analysis:
 - Daily flows output at each SWMZ outlet converted to EWR metrics
 - EWR metrics compared between: BaseWAP and other scenarios
 - EWP Target: Fail no more than 15% of EWR metrics Zone / EoC

Carrickalinga - Strategic LFRs Summary



- LFRs <u>do not</u> impact EWR metrics at outlet of zone and D/S zones 10
 - LFRs <u>do</u> impact EWR metrics at outlet of zone, but NOT required to meet EWP target 17

LFRs required under WAP scenario:	47
Possible exclusion of LFRs TOTAL (green / Yellow):	21 (10 / 11)
Potential reduction in LFRs (Saving \$\$):	45%

SLFs – Implementation







Low Flow Bypass – Gravity

- Use gravity to bypass flows around the dam via a pipe or channel
- A similar version is **pumped bypass** which uses a pump or siphon to bypass flows around the dam.

Release device

- Release low flows via a pipe over or through the dam wall.
- Inflow measured and required volume of low flows to be conveyed by either siphon or pumped from the dam

Also watercourse diversion devices





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Back Va

Myponga F Catchme

rieu peninsula I flows,

- Beef cattle enterprise
 - ise = grazing and pasture)



Date period = Feb 2016 to June 2017



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Securing low flow - programs

<u>2 main programs</u>

- Flows for the Future (F4F) Eastern Mount Lofty Ranges and Marne Saunders.
- State and Commonwealth funded.
- Securing Low Flows (SLF) Western Mount Lofty Ranges
- Low flow trials project commenced 2015/16
- Retrofitting of low flow devices on <u>existing</u> dams
- 11 sites



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Low flow bypasses – *What's happening on-ground?*





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