Inflow and Infiltration

- Inflow and Infiltration (I/I) Definitions:
  - Inflow is generally direct stormwater inputs into the wastewater network from illegal roof connections, low gully traps and cross connected stormwater systems etc. Inflow causes rapid flow increases and can cause surcharging and overflows.
  - Infiltration occurs when water from saturated surrounding soils enters the wastewater network through defects such as deteriorated pipe joints, damaged pipes, private laterals in poor condition, offset manhole risers etc. The response to rainfall is slower and can be prolonged. In areas susceptible to high groundwater, infiltration can occur for extended periods during winter. Groundwater infiltration can occur in the absence of local or recent rainfall as it is often fed by a wide region and influenced by longer term rainfall patterns.

- High I/I Issue in all catchments – most notable is the groundwater infiltration in Featherston.
  - Typical domestic per capita wastewater flows between 210 – 475L/per/d:

		Greytown	Featherston	Martinborough	Carterton
Average per capita flow at ADF	L/per/d	430	1163	433	728
Estimated I/I portion of ADF	m^3/d	360	2136	243	970
	% of ADF	42%	74%	42%	

Inflow and Infiltration

To understand how reducing I/I might affect the long term treatment or disposal option costs, an I/I Sensitivity Analysis was undertaken.

Conclusions:

- Reducing flows through network improvements could significantly reduce capital and as well as ongoing operational costs for Featherston – most “leaky” system.
- Accurate isolation of I/I sources is critical as concentrating spending on a smaller percentage of the network would allow more thorough rehabilitation.
- The sensitivity analysis showed, that for example, assuming a $2M spend
  - on 5% of the network = 43% ADF reduction, $2.5M capital cost saving for treatment & $6M saving for disposal
  - on 30% of the network = 27% ADF reduction, $0.5M capital cost saving for treatment & $3M saving for disposal
- Undertaking investigations for rehab prioritisation not only provides data for cost effective flow reductions to the new treatment schemes but is general good practice for optimising ongoing asset renewal and maintenance programmes.

I/I - Background Review

Based on review of 2004 I/I flow monitoring the following has been concluded:

- The issue was characterised as elevated daily dry weather flows especially in winter but evident year round.
- Primary source of excessive flow volume appeared to be groundwater Infiltration (GWI).
- Direct inflows evident but much less overall volume contribution.
- Immediate GWI source detection for rehab prioritisation recommended.
- 2nd priority - catchment flow monitoring for wet weather response and flow characterisation

Figure 1 Portable Weir Installed in Featherston Sewer

I/I Night Flow Investigation

- Study area 1 (trunk main) contributes the most GWI (9.29L/s out of the total 18.75L/s of night flow) and comprises only 7% of the total network.
- The top 5 ranked catchments contribute 85% of the GWI flow yet comprise only 23% of the total pipe length.
- Beyond the top 5 night flow contributions are wide spread with the remaining 17% of night flow coming from 77% of the total pipe length.
- Focus of remedial works therefore on top 5 ranked catchments.

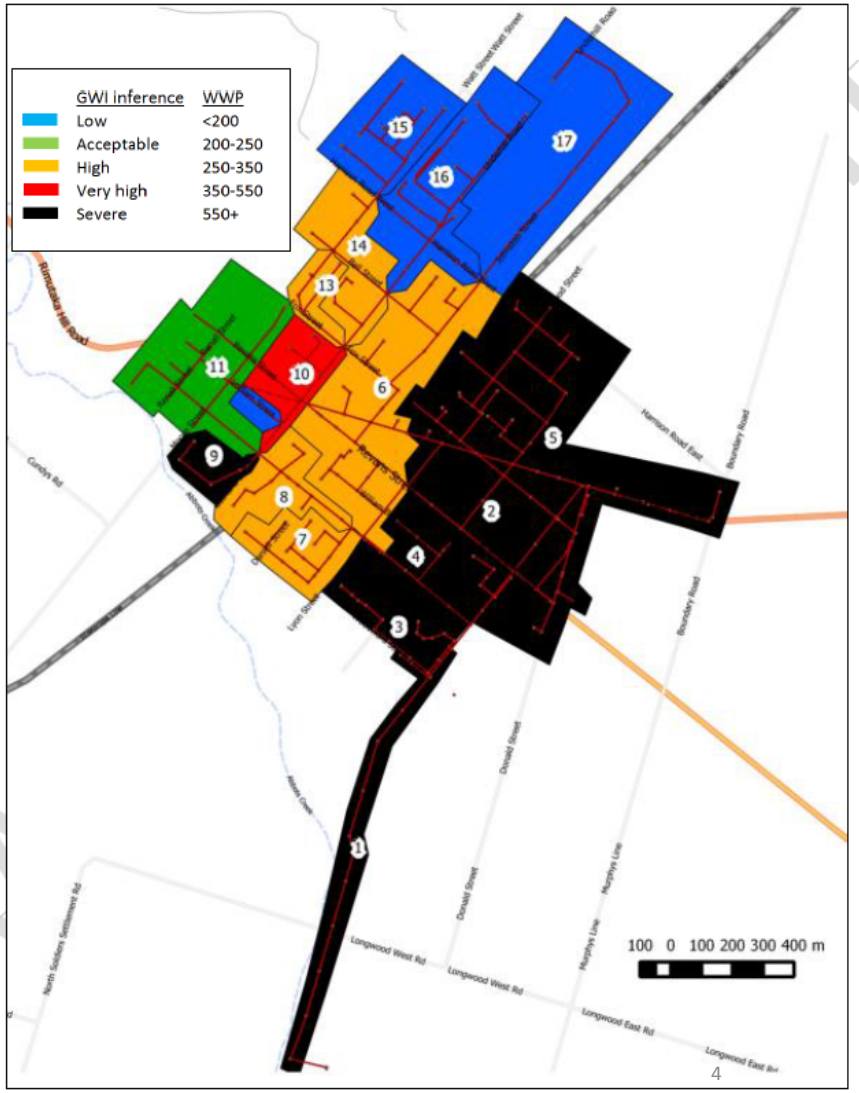
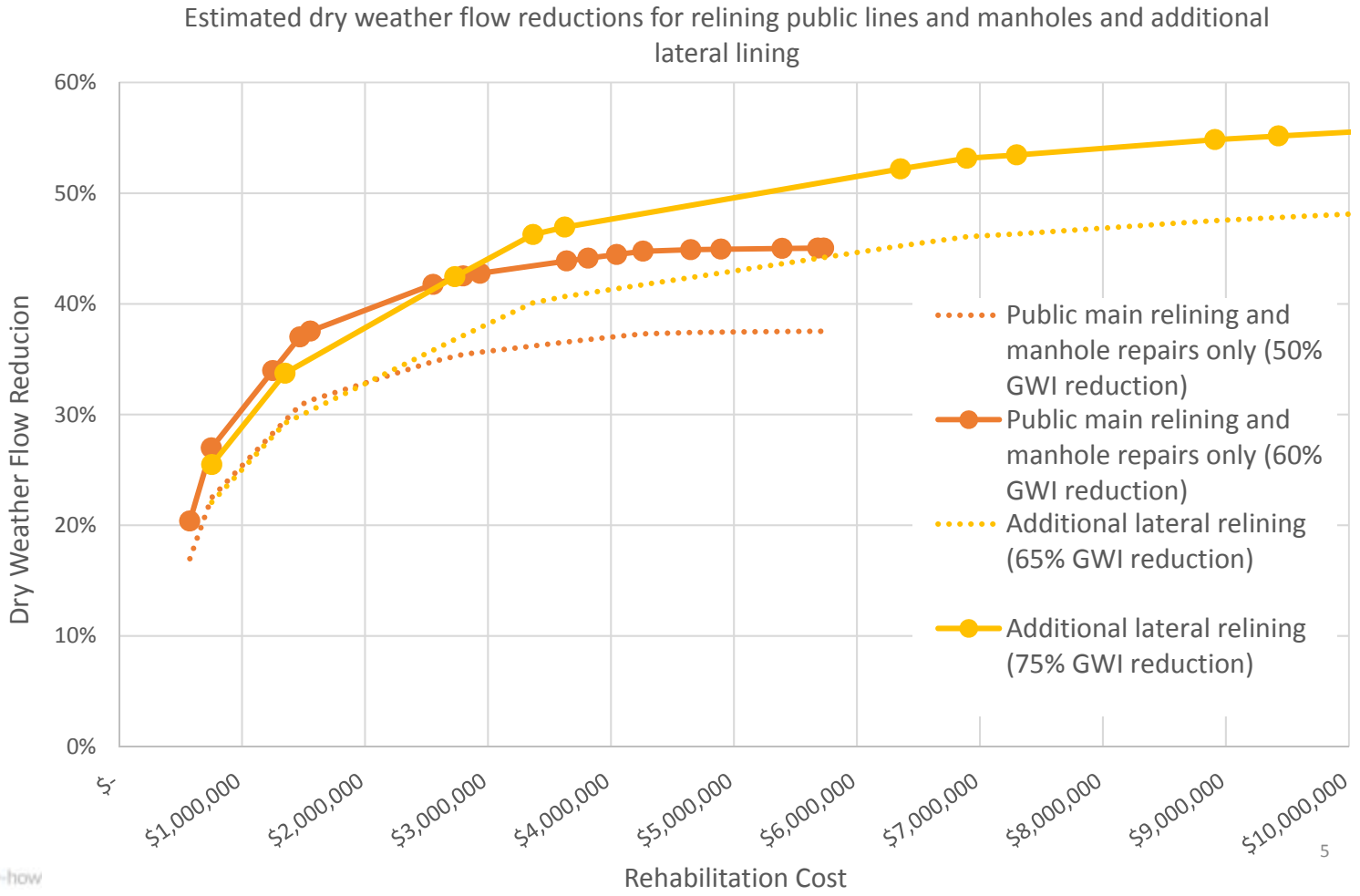


Figure 5: Classification of Study Areas Based on Night Flow Rate

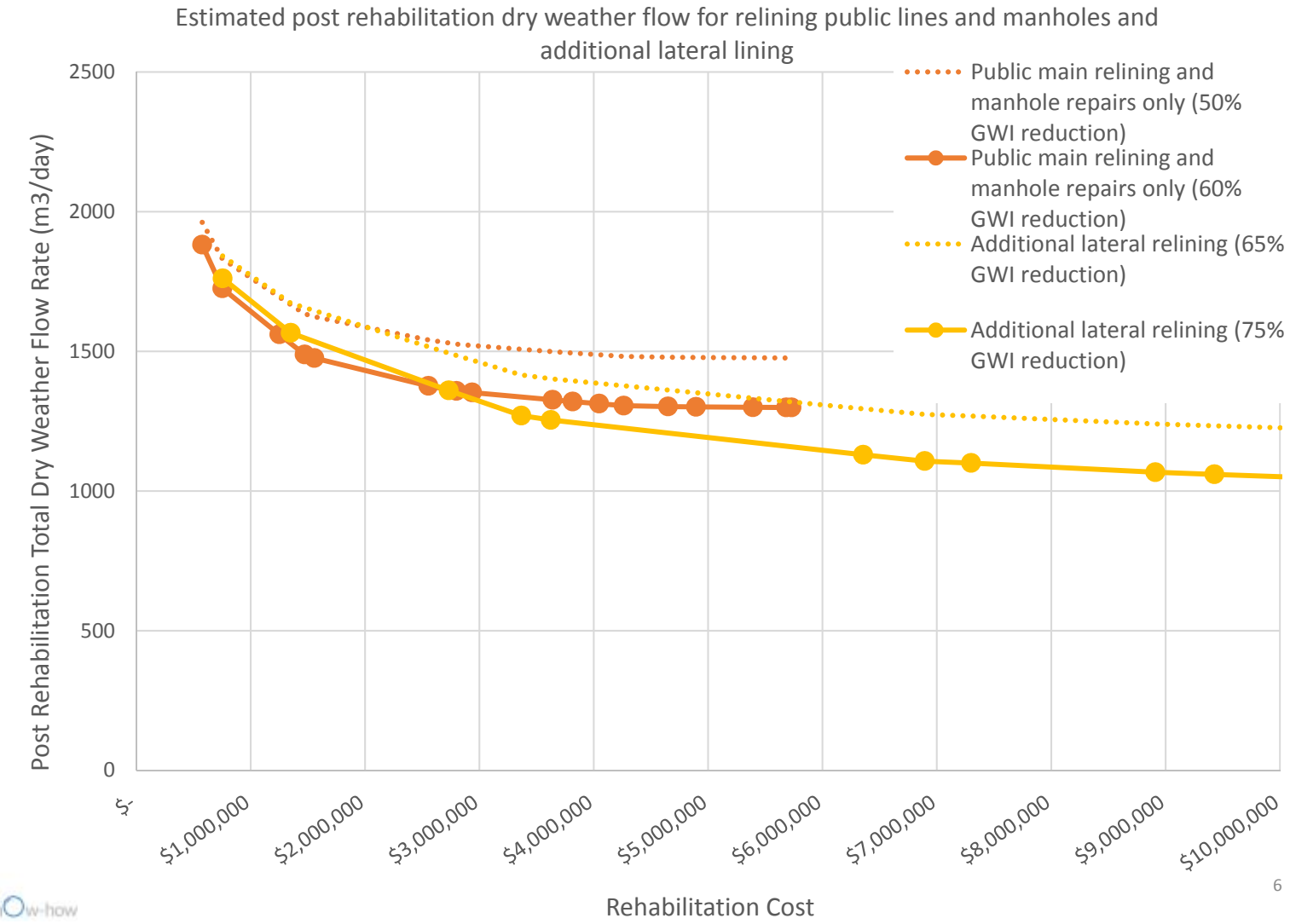
I/I Network Rehabilitation Costs

- A high level costing was carried out for the rehabilitation works with estimated flow reductions. Figures are based on industry rates and reductions achieved by relining public mains and laterals as well as manhole remediation.



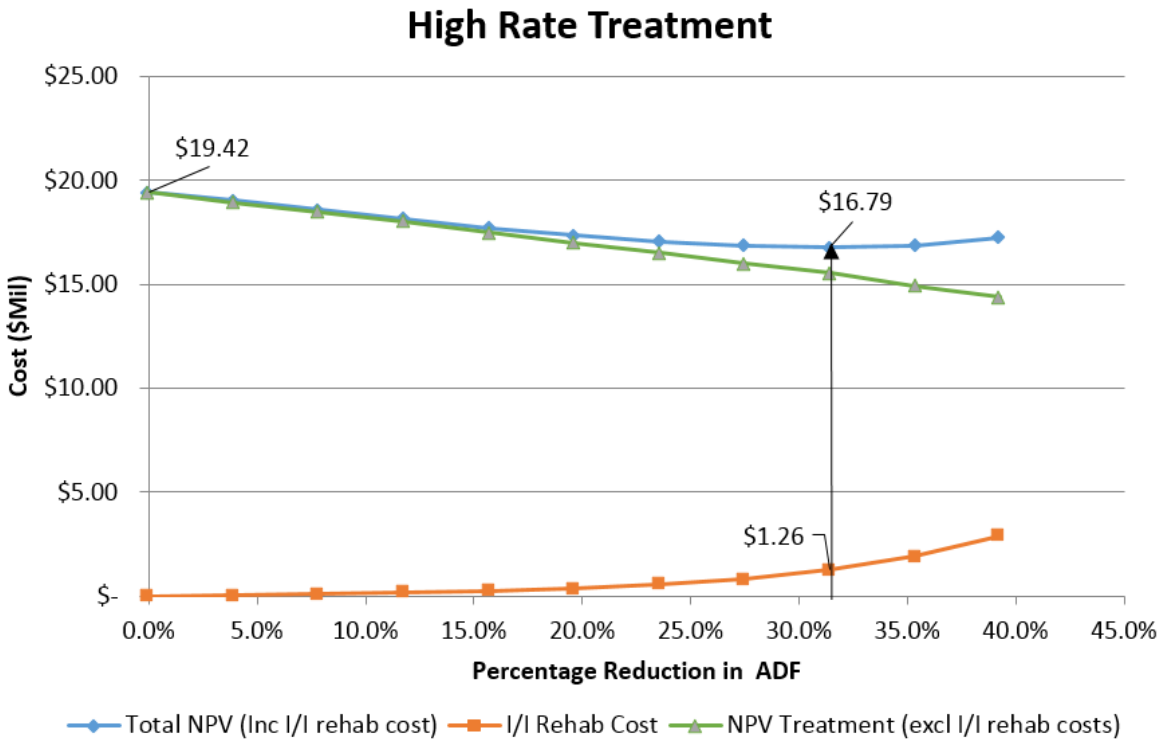
I/I Network Rehabilitation Costs

- High level costing in terms of the estimated dry weather flow post rehabilitation.



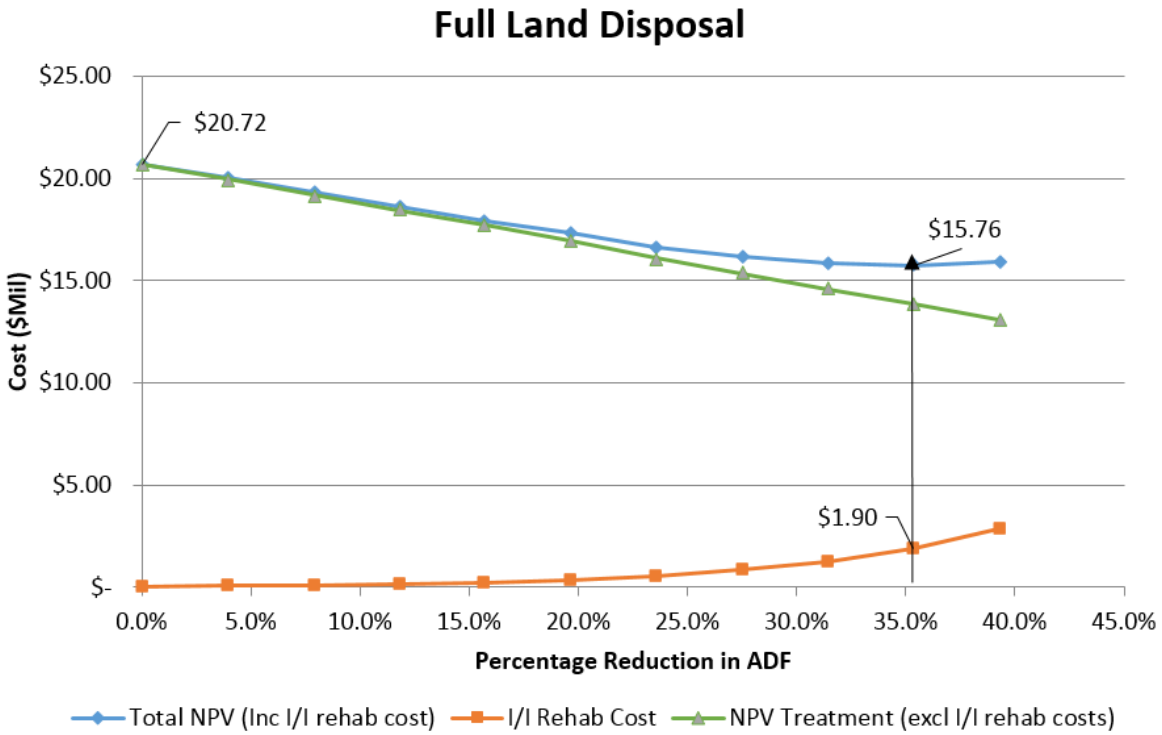
Cost Savings from I/I Rehab

- Rehabilitation cost and expected % reductions in ADF have been derived from Night Flow Isolation study.
- This has been fed into AWT's I/I Sensitivity Analysis to calculate the estimated NPV of Treatment and Disposal Schemes for different levels of I/I rehabilitation – to find the 'sweet spot'.
- Most economical High Rate Treatment scenario is at 31% reduction in ADF ($2.63Mil NPV savings)
  - Rehab public sewers in top 3 catchments or rehab public and private laterals in top 2 catchments.



Cost Savings from I/I Rehab

- The most economical “Full” Land Disposal scenario is at 35% reduction in ADF ($4.96Mil NPV savings)
  - Rehab public sewers in top 6 catchments or rehab public and private laterals in top 3 catchments.



- Further cost savings likely with maintaining an emergency discharge regime for both High Rate Treatment or Land Disposal options.
- $1.9Mil I/I rehab cost is within the budget allocated in SWDC’s LTP (Version V).

I/I – Next Steps

- Undertake CCTV assessment in identified priority catchments only. This will confirm the technique and final cost of rehabilitation.
- Install a monitor at the treatment plant inlet for assessing rehabilitation effectiveness.
- Catchment wide flow monitoring to assess wet weather response (winter gauging) and characterise dry weather flow.
- Rehabilitation plan and works programme combing results from GWI investigations and catchment flow monitoring.
- Undertake works.