GreenCape

Lessons learnt from the City of Cape Town's Capital Portfolio Resilience Assessment

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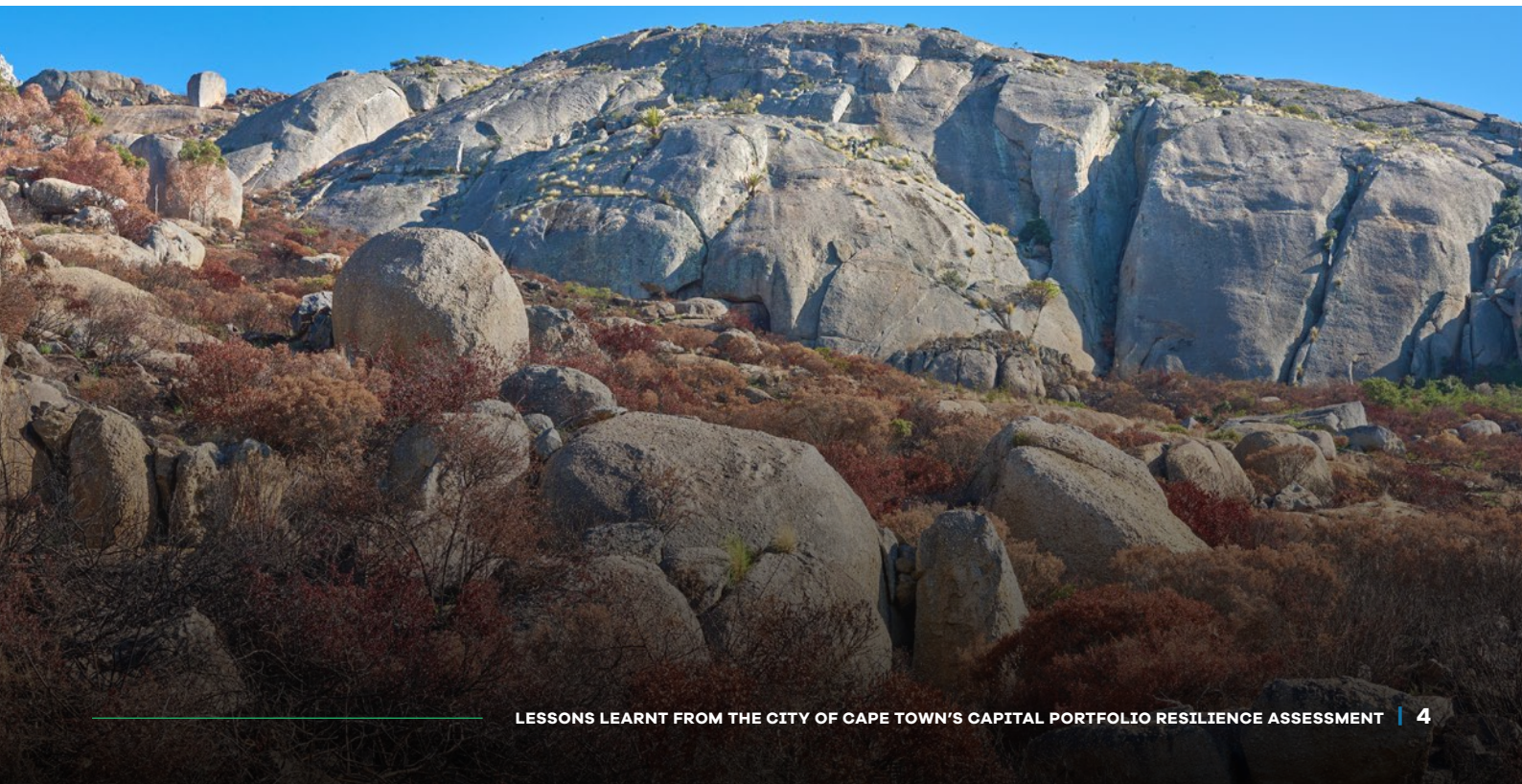
1 Introduction

Cape Town faces a range of climatic shocks and stresses. Its recent experience of the "Day Zero" drought event spotlighted the city's need to be prepared for a range of shock events that are expected to increase in intensity and frequency.

Both the Resilience Strategy (2019) and the Climate Action Plan (2021) call for the integration of resilience considerations into the capital management processes of the City. In this regard, in August 2021, adjustments were made to the City's SAP Project Portfolio Management (PPM) system to allow for tagging of capital projects for resilience outcomes, where relevant. The intention of this process is to allow for periodic analysis of the capital portfolio for the purpose of understanding in what sectors resilience outcomes are being developed, whether those efforts are matched to the likely risk, and to determine underdevelopment of resilience outcomes in other areas.

In early 2022, UK Pact supported a project to do the first ever resilience analysis of the City of Cape Town capital portfolio, focusing on an initial 3-year period of the 10-year pipeline, whilst also developing a methodology to run these assessments on an annual basis. Then, maturing it into a fully-fledged approach that helps the City of Cape Town better understand the requirements for a comprehensive portfolio that aims to build resilience to climate change through its infrastructure portfolio. This was done under a low maturity environment as the tagging mechanism had only been in operation for a few months. Nevertheless, it was important to learn lessons fast in order to inform future improvements.

This report reflects on some of the lessons learnt from this initial resilience assessment to highlight opportunities for other cities that are looking to improve their understanding of how their capital infrastructure investments impact their climate resilience.



2 Project background

2.1. Definitions

Infrastructure (grey or green):

Typically associated with capital investment / budgets (in contrast to operating expenditure (OpEx) / maintenance).

Resilience against:

Adaptation to or "coping with" negative impacts of climate change (in contrast to 'mitigation' / reducing climate change).

Climate related:

Caused by natural systems (in contrast to shocks that are related to economic or human impacts). Notably, some climate related shocks or stresses have required a response by cities even prior to the onset of climate change. In many instances the impacts of climate change require a larger or quicker response to climate related shock and stresses); and in some instances the impacts of climate change require new responses.

Shocks:

Short term negative impacts (in contrast to 'stresses' which are chronic or long term).

Resilience *through* infrastructure:

Meaning the resilience is provided to the city or parts of the city (in contrast to resilience of infrastructure, which means interventions that make the infrastructure itself resilient to shocks / stresses).

2.2. Background

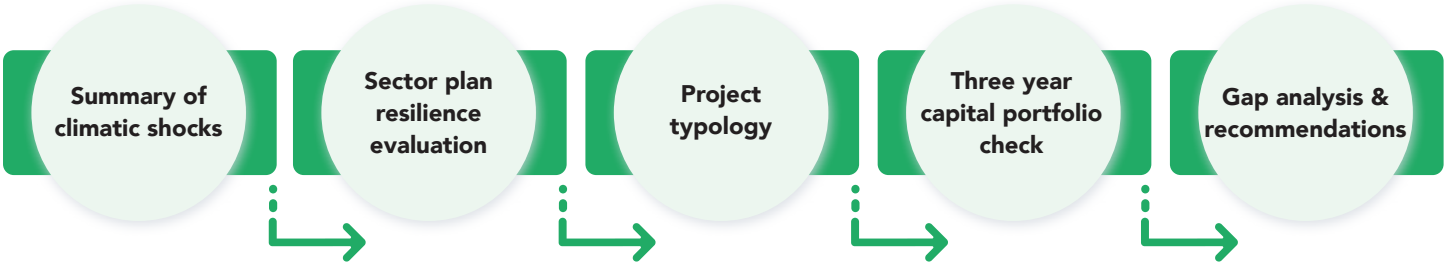
The City of Cape Town has developed its first 'whole of city' Infrastructure Planning and Delivery Framework (IPDF), approved by the City council in August 2021. This includes a 10-year portfolio of infrastructure projects, based on comprehensive long term sector plans, such as those developed by the Water, Waste, Urban Mobility, Human Settlements and Energy Departments. The Framework and 10-year portfolio is a first for a South African metro and will be used to enhance project planning and preparation, and to improve infrastructure delivery. This will primarily be achieved through the integration and analysis of the City-wide infrastructure portfolio and inform decision making on which capital projects are likely to have the greatest positive impact (from an economic, social, spatial and environmental perspective), and greater alignment with Council endorsed strategic goals articulated across the City's strategy suite e.g. Climate Change Strategy, Resilience Strategy, and Water Strategy.

The IPDF informs project prioritisation and sequencing to ensure delivery of the most strategically aligned projects within a fiscally constrained environment. In order to maximize the economic and social returns from these infrastructure projects, as well as to assess the broader resilience and climate change impacts related to capital investment, the IPDF is a vital step towards having a city-wide view of the cumulative and potentially conflicting impacts of these sector plans. A core principle of the IPDF is resilience – including resilience of projects (to climate hazards and changes in energy systems) and resilience through projects (enabling adaptation).

3 Lessons Learnt

Figure 1 highlights the process that was followed to provide context.

Figure 1. The process followed for the first resilience analysis of the City of Cape Town capital portfolio

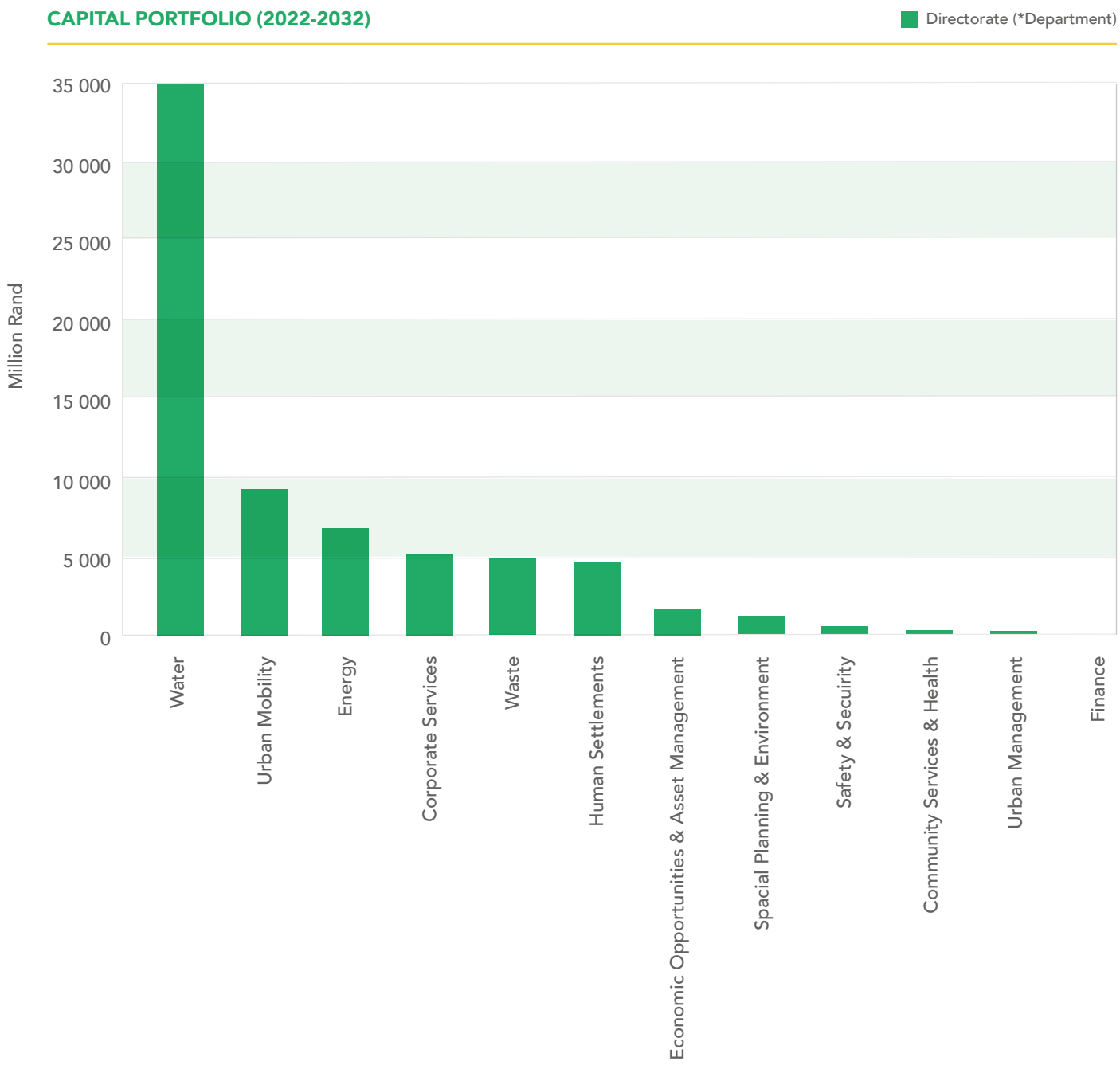


3.1.
Lesson 1: Create a consolidated database with all capital projects

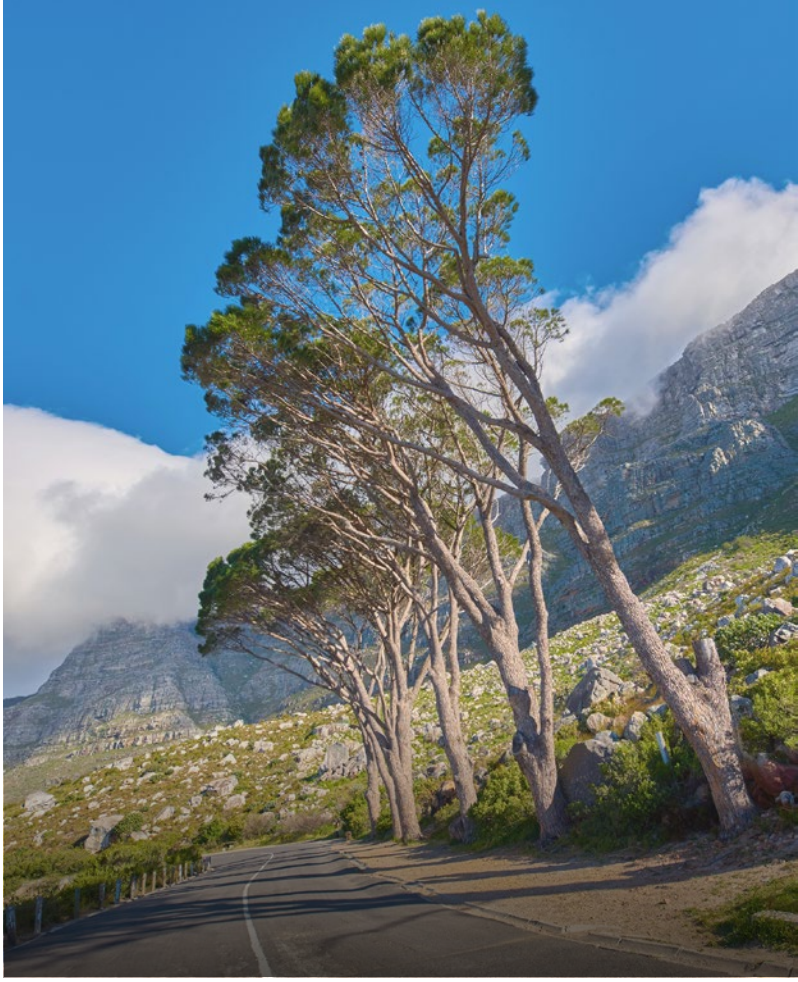
The City of Cape Town developed a 10-year capital portfolio of all its infrastructure projects and tagged the projects with relevant information for their analysis. Whilst some of the information required for a thorough resilience assessment was not available in this first attempt at analysis, the consolidation of all sectoral projects into a single database is a vital first step in providing a foundation for analysis of this kind, as well as other types of service delivery metrics.

The database included 941 projects in its 10-year portfolio with a total estimated value of R69.5bn.

Figure 2. Value of projects within the consolidated capital portfolio by directorate (*or Department)



3.2.
Lesson 2: Focus on climate-related shocks



Conducting a comprehensive resilience analysis of a multi-sector capital portfolio is very complex. The Resilience Strategy (2019) prioritised 10 shocks and 12 stresses for Cape Town, from gale force winds to civil unrest to crime and violence. In order to provide an effective initial assessment of the capital portfolio, it made sense to simplify the analysis down to climate-related shocks. This focused the project team's efforts and reduced the scope to test out the analytical approach on a cross-cutting challenge (i.e. climate change), whilst not getting too bogged down by the multitude of long-term impacts on shocks and stresses from the thousands of projects in the portfolio.

3.3.
Lesson 3: Develop city-wide awareness of plausible shocks and climate-related impacts

The City of Cape Town has developed an extensive understanding of how to build resilience against the projected impacts of climate change on rainfall, largely as a result of the "Day Zero" drought event. This is reflected in the Resilience Strategy (2019), Cape Town's Water Strategy (2020), the recently adopted Climate Change Action Plan (2021) and a wealth of research on climate change that has been commissioned by the City. This research highlights which climate shocks, in addition to drought, are most relevant for the city and which should be prioritised for investment. According the City of Cape Town Climate Change Action Plan (2021) the climate change hazards that Cape Town is facing are:

- A decrease in annual average rainfall.
- An increase in mean annual average, maximum, and minimum temperatures.
- An increase in both average wind strength and maximum wind strength.
- Changed seasonality of rainfall.
- Sea-level rise and increased coastal erosion.
- An increase in the number of very hot days (35+ °C) and the frequency and intensity of heatwaves (three days or more of 32+ °C).

Table 1 provides an overview of the projected climate change impacts on Cape Town (Petrie et. al, 2021).

The projected impacts are indicated as a range, and the accuracy of these expected impacts will improve over time. However, at this stage, they provide a good indication of the direction of climate shocks into the future.

Table 1: Overview of relevant climate shocks and projected impacts for the City of Cape Town

PROJECTED IMPACT ON CAPE TOWN		
CLIMATE VARIABLE	**MID-FUTURE PERIOD (2021-2050)**	**FAR-FUTURE PERIOD (2070-2099)**
Average, maximum and minimum temperature	1-3 °C increase	3-4 °C
Very hot days (+35°C) per year	0-20 days increase	0-50 days increase
Heat-wave days (+32°C for 3 consecutive days) per year	0-10 days increase	0-20 days increase
High fire-danger days per year	0-20 days increase	0-60 days increase
Rainfall (annual average)	60-120 mm decrease	80-160+ mm decrease
Extreme rainfall (> 20 mm per day)	0-3 Days decrease	0-5 Days decrease
Average wind speed	0–0,3 m/s increase	0,6–0,9 m/s increase

3.4.
Lesson 4: Develop a typology for infrastructure projects that would mitigate against the predicted climate shocks

In order to evaluate how comprehensive the proposed infrastructure investment plan is to build resilience against climate shocks, it is useful to understand what is possible. A list of possible and typical infrastructure interventions that provide resilience against the climate shocks relevant to Cape Town has been collated from various sources (Table 2).

TABLE LEGEND:

= Drought

= Heat

= Fire

= Flooding

= Wind

= Storm surge

Table 2: Climate shock actions that include infrastructure elements
(adapted and collated from: C40 Resilient Cities AMIA Tool, Sector Plans and expert inputs)

ACTION	PRIMARY SHOCK/S
Artificial) lakes/reservoirs	
Desalination plants	
Diversification of water supply	
Reclaiming wastewater for drinking	
Reducing water pipe leakages	
Xeriscaping	
Pressure management zones to further reduce and optimise pressures in the water network	
Leak detection and repair	
Reusing water from treated wastewater effluent	
Groundwater scheme	
Extracting water from springs	
Alien invasive clearing programme	
Prevent surface salt water intrusion	
Maintenance of environmental flows	
Including wildfire prevention in building codes	
Legal connections / electrification in informal settlements	
Fire fighting infrastructure (fire stations, equipment)	
Install wind breakers to reduce the spread of fire through wind	
Alternative energy sources for cooking, lighting and heating in low-income and informal households	

Table 2: Climate shock actions that include infrastructure elements
(adapted and collated from: C40 Resilient Cities AMIA Tool, Sector Plans and expert inputs)

ACTION	PRIMARY SHOCK/S
Establish network of real-time heat-monitoring stations (where not covered by SAWS)	
Landfill gas capture and extractions	
Separating organics collection and diverting organic waste to prevent landfill fire outbursts	
Fire-safety structures for landfills (fire suppressant infrastructure)	
Water squares	
Relocating people to formal housing (or reblocking)	
Development of urban floodplains	
Downpour-proof roads	
Flood proof development of new neighbourhoods	
Green river banks	
Levee/dike construction and heightening	
Multifunctional flood defences	
Permeable pavement	
Pumping stations	
Restrict development in low-lying areas (wetlands, mangrove forests, flood plains)	
River basin expansion	
Separated sewers and storm drains	
Storm surge barriers	
Underground storm water retention	
Stormwater ponds	
Stormwater drainage infrastructure e.g. culverts, inlets, junction points etc.	
Improving the capacity of landfill leachate collection systems to accommodate heavy rainfall events	
Ensuring that landfills have multiple access routes and functioning drainage systems (existing and new)	
Avoid new cemeteries in flood prone areas	
Depaving public spaces	
Design specifications and standards	

Table 2: Climate shock actions that include infrastructure elements
(adapted and collated from: C40 Resilient Cities AMIA Tool, Sector Plans and expert inputs)

ACTION	PRIMARY SHOCK/S
Development of parks and urban forests	
Green roofs and facades	
Green transitways for public transport	
River/canal rehabilitation	
Sand bags	
Decentralised transfer stations	
Cool pavements	
Cooling systems for critical infrastructure	
Passive building cooling and heat sensitive architecture	
Shading in public spaces, markets	
Tree planting in public spaces & green belts	
White roofs and walls	
Wind corridors for urban cooling	
Installation of water fountains	
Establish cooling centers in high risk areas for use during a heat wave crisis	
Decentralisation of organic waste treatment plants	
Green belts	
Preserving natural coast protection (beaches, dunes), such as restoration/rehabilitation as well as conservation, and also the construction of artificial/managed dune systems as coastal defences	
Spillways	
Floodwalls	
Breakwaters	
Sea walls or curb walls	
Rock armouring	
Ensuring that waste disposal sites are not located on floodplains or low lying and coastal areas	
Covered collection trucks	
Wind breaks	

However, in order to contextualise this list for the City of Cape Town, these infrastructure interventions were categorised and grouped into the City of Cape Town's relevant directorates or departments to create a resilience project typology relevant to each of the sector directorates / departments. This typology serves to help identify projects within the capital portfolio as contributing to resilience to the City. Secondly, the typology forms the basis of capacity building within sector departments in terms of possible infrastructure projects to consider when addressing resilience to climate shocks, or recognising projects that are already within the core functions of such departments as contributing to resilience against climate shocks.

3.5.

Lesson 5: Analyse the importance of a department or directorate to building resilience, including secondary benefits

The sector directorates / departments were ordered by the relevance of these directorates / departments to infrastructure interventions within their mandates that contribute to building resilience against climate shocks (through infrastructure). This was informed by the prevalence of infrastructure interventions in each department according to the project typology. As seen below, Water and Sanitation are the most relevant to building resilience to climate shocks. Solid Waste and Human Settlements are also highly relevant, but largely as a secondary benefit of their infrastructure investments.

Table 3: Directorate / department relevance to resilience through projects to climate shocks based on the mandates and types of projects contained in the respective sector plans.

DEPARTMENT (DIRECTORATE*)	RELEVANCE TO RESILIENCE THROUGH PROJECTS TO CLIMATE SHOCKS
Water and Sanitation	Very high, mostly as a secondary benefit of primary mandate
Urban Waste Management	High, mostly as a secondary benefit of primary mandate
Human Settlements	High, mostly as a secondary benefit of primary mandate
Spatial Planning & Environment	High, mostly capital projects within primary mandate
Disaster Risk Management (Safety & Security)	High, but mostly not 'capital' infrastructure
Transport	Medium-high (some key interventions)
Recreation & Parks* (Community Service)	Medium-high
IST (Corporate Services)	Medium (mostly in support of other depts.)
Facilities Management (Corporate Services)	Medium (mostly retrofit type interventions / not capital infrastructure)
Energy	Low (mostly mitigation)
Fleet Management* (Economic Growth)	Low (mostly mitigation)

This prioritisation approach will assist in developing awareness raising and capacity building programmes by department / directorate with efforts largely focused on those sectors that have the most impact on resilience building, i.e. those departments / directorates that have the highest prevalence of resilience related projects within their project typology.

Secondary benefits refer to resilience benefits that are accrued due to the infrastructure investment, but was not its original intention. For instance, Water and Sanitation is diversifying its water supply resources in order to ensure long-term sustainable water availability (which is in its mandate as a Water Services Authority), but this approach also improves resilience to drought shocks. Another example is seen in the secondary benefits that Human Settlements provides in the provision of formal housing or the upgrading of informal housing, such as reducing the risk of fire, heat and flooding, which residents who live in informality would experience at a much higher likelihood.

3.6.

Lesson 6: Analyse the departmental sector plans in terms of their understanding of the role they need to play in building resilience

The narrative in each of the sector plans was analysed according to the intent of the directorate/department to building resilience to climate change, as well as their high-level 10-year capital programme.

As expected, Water and Sanitation clearly identify the importance of building resilience to climate change, however when compared to their 10-year capital programme, their focus is largely on building resilience to drought, without as much focus on their other related projects in flooding. Interestingly the Urban Waste Management Directorate showed little resilience intent, despite their relevance, yet they did include a number of resilience relevant projects in their 10-year capital portfolio. This indicates a possible lack of awareness of their role in building resilience. Spatial Planning and Environment indicated a high resilience intent in their sector plan but this was not fed through into their capital programme, which has an underdevelopment of projects that respond to coastal processes such as storm surge, sea-level rise, and coastal erosion over the 10-year portfolio.

It is important that those departments / directorates that have been identified as highly relevant for resilience building have sufficient awareness of the role they can play, and that this role is articulated in their sector planning documents, and is also reflected in their long-term capital planning.

3.7.

Lesson 7: a) Build capacity and awareness amongst the project managers on how their projects contribute to building resilience and b) provide instructions on how they need to tag their projects when adding them to the consolidated capital project database

The first ever resilience tagging exercise was undertaken in the latter part of 2021, and the analysis of the outcomes of this tagging exercise (for the first 3 years of the consolidated capital portfolio) indicate that the tagging of projects in the capital portfolio as contributing to providing resilience to climate shocks through infrastructure projects was low across the entire portfolio, both by number of projects and value.

Adding tags manually indicated that a large number of projects that do contribute towards resilience against climate shocks were not tagged. By value, the total projects that contributed toward resilience against climate shocks was approximately half of the total value of projects represented in the 3-year capital portfolio.

The further analysis by climate shock indicates that the under-tagging of projects as resilience projects occurs across all shocks. Projects that contribute to resilience against heat (waves) are severely under-represented in the capital portfolio.

Analysis by directorate / department indicates that the majority of projects that provide resilience are found in the Water & Sanitation Department (predominantly 'drought' and 'flood'). The most 'under-tagged' directorate is Human Settlements, as almost all of the projects in this directorate provide resilience against some of the climate shocks, notably fire and flooding, but very few of these were tagged as such. This suggest an awareness gap of the project tagging mechanism and potentially an awareness gap in terms of how basic service delivery can contribute to climate resilience.

Therefore, further awareness raising and capacity building exercises need to be run with the project managers, focusing on the departments that have severely under-tagged their resilience projects. However, it also indicates that far more projects are contributing to resilience than were originally thought. Approximately 1/3 of projects that contribute to resilience against climate shocks are tagged as such.

3.8.
Lesson 8: Build a roadmap for a building a mature resilience portfolio

Resilience tagging is a useful way to track relative contribution of sector departments and overall trends in the capital portfolio. However, for directorates and departments that are highly relevant to building resilience against climate shocks, the total interventions needed to build resilience to the extent that City wants to is quantified, such that the capital portfolio assessment becomes more useful in determining the contribution to building resilience to each of the shocks relative to the actual need.

The generic steps required to plan for, monitor and evaluation resilience against each relevant climate shocks (termed 'hazards' here) are summarised in Figure 3. From these, the City has mapped out incremental improvements in delivering a more robust and useful assessment of the contribution towards resilience of the projects within the capital portfolio (Figure 4), from this first assessment in 2022 which had limitations based on the availability / type of data in the capital portfolio.

Figure 3. Climate Adaptation Planning and Monitoring, Evaluation and Reporting Process (40 Resilient Cities, 2019)

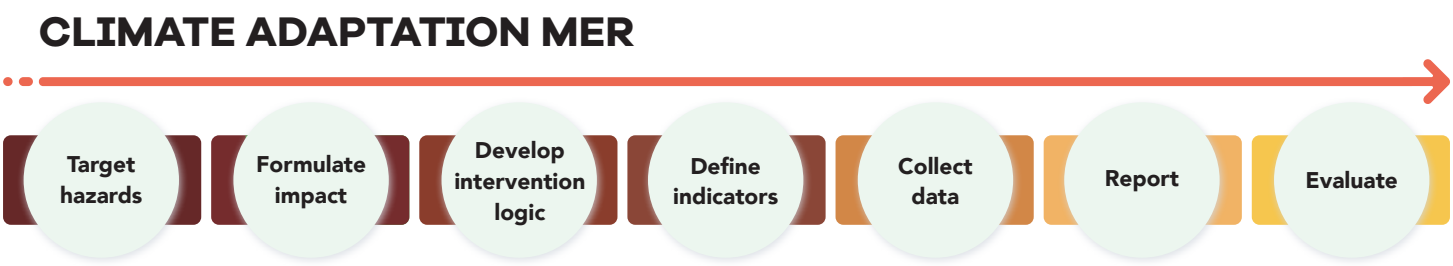


Figure 4. Roadmap towards a more robust and informative assessment of the resilience contribution of the capital portfolio.

	2022	2023	2024	2025
Impact / intervention logic	Drought well developed, other shocks not	Determine level of resilience required against each shock (factoring risk and vulnerability), & interventions needed to achieve this (focus on one new shock per year).	Risk analyses per shock enable prioritisation of infrastructure	Measurable level of resilience against each shock
Scope	3 year portfolio resilience through infrastructure	Include 10 year analysis (1-3 year; 4-10 year)	Develop impact targets per intervention (based on impact / intervention logic)	Incorporate co-dependencies / system level interactions (AMIA tool)
Extent	City-wide vs. community	City-wide interventions or geo-tag overlay to vulnerability maps for spacially specific interventions		Composite indicators per shock (relative impact of interventions)
Metrics	CAPEX & # of projects per shock / dept.	Develop indicators per intervention		
Analytics	Per shock / per directorate	Analysis of y/y trends by ***department*** / aggregated by shock		

4 Conclusion

The resilience tagging of the capital portfolio and the associated resilience analysis of this portfolio are important processes for establishing the extent to which the capital portfolio is responding to the plausible climate shocks and stresses relevant to Cape Town.

The City is thus far only a year into this process, and it is expected to take at least three years more to reach an acceptable level of maturity. Project managers need to understand the tagging mechanism, which requires more awareness raising. This is a valuable opportunity to integrate climate change awareness across the organisation, and its implementation will be a considerable effort at mainstreaming climate change outcomes.

With regards to the resilience analysis of the portfolio, the first analysis has already revealed insights which are important for capital planning going forward. The insights will likely become more sophisticated over time and improve the opportunities for prioritisation of the projects in the portfolio.

The City is currently embarking on an update to the sector plans and this initial analysis will be used to prompt thinking about how the City capital portfolio can further respond to climate shocks.

It is vital that the City continues with its medium to long term capital planning. Without the 10-year portfolio, this analysis is not possible, and this foundational work should be considered a start towards even longer term planning. It is important that the City continues to invest in the research, data and analysis capabilities and partnerships to understand climate impacts and the means to manage uncertainty.

5 Next steps

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