

MANAGING CARBON EMISSIONS THROUGH COLLABORATION AND EMPOWERMENT

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ABSTRACT

Wellington Water provides three water services to six client councils in the Greater Wellington Region. In providing these water services the business generates carbon emissions from both its operational and capital activities. The six client councils have declared climate emergencies, emphasising the need to reduce carbon emissions in line with New Zealand's Carbon Zero Act. Considering these commitments by the client councils and New Zealand Government - 'Net Zero by 2050' is the fifth strategic priority of Wellington Water.

To help achieve this priority, Wellington Water has integrated a carbon management system into its capital programme delivery process. This system enables carbon to be monitored, reported and reduced at every stage of the projects within Wellington Water's Long Term Plan. It has initially focused on 'capital' carbon associated with major renewals and the construction of new assets, but is expanding to incorporate a 'whole-life carbon' approach that also supports driving down operational and end-of-life emissions. The programme seeks to foster collaboration among the Wellington Whanau, including consultancy and contractor panels as well as internal staff. This collaboration is crucial for cultivating a culture of low-carbon thinking throughout the delivery value chain.

The challenges encountered by Wellington Water to incorporate this programme are:

1. Establishing a cohesive approach to tackle emissions while accommodating the different ambitions and commitments of each client council.
2. Creating a standardised system which still has the flexibility to accommodate different project types and sizes.
3. Implementing a new system and process at delivery level amidst uncertainties brought by Water Reform.
4. No funding provided by client councils to incorporate carbon monitoring within the programme of work.
5. Communicating the value of managing carbon and gaining the trust of the wider whanau in this process with the absence of legislative requirements.

Wellington Water operates a unique panel model with consultant and contractor organisations in New Zealand to deliver capital projects. Due to the funding constraints it was necessary to devise an innovative way to deliver the carbon programme and embed a governance system and process. Thus, a crucial component of the programme has been collaboration and change management with the consultancy and contractor panel. A focus was put on empowering stakeholders and wider whanau to help deliver this work, emphasising the role that everyone has to play in this carbon journey.

The engagement and collaboration with the carbon integration programme is resulting in several benefits, including improved data collection, higher uptake and use of information, and stronger acceptance and support from stakeholders. Collaboration with

the wider whānau has resulted in upskilling and utilisation of local knowledge which has led to a better understanding of capital projects and their associated carbon. With increased understanding of carbon embedded in projects, better decision-making and low carbon outcomes become possible.

This paper discusses the approaches taken by Wellington Water to establish a culture of collaboration and empowerment, and outlines the lessons learned from both success and setbacks encountered while navigating these challenges.

KEYWORDS

Climate change, carbon emissions, managing carbon, collaboration, empowerment

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Nadia has over 20 years of experience within the water sector and manages the Modelling Team at Wellington Water. Wellington Waters capital carbon programme is overseen through the Modelling Team with the aim to embed the carbon management system within Wellington Waters capital programme.

1 INTRODUCTION

Addressing climate change is a collective journey we must embark on together. In light of the Carbon Zero act passed in 2019 by New Zealand government, many councils in New Zealand, including those in the Wellington region have declared near term and long term targets to reduce their carbon footprint, and have publicly made statements and commitments towards addressing carbon emissions.

In Aotearoa New Zealand's water sector, managing and reducing carbon emissions associated with water infrastructure assets is becoming a growing priority in the transition towards a low-carbon and sustainable future. Water New Zealand recently published guidelines and acknowledged the role water infrastructure asset managers have to play in reducing both operational and capital emissions (Water New Zealand, 2022). Water infrastructure assets are built, operated, and maintained by many members of the value chain, and all these members have a role to play in reducing emissions.

Typically, the focus was mainly on reducing operational emissions both globally and here in New Zealand. However, it has become increasingly crucial for the water utilities to address and reduce the embodied carbon in capital project due to their significant contribution to the overall carbon footprint (Edmond, Thurston, & Dempsey, 2020).

This paper describes the journey taken by Wellington Water in setting up a carbon management system for the capital projects by adopting principles from PAS 2080. The paper discusses approaches, key lessons learned during implementing the carbon programme and some the challenges encountered through this process. The journey of implementing the carbon programme would not have been possible without the collaboration and engagement of the consultancy and contractor panel.

Collaboration with the wider whānau has resulted in upskilling and utilisation of local knowledge which has led to a better understanding of capital projects and their associated carbon. With increased understanding of carbon embedded in projects, better decision-making and low carbon outcomes become possible.

The paper also highlights insights from Wellington Water's journey and will be of interest to other water authorities who are considering setting up a carbon management and governance system to drive carbon conscious and reduction behaviors across their capital delivery value chain.

2 WELLINGTON WATER'S CARBON JOURNEY

Wellington Water is responsible to manage and operate water infrastructure assets of six client councils across the Wellington Region, including Greater Wellington Regional Council, Wellington City Council, Hutt City Council, Upper Hutt City Council, Porirua City Council, and South Wairarapa District Council. The organisation manages eight water treatment plants and eight wastewater treatment plants serving a population of around 450,000 people across this region.

Wellington Water operates a unique collaborative, relationship-based panel model which consists of consultant and contractor organisations. The model not only ensures alignment with strategic priorities but also aims to deliver on innovation and knowledge sharing through collaborative practices. This collaborative environment provides an opportunity to collectively address and reduce carbon emissions.

In delivering water services, Wellington Water contributes carbon emissions in two key ways:

- Capital carbon emissions, which are the embodied emissions of capital project, which includes manufacturing & transporting materials, construction activities, and waste disposal.
- Operational emissions, are emissions associated with the operations of treatment plants and networks, which includes process emissions of wastewater treatment plants, electricity, fossil gas, etc.

Back in 2018, the water industry was moving towards addressing operational carbon emissions, and Wellington Water took steps to develop its first operational carbon inventory. However, this did not give the full picture of the organisation's carbon footprint. A comprehensive understanding the capital carbon footprint had to be assessed to provide a full picture of emissions associated with the delivery of capital infrastructure projects.

Wellington Water embarked on a journey to reduce its overall carbon emissions, which began by setting up a strategic priority 'Net Zero by 2050'. This strategic priority is one of the five priorities, the others include: looking after existing infrastructure, supporting growth, sustainable water supply and demand, and improving environmental water quality.

The commitment to reduce carbon was further reinforced by incorporating statement of intent (SOI) measures in annual reports (Wellington Water, 2021). Although councils have declared climate emergency and Wellington Water has committed to prioritise emissions reduction, only limited funding is made available for implementing carbon reduction within the sector due to competing priorities within the water industry, including addressing ageing infrastructure and tackling water loss. It is accepted though that in many cases understanding the carbon emissions of infrastructure in the planning phase can reduce the cost of infrastructure as well as ongoing maintenance.

However, Wellington Water recognised that clear steps had to be taken towards proactively committing to reduce carbon emissions through these SOI measures. The SOI measures for the financial year 2021/22 outlined the following objectives:

- Baseline carbon emissions from capital works, and identify potential improvements,
- Update stocktake of operational emissions, and optimise performance of operations to increase energy efficiency, and
- Develop a roadmap for emissions reduction.

Consequently in 2021, Wellington Water commissioned the capital carbon baseline programme working with Mott MacDonald to estimate emissions associated with its capital projects by adopting principles from the PAS 2080.

3 PAS 2080: 2018

As the saying goes, 'you can't manage what you don't measure', Wellington Water acknowledged the importance of starting its journey by understanding the extent of carbon emissions associated with its capital works, before embarking on efforts to reduce emissions.

PAS 2080, a publicly available standard developed by the British Standard Institute (BSI) provides a common framework for all stakeholders involved in delivering infrastructure projects (Manidaki, Depala, Ellis, Steele, & Roe, 2016). With the objectives to encourage stakeholder collaboration, challenge the necessity for new infrastructure, and identify innovative methods to reduce carbon emissions while also lowering infrastructure delivery costs. PAS 2080: 2018 has during the start of Wellington Water's carbon journey been revised and published as PAS 2080: 2023. The standard has an expanded scope, a new emphasis on whole life carbon, and a stronger alignment with the transition to a net zero carbon economy by 2050

To achieve carbon reductions in capital projects, it is essential to set up a robust carbon management system within existing capital delivery processes, as illustrated in figure 1. This process encompasses few main components as mentioned below:

- **Baselining** to identify carbon hotspots, where carbon reduction efforts can be focused, and to provide a reference point to assess carbon reduction performance.
- **Quantification** of carbon emissions at key stages by defining reporting boundaries, quantification methods (top-down or bottom-up assessment), and using quantification tools.
- **Monitoring** as projects progress from one phase to another, in order to track performance at each key touch points of delivering an asset, and against project baselines.
- **Reporting** at appropriate work stages to enable visibility to all value chain members, and to establish metrics and performance indicators.
- **Continuous improvement**, to feed learnings from one work stage to another, and to provide a collaborative environment to learn, foster innovation, and incorporate reduction outcomes for future projects.

In establishing these components of the carbon management system, it is crucial to foster a culture built on collaboration among asset owners, contractors, consultants, and suppliers. The current operating panel model of Wellington Water provides the required mechanism and governance structure to promote this culture, and to integrate this system within the existing capital delivery process.

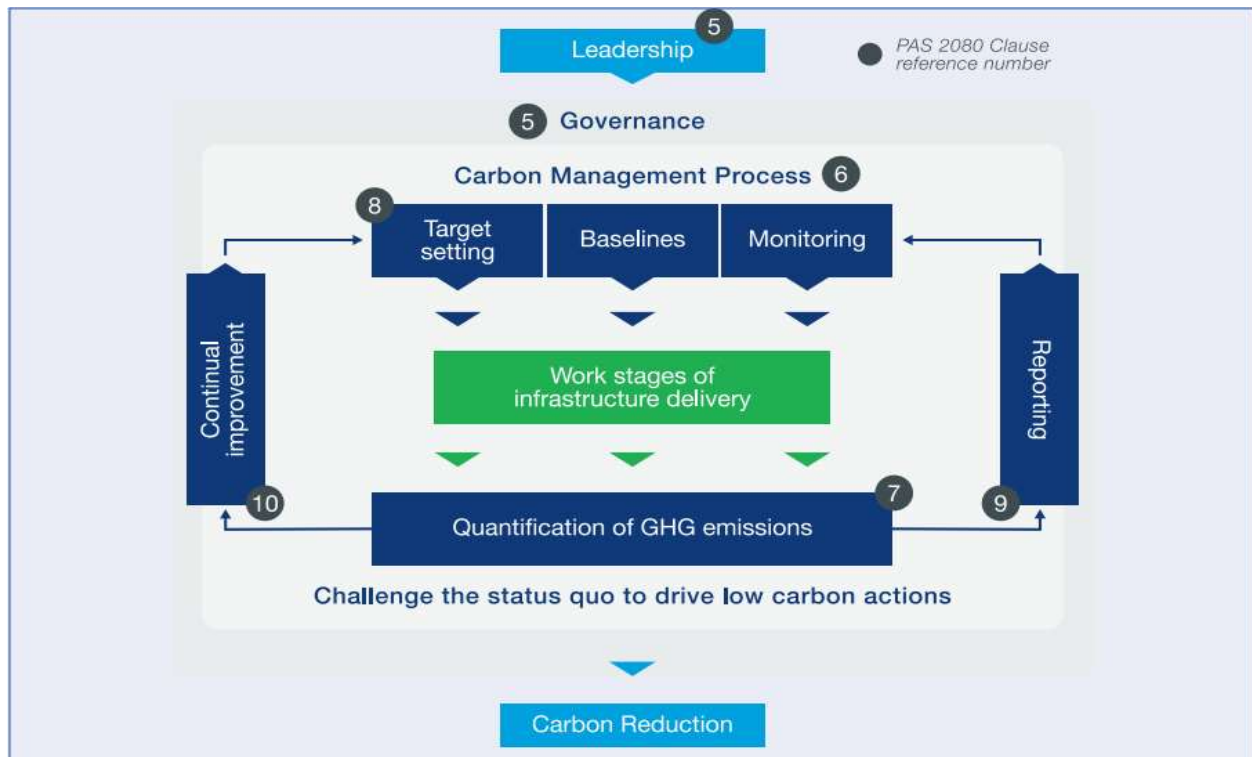


Figure 1: PAS 2080: Carbon Management Process

4 CARBON BASELINE

Baselines are a crucial component to effectively manage carbon emissions in infrastructure projects, as it serves as a starting point for emission reduction efforts. Baselines are typically established for either a programme of work or a specific project. In the case of Wellington Water, a capital carbon baseline programme was commissioned in working with Mott MacDonald, to establish a baseline for the projects in the three-years long term plan from 2021 to 2024.

This initiative aimed to provide a comprehensive understanding of embodied carbon emissions associated with capital projects included in the three year plan, and to serve as a benchmark to compare future carbon reductions against. The three year plan was chosen due to the detail and data that is available to support carbon emission calculations.

The baseline provides a focus on key assets, materials, and construction method hotspots, along with a programme view for carbon reduction opportunities. The baseline captured around 80% of total capital value of the long-term plan, including a number of drinking water, wastewater, and stormwater infrastructure assets at different stages of their delivery. The outcome is a baseline of 83,500 tco₂-eq across projects constructed in three-year period of the long term plan

Due to the nature of capital works of Wellington Water, the majority of the carbon was found in drinking water projects predominantly due to constructing large water reservoirs, bridges, and network upgrades to support growth and supply demand in Wellington region. The majority of the carbon estimated in drinking water network and reservoir projects, is mainly due to two projects: the Omaroro Reservoir and Kaitoke main on Silverstream Bridge, which together account for 46% of the total capital carbon emissions.

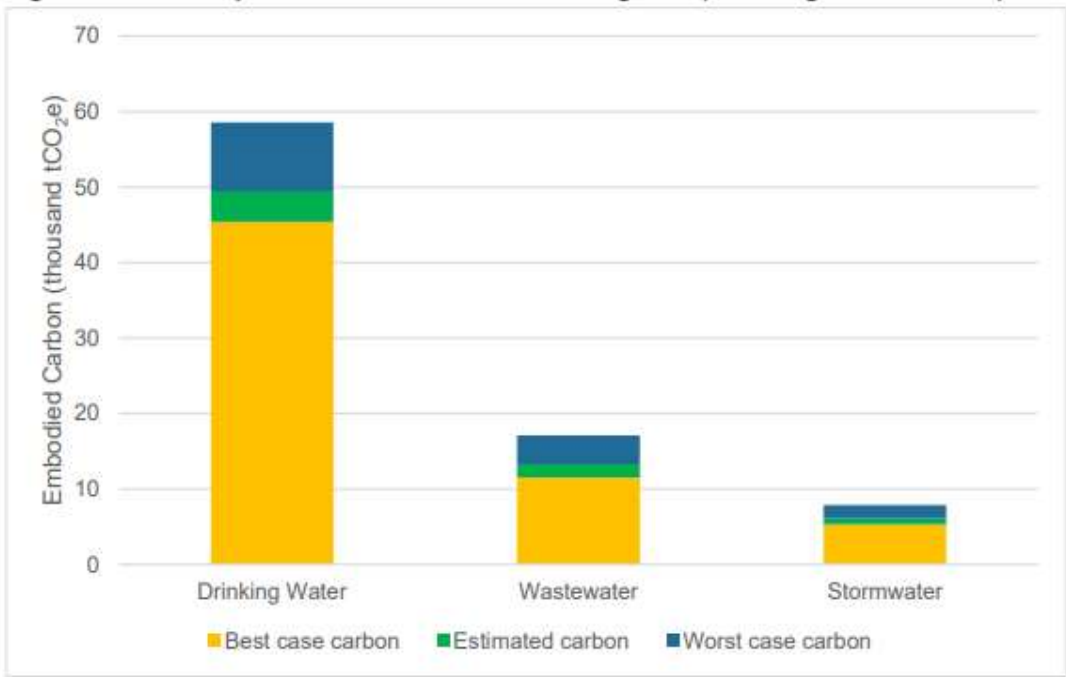


Figure 2: Capital carbon baseline across three waters category

Due to Wellington Water’s focus in addressing water quality and supply shortfall within the region the majority of infrastructure projects are water supply projects. It is therefore no surprise that the carbon was mainly associated with drinking water projects. Among the asset categories analysed, pipe and manholes constituted one-third of the overall embodied carbon in the long term plan. This was largely due to carbon associated with network projects. Similarly, reservoirs also contributed a significant portion to the carbon baseline due to the embodied carbon in concrete and steel structures used.

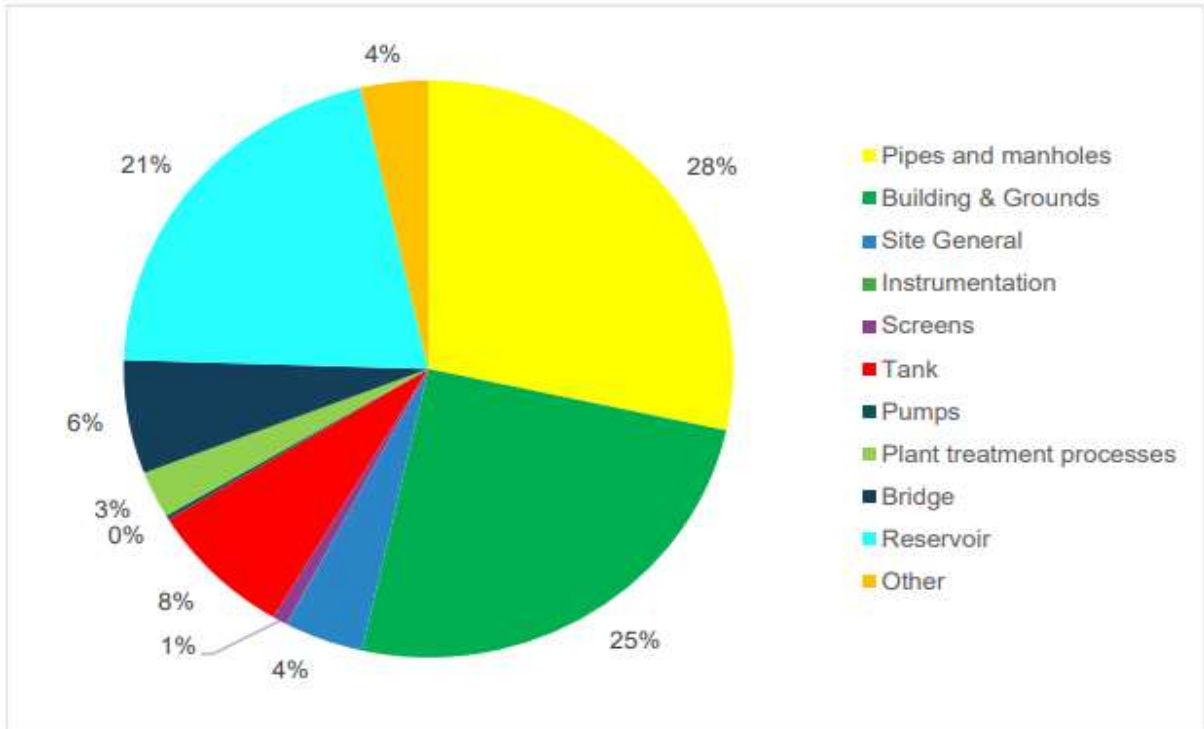


Figure 3: capital carbon of long term plan by asset category

The baseline programme highlighted several insights, setting the stage for targeted business decisions. Some of those insights include:

- Establishing of carbon management system: The programme emphasised the need to establish a monitoring and reporting mechanism at key stages of project delivery. This system would ensure that emissions are effectively tracked and managed throughout a project's lifecycle.
- Role of stakeholders in carbon reduction: The baseline program highlighted that every stakeholder involved in delivering capital projects had a role to play in demonstrating carbon conscious practices. Therefore, a collaborative approach would be essential to achieve meaningful reduction outcomes.
- Integrating carbon assessments into business-as-usual (BAU) practice: The programme focuses on education and building capacity, by developing guidance for carbon assessment and implementing a training plan.

By uncovering these insights, a clear direction was established to set up an Integration plan by involving stakeholders across the delivery value chain. The Senior Leadership team and 3 Waters Decision Making committee supported this initiative to progress.

5 INTEGRATING A CARBON MANAGEMENT SYSTEM

In line with the goals and principles laid out in PAS 2080, Wellington Water had to come up with an way to integrate a carbon management system, within the context of constrained funding, to support carbon reduction initiatives. To address this, the capital delivery process update (Project Toolbox) provided a window of opportunity to incorporate some of the components of PAS 2080 into existing processes. The capital projects are delivered using the phases and gateways as shown in below diagram.



Figure 4: Wellington Water's Capital delivery Phases and Gateways

The Carbon Integration programme plan was established, with the primary objective to integrate a standardised carbon management system into this existing process. A crucial part of the integration of carbon was envisioned to be achieved through collaboration and change management with the panel members. The focus of this collaboration was to understand the needs, system, and processes that would be needed in order for the integration to be successful. This involved engaging the entire delivery value chain, including Wellington Water's capital delivery team, panel consultants & contractors.

The aim of the plan is to effectively monitor and report carbon emissions generated by capital projects, while encouraging carbon-conscious practices, and to enable well-informed decisions into long term business processes.

The programme is structured into several sequential phases, including planning, resource development, rollout, initiation of monitoring & reporting, and improvements. Currently, the programme is in the rollout phase. In the initial planning phase, the requirements and stakeholder expectations for implementing a carbon management system were

identified. Subsequently, the development phase focused on developing necessary resources such as guidance documents and introducing carbon quantification tools.

Throughout the entire programme, collaboration with members of the value chain has remained a crucial aspect, which is being achieved through workshops and training sessions. This approach ensured that all members are actively involved, develop shared understanding, and get stronger acceptance from stakeholders.

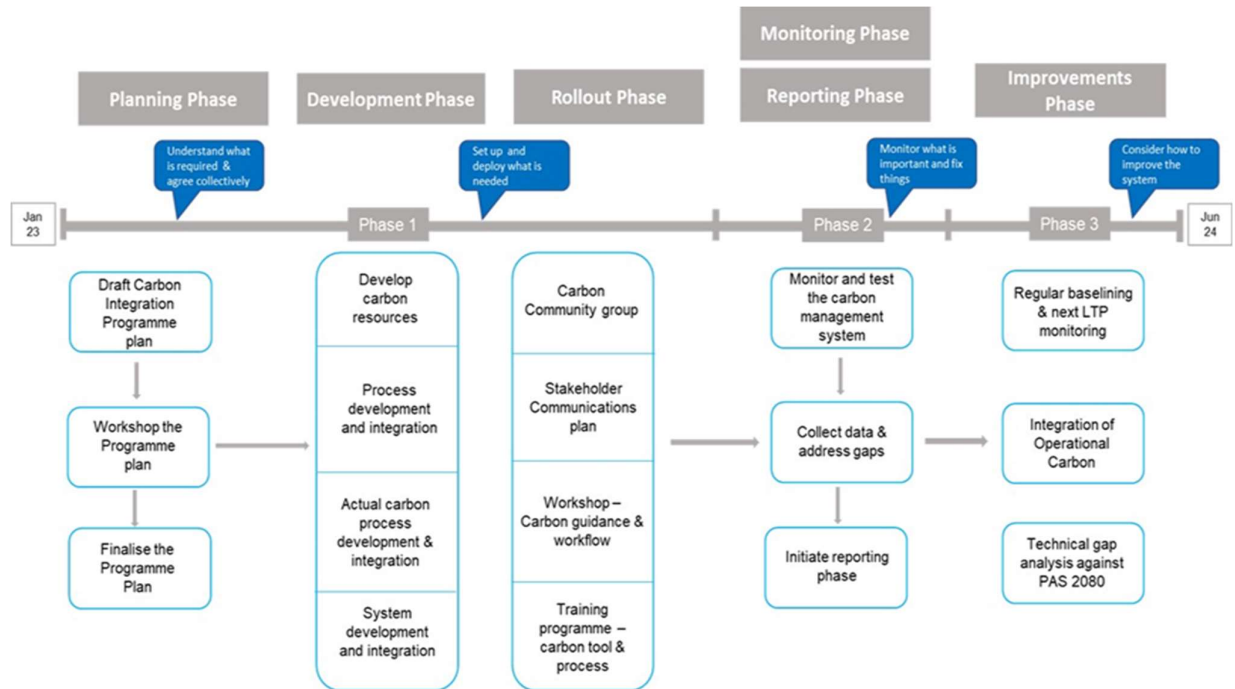


Figure 5: Carbon Integration Programme Plan

The key deliverables of the programme are:

Resources and tools to set up a standardised system:

In following the PAS 2080 carbon management framework and guidance, it is clear that carbon should be measured and reported at key stages of delivering capital projects. In doing so, it would be a collective effort required by the delivery value chain to implement this system. A standardised system would be required for consistent reporting, and to enable the functioning of regular monitoring of carbon.

In setting up a standardised carbon management system, the key aspects of the programme are education, collaboration, and building capacity. To achieve these, a Carbon Guidance document and the Moata Carbon Portal is being adopted within the capital delivery process.

Carbon guidance document:

The Carbon Guidance document of Wellington Water is collaboratively developed with inputs from different members of the value chain. The document provides guidance on how to manage carbon within the existing capital delivery process. The aim of the document is to provide:

- Clarity on the process to follow and reporting requirements,
- To standardise a methodology and carbon deliverables,
- To encourage carbon reduction initiatives, and

- To incorporate low-carbon practices

Carbon Tool:

As part of the carbon management system, a quantification tool would serve as an integral part in carrying out carbon assessments and embed carbon-conscious thinking into business processes. For these purposes, Wellington Water is adopting Moata Carbon Portal to measure and report capital emissions.

This carbon tool is equipped with existing carbon models to facilitate high-level top-down assessments for projects in their early stages which allows for preliminary estimations. As project progress, into design and construction stages, the tool also supports bottom-up detailed material assessments, providing a more in-depth and accurate analysis. By enabling these two types of approaches, the tool allows carbon to be considered through the different stages of a project delivery.

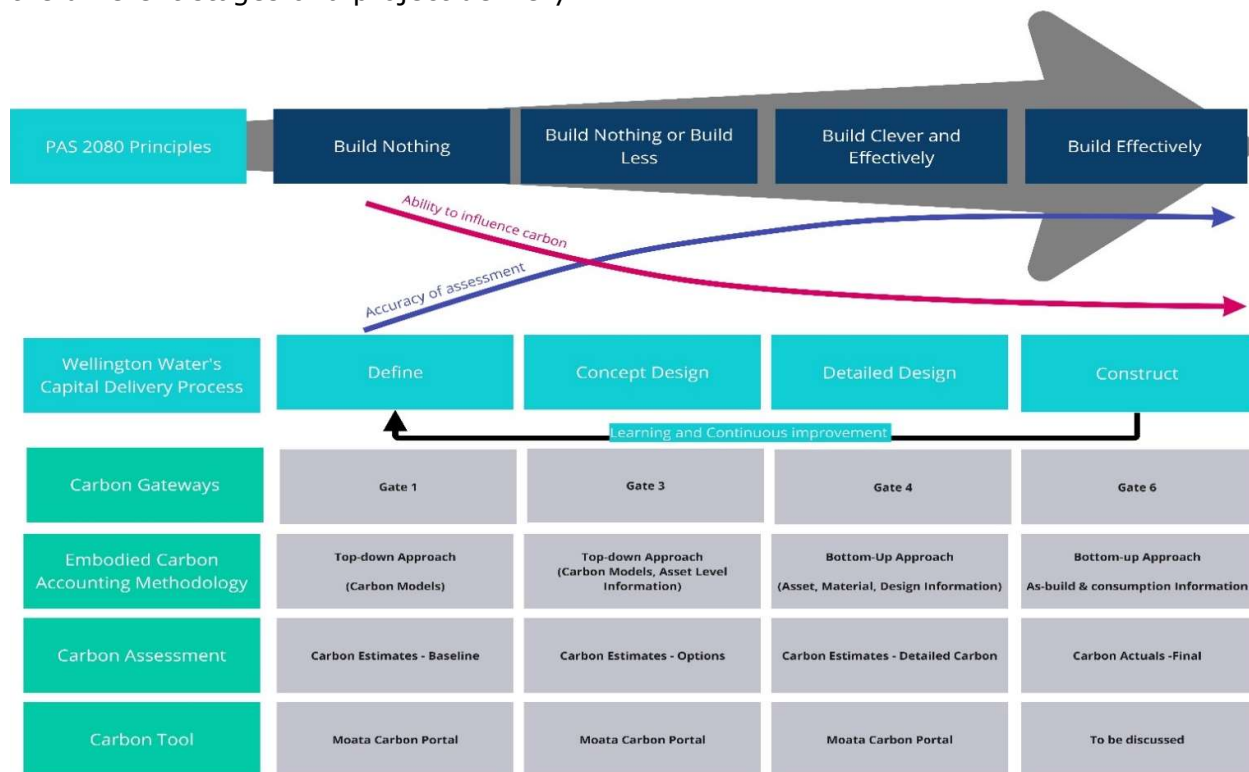


Figure 6: Conceptual carbon framework of Wellington Water

6 DELIVERY THROUGH COLLABORATION AND EMPOWERMENT

As part of this programme, a working group called the Carbon Community Group was established to function collaboratively on carbon initiatives of Wellington Water. The group is representative of members of the different work stages of capital delivery value chain including engineers, designers, project managers, consultants, and contractors.

The formation of this group was driven by the intent to collaboratively oversee and promote the various carbon initiatives. In efforts to promote these initiatives, the group's aim is to maintain an ongoing dialogue about carbon within the capital delivery value chain. Additionally, the group plays a role in facilitating the implementation and improvement of the developing carbon management system.

After the establishment of the Carbon Integration Plan, the outline and the outcomes it aimed to deliver on were workshopped with this group to seek input and perspectives from different representative members. The purpose of this workshop was to facilitate a discussion around the objectives of the plan and to generate ideas while comprehending the essential components needed to effectively integrate the carbon management system.

Subsequently, the group focused its efforts towards developing the Carbon Guidance document over two workshop sessions. The objective of these sessions was to outline procedures for carbon assessment reporting criteria at each phase of capital delivery. At present, the group is actively testing the application of the formulated guidance document, with the intention to publish it for wider adoption.

These guidance document and knowledge sharing practices are empowering stakeholders by equipping them with necessary tools and resources necessary to make well informed decisions that align with the overall goal to reduce carbon.

This approach not only provides the opportunity to collaborate amongst distinct work streams, but also provides a platform to learn about carbon management practices. These learning platforms empower stakeholders to adopt these new practices and helps to transparently communicate the rationale behind it, along with the challenges that come with it.

7 CHALLENGES

A number of challenges were identified though this journey:

- **Setting up a cohesive carbon reduction approach:** The current operational model of Wellington Water presents challenges when it comes to implementing a cohesive approach to reduce carbon emissions. This is primarily due to variations in ambitions, investment prioritisation, and climate objectives among the different councils served by Wellington Water. Each council has its own emissions portfolio, which necessitates different areas of focus for emission reduction efforts.
- **Establishing a standardised system with enough flexibility to suit different types and sizes of projects approach:** Due to the diverse range of stakeholders involved, and sources of data and tools, there is a risk of misinterpreting information, which might hinder effective decision making. All these factors can lead to discrepancies and inconsistencies in carbon management practices.
- **Active stakeholder buy-in through behavioral change:** Behavioral change is identified as a key risk as there new methodologies, tools, and practices that had to be adopted. Communicating the value of managing carbon and gaining the trust of stakeholders through this process has been essential.
- **Absence of legislative requirements:** At present reporting carbon emission is not a statutory requirement for Wellington Water. A large portion of emissions might get unnoticed or unreported, in the absence of such requirements, reporting and governance systems, and mandated reduction targets.
- **Finding a balance between funding, project outcomes, and promoting effective carbon reduction practices:** In driving good carbon reduction practices, a crucial notion that emerged during the integration of this system is that lower carbon results in higher costs, which might not always be the case. This has significantly highlighted the need to balance the two parameters (cost & carbon), without impacting other project outcomes and allocated fundings.

- Although reducing carbon emissions is a priority for Wellington Water, low carbon approaches had to be adopted without making significant low carbon emissions investment decisions.

8 KEY BENEFITS AND LESSONS LEARNED

There are a number of benefits and lessons learned from implementing this programme of work on carbon management, some of those identified include:

- **Establishing a culture of collaboration:** Having a collaborative work environment and actively engaging key members of the delivery value chain, helps to incorporate diverse perspectives and experiences into existing systems. This approach is proving instrumental in building capacity and creating shared understanding.
- **Feedback learnings and continuous improvement:** Carbon management is an ongoing process that requires constant evaluation, improvements based on lessons learnt, and adaptations as more information becomes available. In setting up this system, over time, it will provide benefits to continuously improve and enables the value chain to keep carbon reduction in mind.
- **Being consistent:** A carbon management system ensures that carbon is consistently and transparently quantified at key points in delivery, so that well interpretable data can be shared along the supply chain. Through this, common practices can be adopted, and programme wide efforts can be made.
- **Empower decision makers to embrace the challenge, and consider carbon in key stages:** Shared learning, building capacity, and upskilling the value chain are several benefits that can be unlocked.
- **Integrated approach alongside other environmental and project outcomes:** In setting up the system, an integrated approach allows to include carbon within projects alongside achieving other project outcomes, rather than making it THE OUTCOME.

9 CASE STUDY: DRIVING OPTIMAL EMISSION REDUCTION OUTCOMES FROM THE GET GO

Wellington Water are only at the start of their carbon reduction endeavors and are just starting to uncover the potential opportunities for reducing carbon emissions within their programme initiatives, using the approaches and tools discussed above. One such example of adopting such approaches is outlined below.

9.1

Background:

The New Zealand government is working on a transition plan to reduce reliance on natural gas as set out in its Emission Reduction Plan (MBIE, 2023). The Seaview Wastewater Treatment Plant (WWTP) treats wastewater from Lower Hutt, Upper Hutt, and Wainuiomata. The WWTP generates greenhouse gases in the treatment process of wastewater and in drying the sludge.

The existing sludge drying facility uses natural gas and contributes to around 20% to overall carbon footprint of the plant's operation each year, making it a significant source in the direct control of the organisation.



Figure 7: Sludge drying facility at Seaview wastewater treatment plant

Carbon reduction opportunity:

The existing dryer facility is nearing the end of its operational life and in need of replacement. There is a significant opportunity to consider alternative fuel sources to reduce emissions from burning natural gas. However, in replacing the sludge dryer, the project will contribute a significant amount of embodied capital carbon emissions, along with operational emissions through its lifecycle.

The project is currently in the definition phase of its project lifecycle, and is therefore strategically positioned to inform decisions on carbon reduction and investments, alongside achieving other consenting requirements and project outcomes.

Solution:

In the pursuit of emission reduction, Wellington Water is currently exploring various sludge drying technology replacement options. It was crucial to consider both the capital and operational carbon impact of the various options right from the planning stages of this project.

In the absence of supplier specific information at this early stage, the models built into the Moata Carbon platform were used for a top-down capital carbon assessment. The aim was to embed low-carbon thinking in decision making rather than prioritising accuracy of carbon assessments at this early stage.

This approach is initiating the reporting and monitoring of carbon as the project progresses through the different stages of its delivery. Early engagement of carbon assessment is helping embed carbon reduction practices into business process decision making at key phases. This wouldn't have been possible without the collaborative effort of stakeholder involved at different work stages.

Outcome:

The carbon assessments of different the replacement options have identified opportunities where efforts can be made to reduce emissions. Replacing the dryer "as is" (BAU method) would seem beneficial from a capital carbon perspective, but will lead to higher operational carbon emissions throughout its lifespan - offsetting any potential

gains. Options with higher capital carbon with substantially lower operational carbon footprints are being explored as alternatives to lower the overall project life carbon emissions. Considering carbon right from the start of a project, provides the opportunity to make long term investment decisions for reducing carbon.

By conducting carbon assessment at the project definition stage, the investigation team can pass on the baton to project managers, designers, and contractors to further explore possibilities to lower carbon through innovative design, construction practices, and material selection. The presence of a carbon management system enables such carbon reduction thinking to flow collaboratively from one stage to another, ensuring carbon reduction decisions are considered at key stages in its delivery.

Key takeaways:

- When dealing with a capital project that is anticipated to generate substantial operational emissions, it is essential to factor in both operational and capital carbon emissions for better decision making.
- Integrating carbon conscious practices as early as possible in the project will provide a clearer understanding of the investment requirements.
- Apply an integrated approach, to achieve carbon reduction alongside other outcomes and ensuring carbon is considered at every stage of the capital delivery.
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10 CONCLUSION

Addressing climate change and reducing carbon emissions presents a challenge nationally that demands collective actions within the water sector. It is essential for all of us as water professionals to recognise the role we all have to play in addressing these challenges.

Implementing a carbon management system based on principles of PAS 2080, offers a structured approach to effectively and collaboratively manage carbon emissions associated with water infrastructure assets, while promoting a culture of lowering carbon. The key in establishing this system lies in shared practices, shared understanding, capacity building, and commitment towards continual learning.

Wellington Water by integrating the carbon management system is equipping stakeholders with necessary tools, resources, and is passing on knowledge to take actions at right stages. Incorporating a continuous monitoring and reporting system will provide key decision-makers at all levels, with the assurance that the system is ongoing and continuously improving, and progressing towards the overall goal of reducing carbon emissions.

These collaborative strategies will effectively facilitate the management of carbon across various projects during different stages of work. The collaborative endeavors of Wellington Water's capital delivery value chain is proving instrumental for new practices to gain broader adoption.

Moreover, collaborative efforts and knowledge sharing among water authorities will be crucial in navigating the complexities of carbon reduction and achieving meaningful progress. Upskilling and capacity building will be vital for significant reduction outcomes to be achieved across the sector. This exemplifies the transformative potential that lies ahead of us.

As the collective journey towards reducing carbon emissions, and commitments towards adopting new approaches grows in the water sector - stands a beacon of hope towards a sustainable low-carbon future.

11 ACKNOWLEDGEMENT

Phil Garrity (Wellington Water) for providing inputs towards case study of sludge dryer project.

Ushma Dahya and Marian Goodwin from Wellington Water for the help with driving and implementing the capital carbon within the capital programme.

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