## Attachment 1 Explanation: Cost Methodology to Statement of Evidence of Mr David Walker (Economics) 28 February 2025

Hearing Stream 2 of the Proposed Plan Change 1 to the Natural Resources Plan for the Wellington Region

**PURPOSE**

The purpose of this Appendix is to provide supplementary detail on:

- Data sources used in estimating the costs and benefits of the proposed investments to improve water quality outcomes through lower levels of *E. coli* in freshwater and metals in stormwater.
- Processes followed to calculate these costs, benefits and estimated affordability and achievability of these investments.

**INTERVENTIONS REQUIRED TO ACHIEVE POLICY TARGETS**

The first step was to determine what types of interventions would be required by TAs to support achievement of the PC1 metals TAS and the *E. coli* MRI and PC1 TAS.

- Dr Michael Greer was able to **model the estimated load reduction** in metals (in the case of stormwater) or *E. coli* (in the case of wastewater) required to achieve the MRI and/or TAS in each pFMU. Dr Greer has emphasised repeatedly that these modelled estimates are indicative only.
- Dr Greer was able to then **interpret these required load reductions as interventions**, such as a requirement for 64% of Grade 4 and 5 pipes to be replaced in a particular pFMU. In some cases, he was able to provide two or more possible interventions for reducing loads, such as treating 61% of impervious surfaces by rain gardens or 72% of impervious surfaces by wetlands to achieve the same outcome. The estimated scale of these interventions is meant to be indicative only.
- Interventions aimed at improving stormwater metals outcomes were provided for five pFMUs represented by Kaiwharawhara Stream, Te Awa Kairangi urban streams, Wai-o-hata, Waiwhetū Stream and Wellington urban; and for 14 pFMUs in the case of wastewater.

**ESTIMATING STORMWATER COSTS**

Having established the potential interventions possible to support achieving stormwater MRI and wastewater MRI and PC1 TAS, I was in a position to begin calculating the likely costs of these interventions.

- Dr Greer was also able to provide indicative estimates of the amount of impervious surface in each of the five pFMUs that would need to have treatment to reduce metal loads, and as a sub-set of impervious surfaces, roof space.
- Combining the knowledge of Dr Greer with that of some of GHD's stormwater engineers, I was also able to estimate the relationship between impervious surfaces and the surface area (in hectares) of the various types of interventions. For instance, it was estimated that the ratio of impervious surface to wetlands required for treatment was 50:1. So 50 hectares of impervious surface that needed to be offset would require one hectares of wetlands. The assumption was the same for rain gardens (50:1), but for swales the assumption was 10:1 because of the tendency for metals to re-enter water when treated via swales during the next major rain event.

- Pricing for the cost per hectare to construct a wetland, rain garden, swale or to replace roofs came from a variety of sources:
  - GHD developed an estimate for the cost of constructing a wetland of $4 million per hectare based on previous work using real-life examples of wetlands
  - GHD developed estimates of the costs for constructing rain gardens of $3 million per hectare plus $12,000 in per-garden costs. This was to reflect the fact that in reality rain gardens are typically small (100m2 or less) and there is a design cost for each garden such that smaller gardens will cost far more than the $300/m2 assumed by the averaged cost of $3 million per hectare. These estimates were cross-checked by speaking to staff at Wellington Water Limited (WWL) and Wellington City Council about recent and planned rain gardens. These discussions suggested that our estimates were in the right range. We assumed an average rain garden size of 1,000m2, which would be large, and thus may underestimate design costs although overall costs would be fairly accurate as design is a small share of total cost for the scale of these interventions.
  - GHD estimated the cost of swales at $2.5 million per hectare. While no independent verification of the actual cost of swales of the scale required was available, WWL staff indicated that the ratio of rain garden to swale pricing seemed appropriate. I assumed a design price for swales of $9,750 per swale, which again accounted for the higher price per $m^2$ for smaller swales. We assumed an average swale size of one hectare, which would be large, and thus may underestimate design costs although overall costs would be fairly accurate as design is a small share of total cost for the scale of these interventions.
  - Roof replacement costs were estimated at $15,000 per $100m^2$ ($1.5 million per hectare), which is a rough order of magnitude for a fairly standard roof replacement.
- I also estimated costs for urban land and rural land in each of the four council areas. The reason for this is that if land for wetlands, rain gardens or swales is not currently owned by the relevant council, they will need to buy land. Using previous GHD work, I was able to estimate approximate costs per hectare for urban land and rural land in each council jurisdiction. Rural land costs are much lower than urban land, at around $41,000 per hectare across locations, while urban land prices range between $3.9 million and $5 million per hectare across the urban areas.
- Using data on impervious surfaces (non-roof); impervious surfaces (roofed); ratios of impervious surfaces to wetlands, rain gardens and swales; and prices to design and construct wetlands, rain gardens, swales or replace roofs allowed me to estimate the cost of multiple intervention options for each of the five pFMUs. An example of the calculation follows:

  In pFMU X, to achieve TAS requires 47% of impervious surfaces to be treated in the case of using a rain garden. There are 82 hectares to be treated, and the ratio of impervious surface to treatment area is 50:1. The design cost is $12,000 per rain garden, with an average rain garden size of $1{,}000m^2$ and a per hectare construction cost of $3 million. The calculation would be as follows:

  82 hectares X 47% X 2% = 0.771 hectares ($7{,}710m^2$ of rain gardens needed)

  Construction cost = 0.771 X $3 million = $2.31 million

  Design cost is for $\frac{7710}{1000}$ = 8 rain gardens (rounded up), so $12,000 X 8 = $96,000

Total cost to design and construct rain gardens is $2.31 million + $96,000 = $2.41 million

If land has to be purchased, this could be an extra $3.59 million in an urban area, leading to total cost of **$6 million for rain gardens to service this pFMU**.

- There were six different intervention options for one pFMU, five for another, four for another, and one intervention option for two pFMUs. I was thus able to estimate a set of lowest-cost interventions and a set of highest-cost interventions for achieving TAS, which are presented in the Evidence Statement.

The most expensive intervention options tended to involve swales (due to their lower treatment capability) and roof replacements due to their high cost. The least expensive options tended to be rain gardens or wetlands. The range of stormwater costs to achieve TAS is shown in

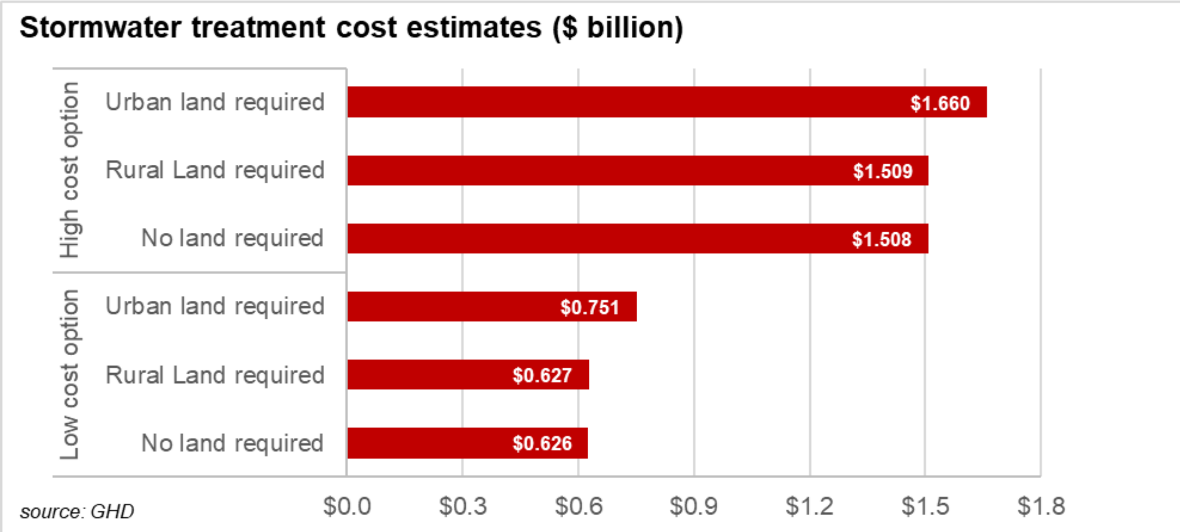


Figure *1*.

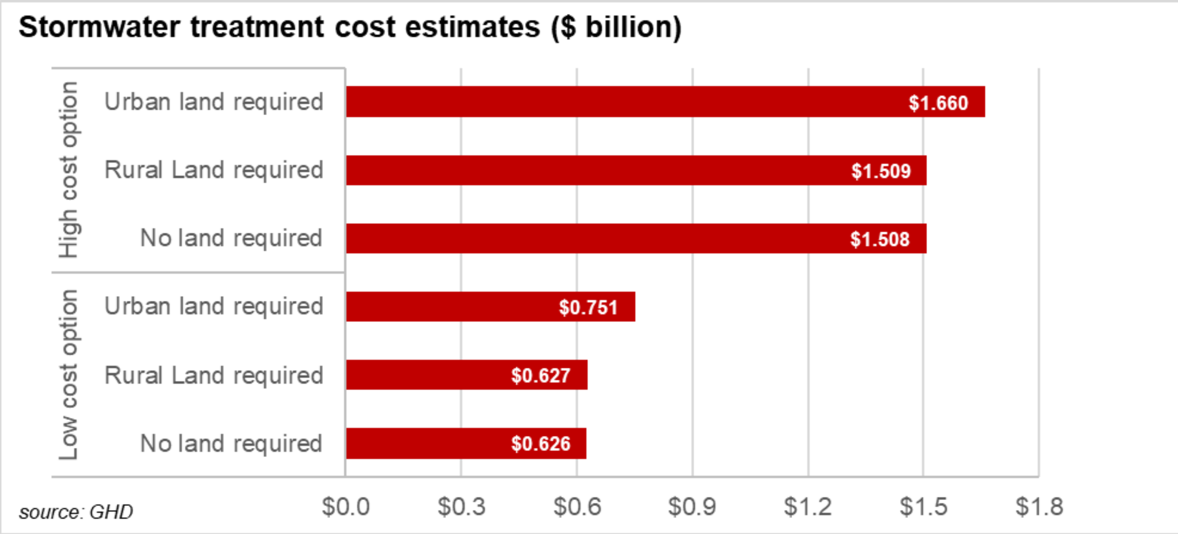


**Figure 1. Stormwater remediation costs accounting for land costs and low and high construction estimates**

## ESTIMATING WASTEWATER COSTS

There were two elements to the interventions to reducing *E. coli* loads: replacing Grade 4 and 5 pipes (the pipes in worst condition) and reducing overflows, primarily through increased pipe capacity and accompanying upgrades to pumps stations and rising mains.

- Dr Greer was able to provide an estimate of the length of pipes that were graded 1 through 5, as well as his indicative estimate of the share of Grade 4 or 5 pipes that would need to be replaced to achieve the TAS / MRI, or the reduction in overflows that would be needed, or both.
- Working with WWL, I was able to estimate the cost of a typical like-for-like pipe replacement for 150mm pipes for instance (to estimate Grade 4 and 5 replacement costs), as well as pricing for larger gauge pipe replacement to improve capacity and to upgrade pumps stations and rising mains (to estimate costs for reducing overflows).
- A further important element to reducing contamination from overflows is to reduce cross connections. WWL is not responsible for remediating cross-connections on private property but does envisage a programme to determine where cross connections exist and require homeowners to remediate the problem. This programme is estimated to cost around $18,750,000 over the implementation timeframe.
- It is not known at a pFMU level what share of the pipe network would need to be replaced with pipes of greater capacity to reduce overflows. Our working assumption, reasonably borne out by WWL data, is that replacing 20% of pipes with higher-capacity pipes would overcome 100% of the capacity problem.
- Armed with cost to replace; lengths of each grade of pipe in each pFMU; the share of pipes needed to eliminate capacity constraints; and Dr Greer's indicative estimates of the reduction in overflows or pipe replacements needed to achieve the TAS or MRI in each pFMU, I could estimate the cost of pipe replacement work. An example follows:

In pFMU X, the MRI could be achieved by reducing dry-weather leaks by 64% and overflows by 49%. There are 20.37 km of Grade 1 to 3 pipes and 1.74 km of Grade 4 to 5 pipes (22.11 km in total).

- Reduce overflows by 49% by replacing 49% X 20% X 22.11 = 2.17km
  These 2.17 km of pipes include some Grade 4 and 5 pipes that needed replacing anyway, so we don't want to double-count pipe replacement. We will have already replaced 0.17 km of Grade 4 and 5 pipes with higher capacity pipes.

- Replace 64% of Grade 4 and 5 pipes minus the 0.17 km we have already replaced with higher capacity pipes, which equates to 64% X 1.74 km – 0.17 km = 0.95 km.

Working with WWL case studies and scaling up for different pipe sizes provided estimates of pipe replacement costs. Higher capacity pipes are assumed to be 250mm pipes replacing 150mm pipes on average, at a cost of $5,130 per lineal metre. Other Grade 4 and 5 replacement pipes are assumed to be 150mm pipes at $4,070 per lineal metre.

Therefore, 2,170 m X $5,130 + 950 X $4,070 = $14.97 million.

- Unfortunately, because I do not know how many pump stations and rising mains need to be upgraded, I was unable to estimate the total cost of those capacity upgrades as part of our work.

  As with stormwater, there were sometimes more than one intervention option for a pFMU, allowing a higher and lower estimate of costs for that pFMU. Typically, interventions that required overflow treatments as well as Grade 4 and 5 replacements were more costly. The range of wastewater costs for achieving MRI and TAS is shown in

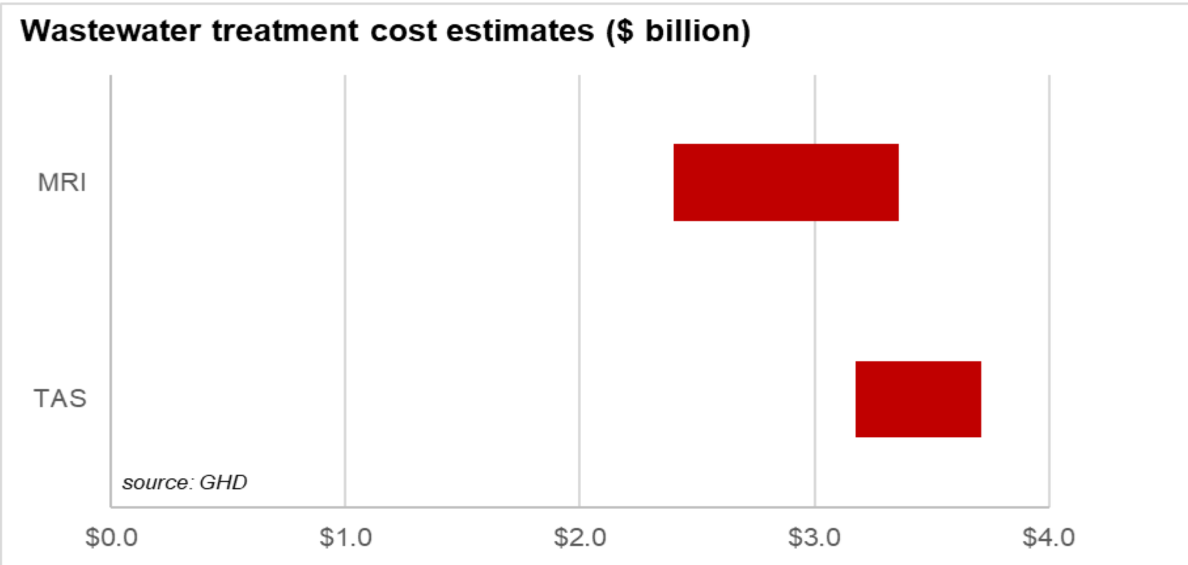


Figure *2*.

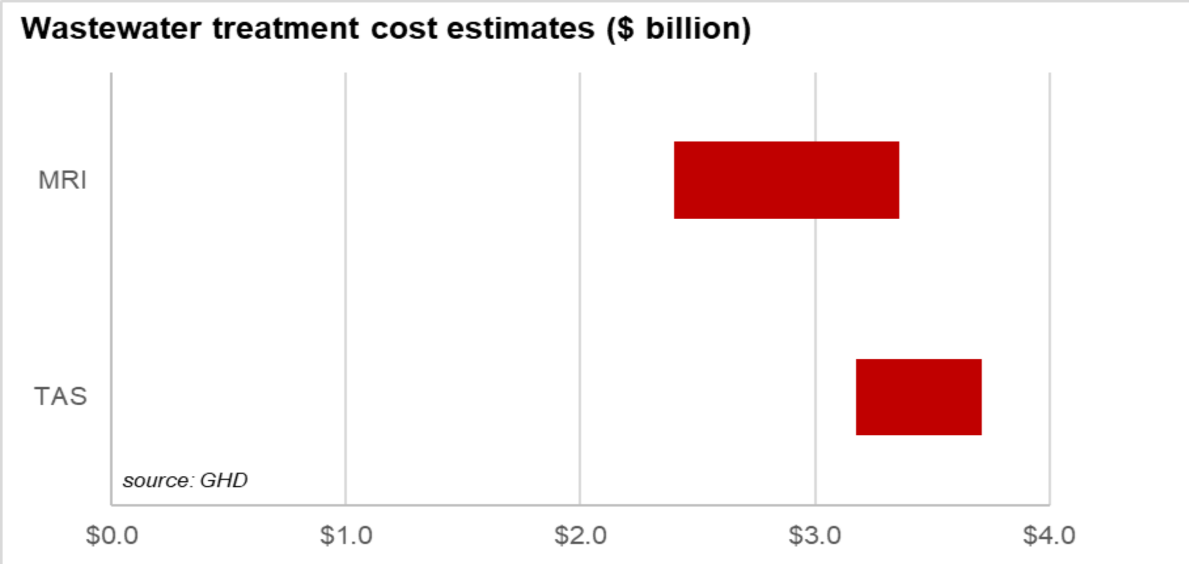


**Figure 2. Range of costs for achieving wastewater targets**

**LONG-TERM PLAN (LTP) INCLUSIONS**

Having estimated the costs of achieving PC1 metals TAS and *E. coli* MRI and PC1 TAS, the question arose as to whether these costs would all be additional to what is currently planned in LTPs or whether some of the costs were already anticipated in current LTPs. We downloaded data and PDFs of the LTPs to understand recent historical and planned spending on stormwater and wastewater capital projects.

Unfortunately, the data and the public LTP documents do not provide much detail on what projects are included under the stormwater and wastewater renewals and level of service improvement categories. I was able to determine that some large projects that are not aimed at achieving the MRI and TAS are included in LTP figures, such as the wastewater treatment plant renewal at Seaview, which means that the share of the LTP figure being spent on achieving the MRI and TAS covered in the evidence will be smaller than the LTP overall figure. Further, anecdotally I know from announcements out of the TAs that a relatively small length of pipes is being replaced each year.

**AFFORDABILITY OVER DIFFERENT TIMEFRAMES**

Having estimated costs to achieve council ratepayer contributions to achieving metals TAS and *E. coli* MRI and TAS, it was important to understand the affordability of these costs to ratepayers.

I began by sourcing a lot of data from different sources:

- I used Council Annual Reports to determine total rates revenue collected by each council including rates collected on behalf of Greater Wellington Regional Council.
- I used Sense Partners population and household forecasts to determine approximate population and number of households in each pFMU.
- I mapped each pFMU across council boundaries to assign part or all of each pFMU to councils in which they fall.
- I sourced 2024 estimates of household income by council area from Infometrics.

- I sourced the share of population who are of working age (15 to 65 as per the Stats NZ definition) from Stats NZ, as well as forecasts on how this is expected to change over time. The higher the working-age population, the more earning power and therefore ability to pay for improved water infrastructure. This data yielded the graph in

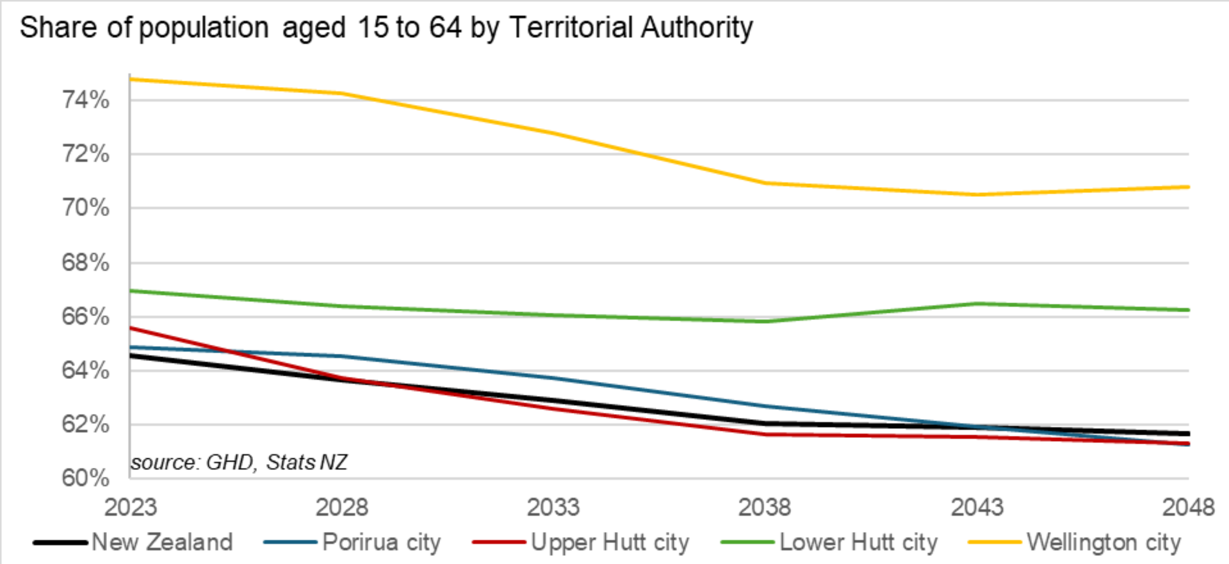


Figure *3*.

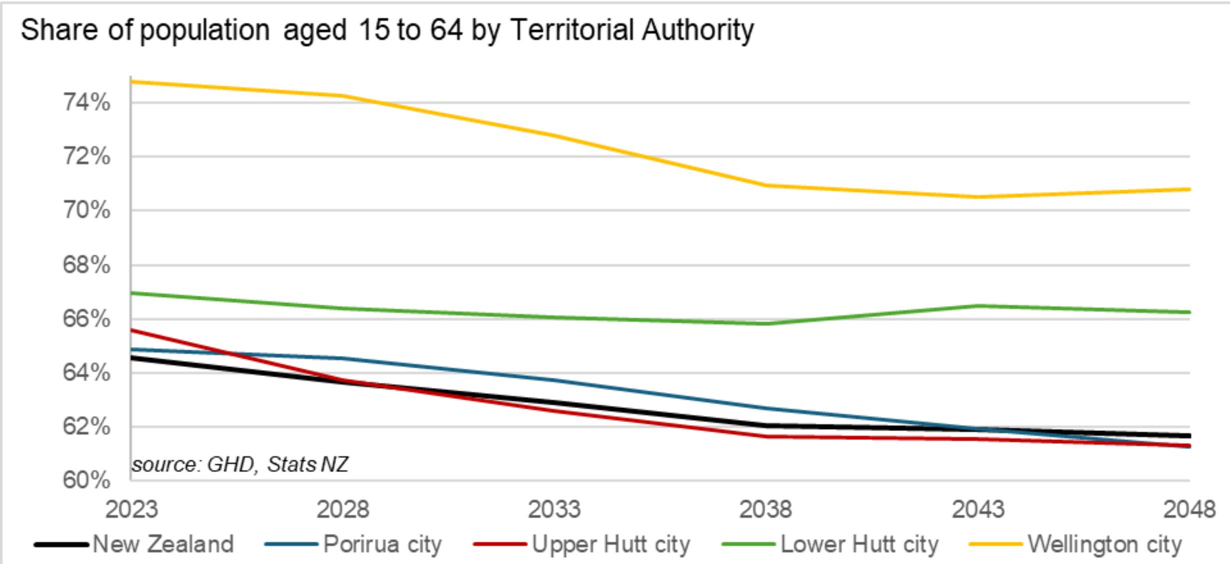


**Figure 3. Population of working age by council over time**

- I used the information on costs by pFMU calculated previously, plus estimates of how much of each pFMU fell in each council, to estimate a dollar cost per council area to achieve the MRI and TAS.

- I divided total rates collected by council by the current number of households to get an estimated total rates per household for each council area.

Having established the cost per local council area for remediation to achieve the targets, I could:

- Divide those costs by the appropriate timeframe for achieving the targets, ranging from the 16 years to 2040, to a longer 36-year timeframe to 2060.

- Divide the cost per year for different timeframes calculated above by the current rates collected each year yielded the estimated step-change in rates required to support achievement of the MRI and TAS.

For example, Porirua in 2024 collected around $113.7 million in rates revenue (including regional rates). To achieve the TAS for metals and *E. coli* in 16 years would require up to $28.1 million in improvements spend a year each year, which is the equivalent of a $\frac{28.1}{113.7}$ increase in rates, or 24.8%. Over a 36-year period, this upper estimate would be $\frac{12.5}{113.7}$ or an 11.0% increase in rates. These impacts for Porirua by way of example are shown in

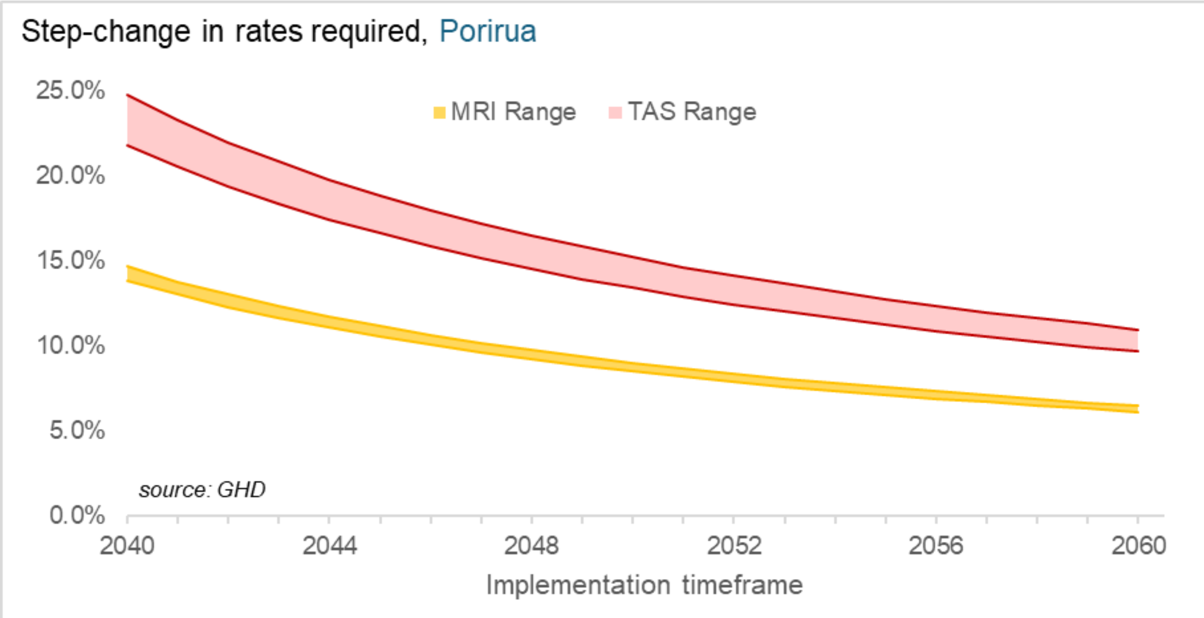


Figure *4*.

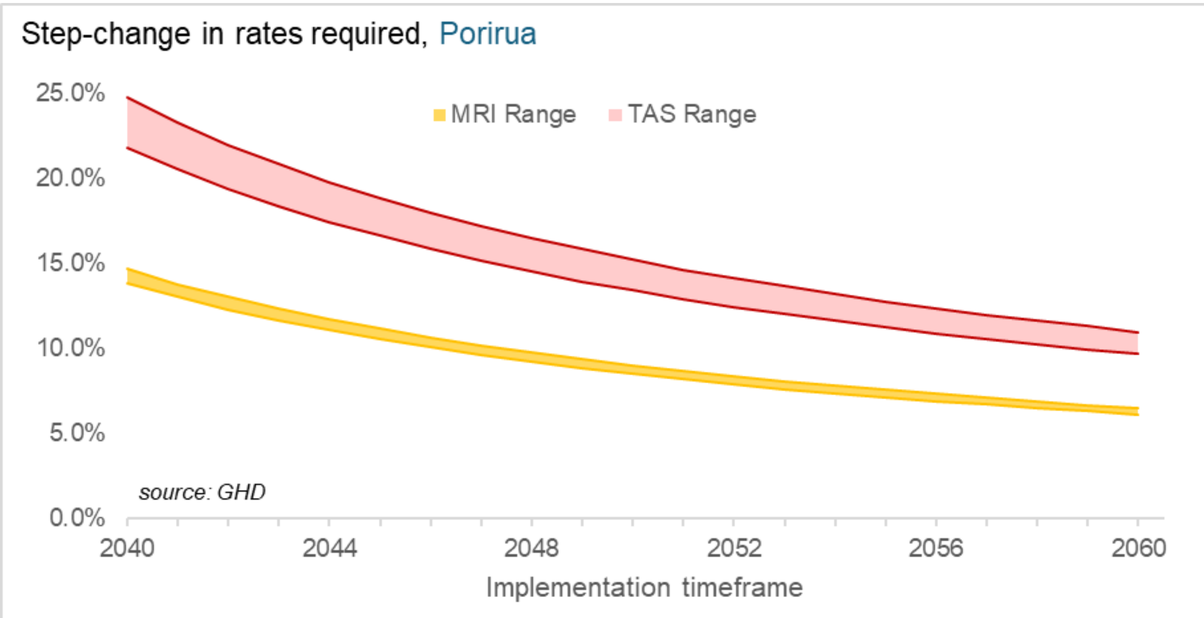


**Figure 4. Example of step change in rates required by target level and timeframe**

Some will argue that this figure is an overestimate because some interventions to achieve targets are already being undertaken each year. My response is that as discussed previously, the scale of interventions today to achieve targets is a tiny fraction of what is required, and my cost estimates are conservative in that they make no allowance for ongoing maintenance of new infrastructure (such as wetlands), or any costs of borrowing, for instance. I assume all improvements are "pay as you go".

**ACHIEVABILITY OVER DIFFERENT TIMEFRAMES**

A further question was whether the various targets were physically achievable over the timeframes being considered. To answer this, I considered:

- The size of the civil and heavy engineering sector in Wellington Region and the four TAs specifically compared to the national sector. This data was sourced from GHD's Regional Economic Database, which includes data on employment from the Stats NZ Business Demography dataset. This analysis is demonstrated in

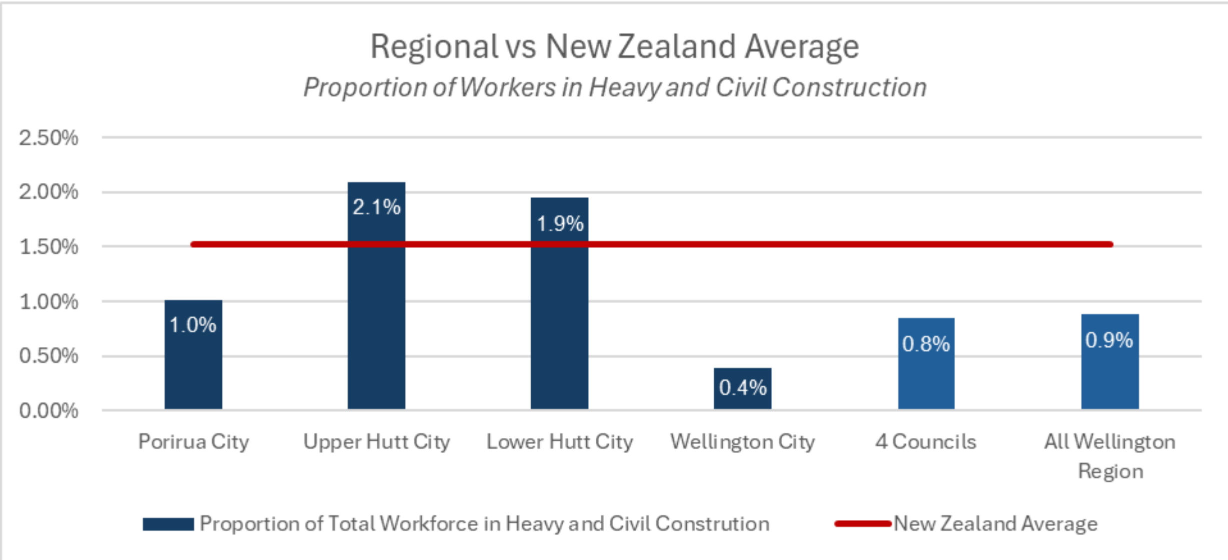


Figure *5*.

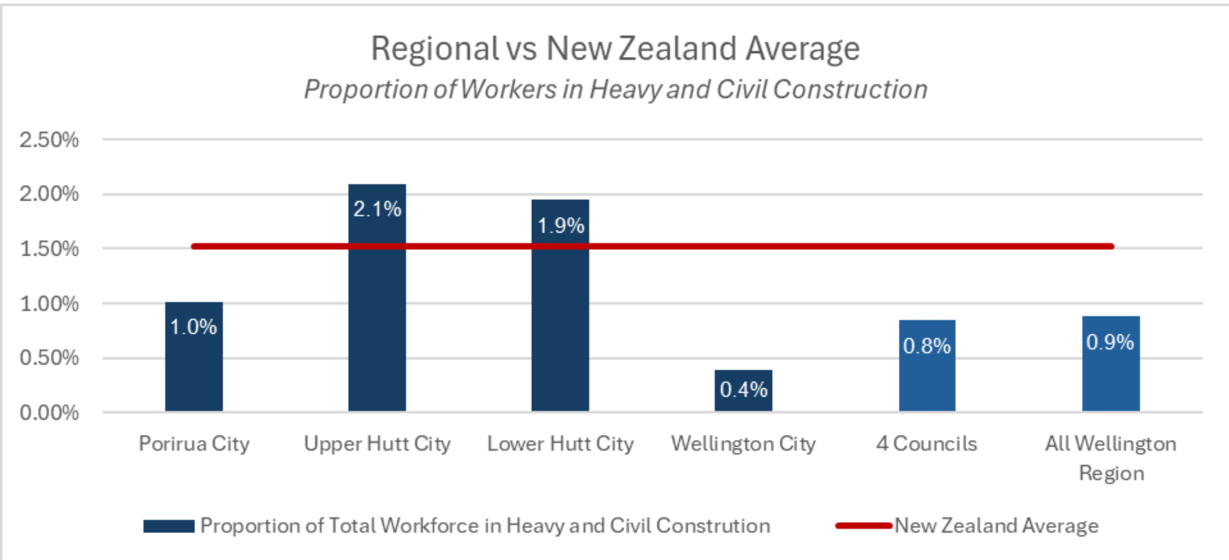


**Figure 5. Employment in heavy and civil construction across Wellington Region and New Zealand**

- Recent spending on stormwater and wastewater level of service improvements and renewals noting that those figures will include large amounts not relevant to the work that would need to be done to achieve the targets. This data was sourced from council Annual Plans and LTPs.

- Planned spending over the next few years in LTPs, noting again that these figures will overstate planned capital works targeting the load reductions covered in the evidence. This data was sourced from council Annual Plans and LTPs.
- These recent and planned LTP spend figures were compared to the annual spend estimated previously to achieve the MRI and TAS across different timeframes to demonstrate achievability. Importantly, we excluded the cost of any land purchases for stormwater management purposes as land acquisition does not require capital works and so including land costs would overstate the step-change in workforce capacity required to achieve the targets.
- Presenting recent annual spend on level of service improvements and renewals as well as what is planned in the next LTP against the annual spending required to support achieving MRI and TAS provided a clear picture of the step-change in activity by the construction sector required to achieve the targets. The overall picture for the two Whaitua is shown in

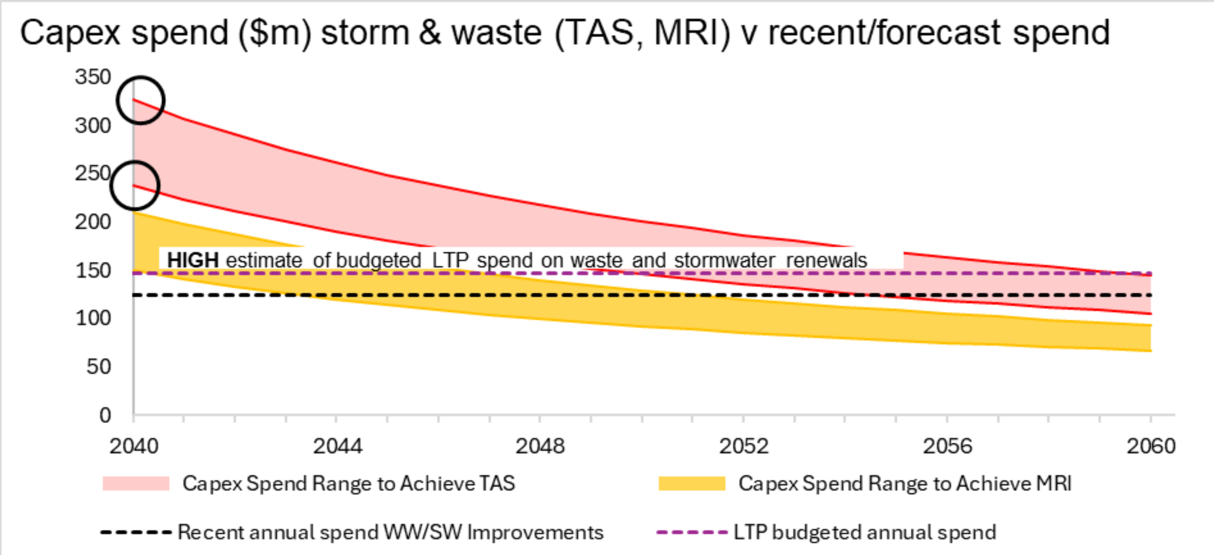


Figure *6*. Notwithstanding that the figures on recent spending and planned spend will include all sorts of other wastewater and stormwater spending not aimed at achieving the targets, there is a large step-change in spending (and this workforce capacity) required to move from today's levels to what is required for either the MRI or TAS if a 16-year timeframe is maintained.

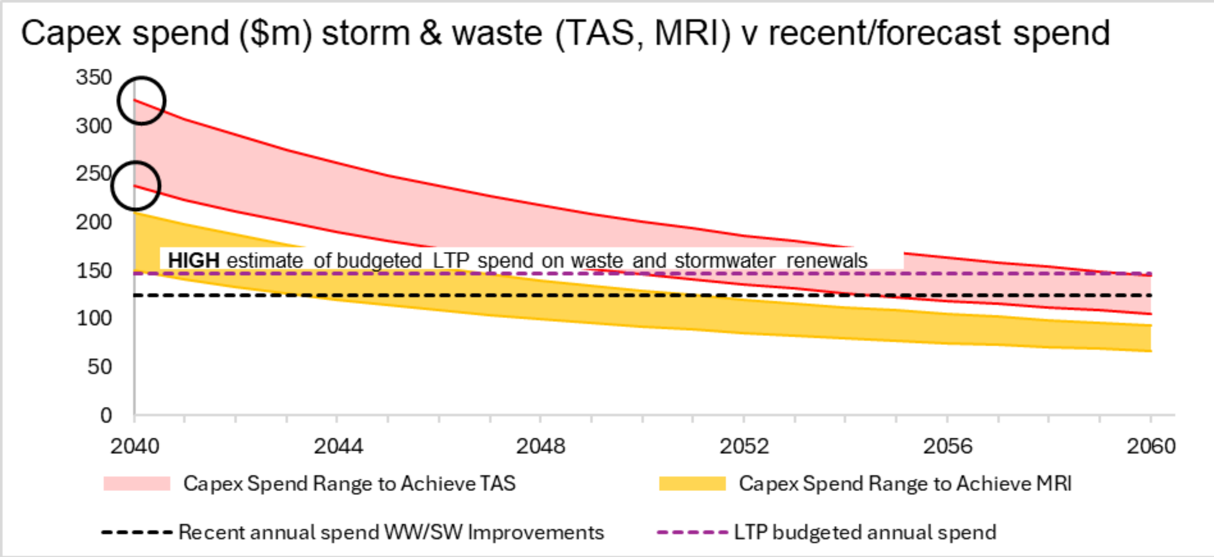


**Figure 6. Spend required to achieve targets compared to recent and planned spend**

It was also possible to present these step changes in capacity that would need to be dedicated to achieving the targets in terms of employment growth required in the sector:

- I estimated the GDP generated by the Wellington Region heavy and civil construction sector, then used that to estimate revenue for the sector.
- Having estimated revenue, I could divide spending by the four TAs on wastewater and stormwater renewals and level of service improvements to estimate the share of workers employed directly in these areas.
- Using the step change in spending required, I could estimate the likely step-change in employment needed to meet these capacity challenges. The results of this analysis are presented in

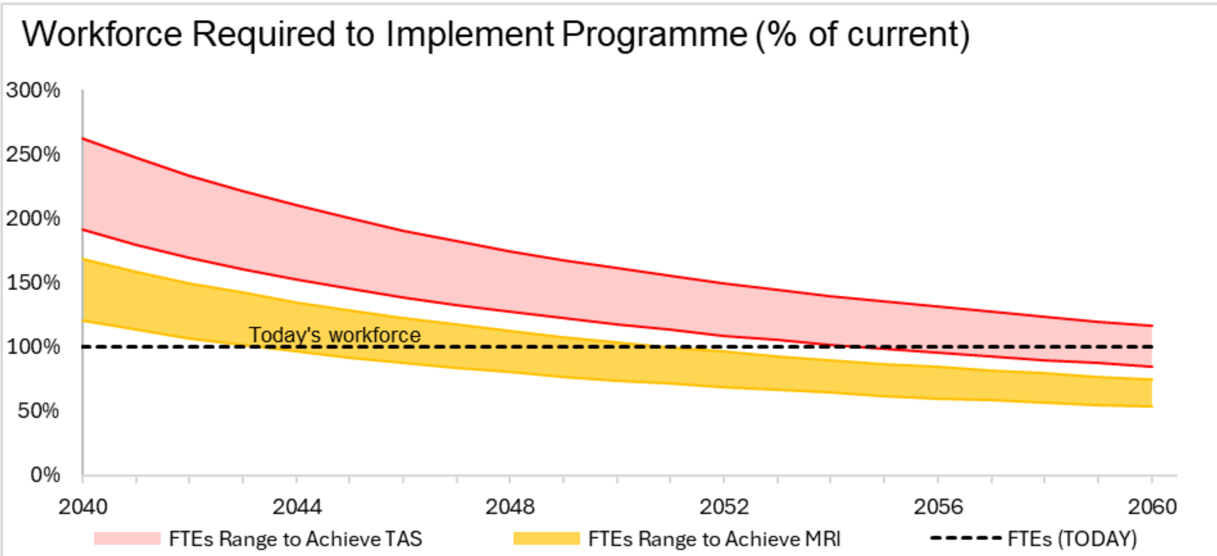


Figure *7*.

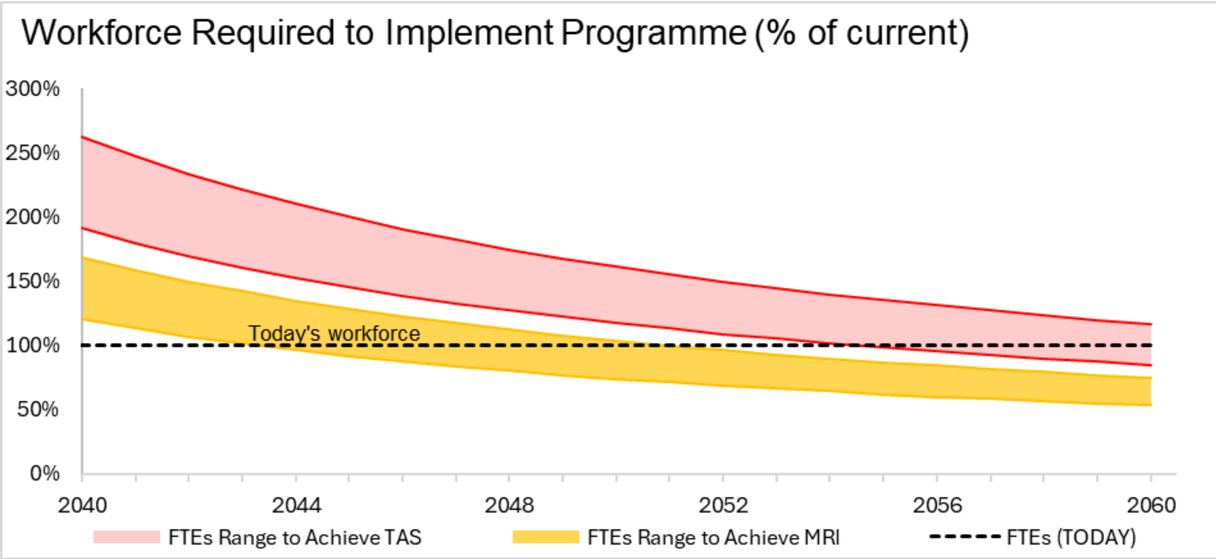


**Figure 7. Step-change in workforce size to achieve targets**