

Durban, South Africa Urban Design Climate Workshop

Sean O'Donoghue, eThekweni Municipality
Enza Tersigni, Università di Napoli Federico II
Sean.ODONOGHUE@durban.gov.za

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Keywords	Urban renewal, built environment, open space, climate resilience
City Population (Metropolitan Region)	4,239,901
City Area (Metropolitan Region)	2,297 km ²
City GDP	83.9 billion USD
Climate Zone	Cfa (humid subtropical)
ARC3.3 Linkage	Urban Planning, Design, and Architecture Element

Introduction. The Urban Climate Change Research Network proposed in 2019 a district-level Urban Design Climate Workshop (UDCW) program for isiPhingo in Durban, South Africa. The aim of the workshop was to facilitate participating City Teams, already mandated to implement an urban renewal programme, interacting and learning from each other's experiences, incorporating climate change actions and initiatives into the isiPhingo Rehabilitation Programme. The goal of the sessions was to develop implementation actions together that consider varied governmental, developmental, socio-economic, and ecological conditions while simultaneously developing perspectives on raising ambition for engagement and implementation efforts. A further goal was to rapidly build capacity across multiple stakeholder groups, particularly spatial planning and land use management staff in eThekweni Municipality, and students at the local University of KwaZulu-Natal, to implement mitigation, adaptation, resilience, and transformation actions to respond to climate change.

During the preparatory weeks of the Workshop, GIS tools were used as multilevel information systems capable of cataloguing and linking information related to extended urban areas, starting from multiple types of aerial photogrammetric data. It was thus possible to elaborate thermal maps on a regional scale through the spatial downscaling of global climate models, or to display and analyse data on the Land Surface Temperature (LST) by geo-referencing the available

satellite data. GIS-based data processing tools able to evaluate urban well-being through the calculation of comfort parameters such as the mean radiant temperature (MRT) or the universal thermal climate index (UTCI), while the interrelation of specific data - groundwater levels, rainfall data, DTM, soil permeability, percentage of evapotranspiration and runoff class - made it possible to identify potential flood zones in case of extreme events.

At this stage, several challenges were experienced in securing effective Land-Use/Land-Cover datasets: the data availability, the size of dataset files to share across African networks, the access limitations at eThekweni Municipality and the data spatial resolution of local land use management planning. During the workshop, after on-site surveys in the study areas, two main types of activities have been implemented:

- A community engagement session (civil society, private sector, isiPhingo residents and representatives from various industries in the region), where post-it notes were handed back to the facilitators for discussion, allowed gathering feedback in order to evolve strategies and characterise barriers and bridges;
- A co-design session that allowed city officials from eThekweni Municipality (including the multi-sector isiPhingo Urban Regeneration Team) to integrate and scale up mitigation and adaptation principles by reducing energy consumption in the built environment, strengthening urban climate resilience, and enhancing human comfort and quality of life.

UCCRN proposed a district-level UDCW Program for isiPhingo in Durban using three scenarios to interrogate current climate-related challenges - including flooding hotspots and known heat densities - against 2050 projections done according to business as usual and best practice scenarios. In the design phase, GIS tools were used to test district-wide concepts while at a neighbourhood scale the evaluation of the effectiveness of climate-adaptive solutions for the resilient regeneration of urban spaces was developed through a set of algorithms written using a parametric design tool (Grasshopper for Rhinoceros and the open-source plugins Ladybug and Honeybee). The aim was assessing the comfort of open spaces comparing alternative urban regeneration scenarios, also with respect to the projections of climatic data: the results of the simulations allowed to measure the effects of the use and extension of green surfaces, water, shading systems or specific solutions for floors and facades with respect to physical environmental parameters such as air or surface temperature.

The UCCRN Urban Design Climate Workshop sessions allowed city officials from eThekwin Municipality to integrate and scale up mitigation and adaptation principles by reducing energy consumption in the built environment, strengthening urban climate resilience, and enhancing human comfort and quality of life. Through the participatory engagement of the City Teams, the Climate Workshop was able to demonstrate that through energy-efficient urban planning and urban design, compact urban districts can work synergistically with high-performance construction and landscape configuration to create interconnected, protective, and attractive urban areas that promote a resilient transformation through mitigation and adaptation actions.

Recommendations from the 2019 UCCRN's isiPhingo Urban Design Climate Workshop were revisited in January 2023 in a one-day workshop to illustrate how a climate-resilient approach to urban design can support the ongoing initiatives of the Transformative River Management Programme (TRMP), supported by the Cities and Climate in Africa (CICLIA) programme. The TRMP is an ongoing programme investing in the city's rivers as a core component of transformative adaptation that will help to mitigate the impacts of climate change.

This project aims to address flooding, water quality, solid waste and climate change challenges experienced within eThekwin and provides cost-efficient and practical approaches to addressing these key issues. The CICLIA project was undertaken in four catchments within eThekwin, namely, Ohlanga, uMhlangane, Palmiet, and uMhlathuzana, with precinct plans developed that respond to projected changes in catchment hydrology and ecosystem service provision, informed by anticipated development and climate change.

The UDCW, facilitated by UCCRN experts and UCCRN_edu (an Erasmus+ Cooperation Partnership, from the European hub of the international UCCRN consortium) project members, provided guidance on how urban settlements can be prepared for the impacts of climate change through planning that aims for low carbon and efficient systems, retrofitting renewable energy and energy efficient technologies for new developments, and landscape management to reduce heat impacts and flood risk while delivering social, economic and environmental co-benefits to local stakeholders and communities. A collaborative session was carried out to pinpoint steps, actions, policies and stakeholders to engage to reach the desirable scenarios.



Figure 3: UDCW-developed climate analysis mapping of Durban

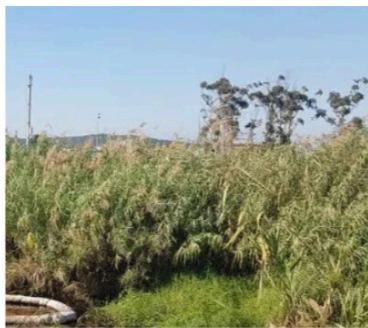


Water Issues / Challenges:

1. Human Health and Safety Concerns
Caused by:
 - Flash Floods
 - Toxic runoff
 - Difficulty accessing food and clean water during flooding
2. Damage to infrastructure and community/industry property
3. Decrease in Water Quality / Ecosystem Damage

CHALLENGING AREAS

1. **TRANSIT CAMP** – Area frequently flooded (endangering residents). Located on former wetland site.
2. **MALFUNCTIONING WEIR**: Only 10% Flow to Canals
3. **SIGNIFICANT RUNOFF FROM UPSTREAM CBD** - Impervious surfaces, lack of building-level stormwater management plans, frequently blocked and aging sewers, polluted runoff
4. **ILLEGAL CONTAINER DEPOT WITHIN WETLANDS**
5. **CANALS** – Inadequate flow for estuary health, causes flooding of industrial sites, severely polluted.
6. **ESTUARY** - Insufficient Flow, garbage and sewage, sand blockage of outlet



1. Relocate Transit Camp / Restore Wetland Ecosystem Services

2. Isipingo Inlet Weir Restoration

(Restore a consistent flow of clean water to canals and downstream estuary ecosystem)

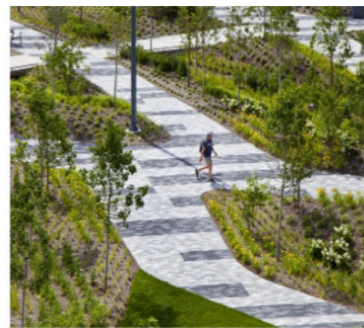
- There is a gabion weir on the river that is supposed to route water into the inlet under baseline conditions. Under flood conditions, the water flows over the river into the Mbokodweni River. The challenge is that the river changes flow and continues to flow on a different path into the Mbokodweni River. Invasive water plants are a factor causing the flow into the Mbokodweni River.



3. Develop Water Retention Sites Upstream of CBD

(Attenuation Facilities Already in Planning)

- Purpose is to capture water and allow for slow release
- When possible, the sites will be utilized for some social benefits (e.g. park)
- Opportunity for commercial mixed use development and high-density housing
- Central bowl can be developed; surrounded by roads
- Desire for water from detention basins to gravity flow to canals (12 meter elevation difference?)



4. CBD Green Infrastructure Design Interventions

- Require building parcels to implement their own stormwater management measures including rooftop and site rainwater collection, detention, and/or reuse
- Municipality to make use of 9 ha area freed up within CBD for rain gardens / infiltration zones



6. Canal System Upgrades (opportunities to improve design and operation)

- Sluice gates to control illicit discharges from industry upstream.
- Closing gates and taking advantage of the head; allowing more flow into the estuary (To be further studied)
- Modifying slope to increase hydraulic gradient towards the estuary (To be further studied)
- New canal running through the site with the container depot
- Removal of invasive water plants, drying, and use for animal feed.

7. Restoration of a healthy estuary Ecosystem

Figure 3: Water management issues and challenges, and planned and potential projects in isiPhingo area



Figure 4: *Current activities under the Transformative River Management Programme (TRMP): protection, management, and restoration of rivers and streams through a community ecosystem-based adaptation approach*

Notes:

- NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP) dataset were utilised which includes downscaled projections for RCP 4.5 and RCP 8.5 from 21 models and scenarios for which daily scenarios were produced (spatial resolution of the dataset 0.25 degrees ~25 km x 25 km).
- From eThekweni Municipality involved expertise were: Strategic Spatial Planning, Branch (SSPB), Development Planning Department (DPD), Development Management Department, Environmental Health, Primary Health Care Area Office, Urban Design, Architecture Department, Strategic Development Manager, Architecture Department, Biodiversity Impact Assessment Branch, Environmental Planning and Climate Protection Department (EPCPD), Climate Protection Branch, EPCPD and UCCRN Durban Knowledge Hub.

Additional Information

- Population Density: 1,845 people/km²
- Gross National Income (GNI): \$6,780 (Higher Middle-Income)
- Gini Coefficient: 66.9
- Human Development Index (HDI): 0.717 (High)
- Type of Climate Information: Both