Infrastructure Cliff

Fact or Fiction?
The Queensland Water Regional Alliances Program (QWRAP) commenced in 2011 in response to calls for reform of the Queensland urban water and sewerage sector.

Examines opportunities for voluntary regional approaches among Queensland councils to address common challenges facing water and sewerage service providers.
Investment by:

- Qld Government (QWRAP funding)
- LGAQ – program owner
- qldwater – project manager
- Participating councils

Five regions to date. Each:

- Investigates collaboration opportunities
- ‘Considers’ new governance models

⇒ 3 formal Water Alliances formed.

Funding for small research projects.
Why a research project on asset ageing?
Drivers of water reform

<table>
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<tr>
<th>Suggested drivers for reform in regional Qld</th>
<th>Other jurisdictions where drivers were implicated</th>
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<tbody>
<tr>
<td>Water Security Failure</td>
<td>Australia: SEQ; OECD and G20 Countries: Ireland, Italy, Saudi Arabia</td>
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<td>Poor Water Quality</td>
<td>Australia: NSW, Tas; OECD and G20 Countries: Ireland, Italy</td>
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<td>Failures in Regulatory Compliance</td>
<td>Australia: NSW, Tas; OECD and G20 Countries: Estonia, Ireland, Lithuania, Saudi Arabia</td>
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<td>Efficiency for Financial Sustainability</td>
<td>Australia: ACT, SEQ, Tas, Vic, NSW; OECD and G20 Countries: Argentina, Auckland, Belgium, Denmark, France, Ireland, Netherlands, Saudi Arabia, UK, Scotland, Spain</td>
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<td>Need for Increased Capital Investment</td>
<td>Australia: ACT, SEQ, NSW, Tas, Vic; OECD and G20 Countries: Belgium, France, Ireland, Italy, Lithuania, Saudi Arabia, Spain, UK, Scotland, USA</td>
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<td>Failures in Customer Service</td>
<td>Australia: Tas; OECD and G20 Countries: Argentina, Estonia, Lithuania, Saudi Arabia, Scotland, USA</td>
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<td>Shortage of Critical Skills</td>
<td>Australia: NSW; OECD and G20 Countries: Ireland</td>
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<tr>
<td>Need for Micro-economic Reform</td>
<td>Australia: Vic; OECD and G20 Countries: Brazil, Denmark, Finland, Netherlands, UK, USA</td>
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<tr>
<td>Desire for Better Planning</td>
<td>Australia: NSW, SEQ, Tas; OECD and G20 Countries: Auckland, USA</td>
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</table>
Qld Water Sector

- 1.9 mill water connections
- 42,000 km of water mains
- 381 water treatment plants
- 1.7 mill sewerage connections
- 34,000 km of sewers
- 285 sewage treatment plants
- $37 bill water & sewerage assets
- 63 utilities
- 370 supplies
- 88% potable
- \( \frac{2}{3} \) with < 1,000 people
- \( \frac{1}{2} \) with < 500 people
Emerging asset deficits

USA: $13 - $30 billion per annum in water main replacement costs by the 2040. AWWA, 2013

UK: investment in water and sewer mains must increase 2-6 times for current service levels to be maintained. UKWIR, 2017

Queensland: Infrastructure investment profile

investment required to replace ageing water and sewerage mains “is expected to be above current annual budget levels”. WSAA, 2013
Summary of Drivers and Scope

Research Drivers:

- Potential for reform
- Possible asset deficit
- Emerging industry trends

Research Scope:

- Qld urban Service Providers
- In-ground assets
- Initial focus on age profiles

Expert Advisory Panel

- Chris Adam (Strategic AM),
- David Brooker (QUU),
- Brad Cowan (Aqua Projects),
- Aneurin Hughes (Cardno).

The advisory panel provided direction during the project and insightful feedback and comments on drafts of the report. However, any errors or mistakes are those of the authors alone.
Data Collection

Since the models have been run we have received 95% of the states water mains

71% of total mains length

67% of total mains length
Digression – Pipe Diameters

Water Mains
- 100 mm
- 150 mm
- 200 mm
- 300 mm

Sewers
- 150 mm
- 100 mm
- 300 mm
digression – expected lives

Pipe Length (m)

Listed Expected Useful Life

Pipe Material (group)
- AC
- CI and DI
- Concrete & Glass Rein.
- PVC & PE Based
- Steel, Galv and Copper
- uPvc
- Other

[Graph showing pipe length and listed expected useful life]
Water – Materials and Age

- PVC/PE
- AC

AC peak (70’s)
Failure modelling

Pipe Length (km)

Year

100 mm mains

150 mm mains
Break modelling

- Total breaks predicted for 100, 150 & 300 mm AC pipes
- Number of “AC breaks” reported in recent years by the same utilities
- 2030: double current rates, 2040’s: quadrupling
Summary of Findings

Ageing Mains in Queensland:

- Large cohort of early AC mains.
- Peak installation 1960’s – 80’s.
- Median expected life of 70 years.

Modelling Degradation:

Agreement among 3 independent modelling approaches.

- Small increase in failures to 2020
- Rapid acceleration to 2040’s.
AC Mains in perspective

Qld mains

AC mains – 28%

Annual Replacement Rates

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<th></th>
<th>Water</th>
<th>Sewer</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>UK</td>
<td>0.6%</td>
<td>0.2%</td>
<td>UKWIR, 2017</td>
</tr>
</tbody>
</table>

> 170 years
Scale of Costs.... With extra data

1.9 mill water connections
42 000 km of water mains
381 water treatment plants
1.7 mill sewerage connections
34 000 km of sewers
285 sewage treatment plants

$37 bill water & sewerage assets

39 705 km 95% of Water mains
3 270 km 8% of Water mains

Greenfield install costs: $16,300,000,000
DASB Greenfield install Costs: $1,340,000,000
Can DASB be compared against the State?

The DASB data received suggests the region has to replace a similar % as the state average in the next 25yrs.

Pipes Prior to 1975 are at the most risk
Replacement for DASB....

Applying a 70yr life

- 28% of 3,270 km will need replacement (25yrs).
- Over 1,000 km of AC pipe is in use.

If the council doesn’t have appropriate depreciation or rehabilitation works to extend pipe life, bills will need to rise by $157 per year to meet the replacement requirement.

OR

$15,000,000 per year
For 25yrs
28%

$375,000,000

$1,400,000,000
Optimal Response?

“Postponing the investment steepens the slope of the investment curve that must ultimately be met...[and]... increases the odds of facing the high costs associated with water main breaks and other infrastructure failures.”


“It is not cost-effective to replace a pipe before, or even after, the first break [...] a proactive approach to pipe asset management is crucial in determining the optimal time to replace a pipe”.

Punurai and Davis, 2017.

“Ideally, pipe replacement occurs at the end of a pipe’s ‘useful life’, that is, the point in time when replacement or rehabilitation becomes less expensive going forward than the costs of numerous unscheduled breaks and associated emergency repairs.”

Replacement vs. Repair; the eternal struggle

The Consequence or Severity is made up of a combination of factors e.g:

• Decline in Water Quality
• Customer Service levels
• Public safety
• Criticality of Pipe

The graph shows the NPV Repair and NPV Replacement costs, with the y-axis representing NPV in millions and the x-axis showing the number of annual breaks per 100 km. The severity matrix in the top right quadrant indicates risk levels, with Incredibly Unlikely, Unlikely, Occasional, Likely, and Almost Certain probabilities.
Next Steps - communication
Next Steps - Research

1. Complete stage 2 report:
   - costs of ageing AC pipes (optimistic, moderate, pessimistic)
   - cost tradeoffs: repair vs replacement
   - distribution of costs regionally (case study scenario examples)
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