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Deltares

WASH in a wider context

Planning resilient WASH services

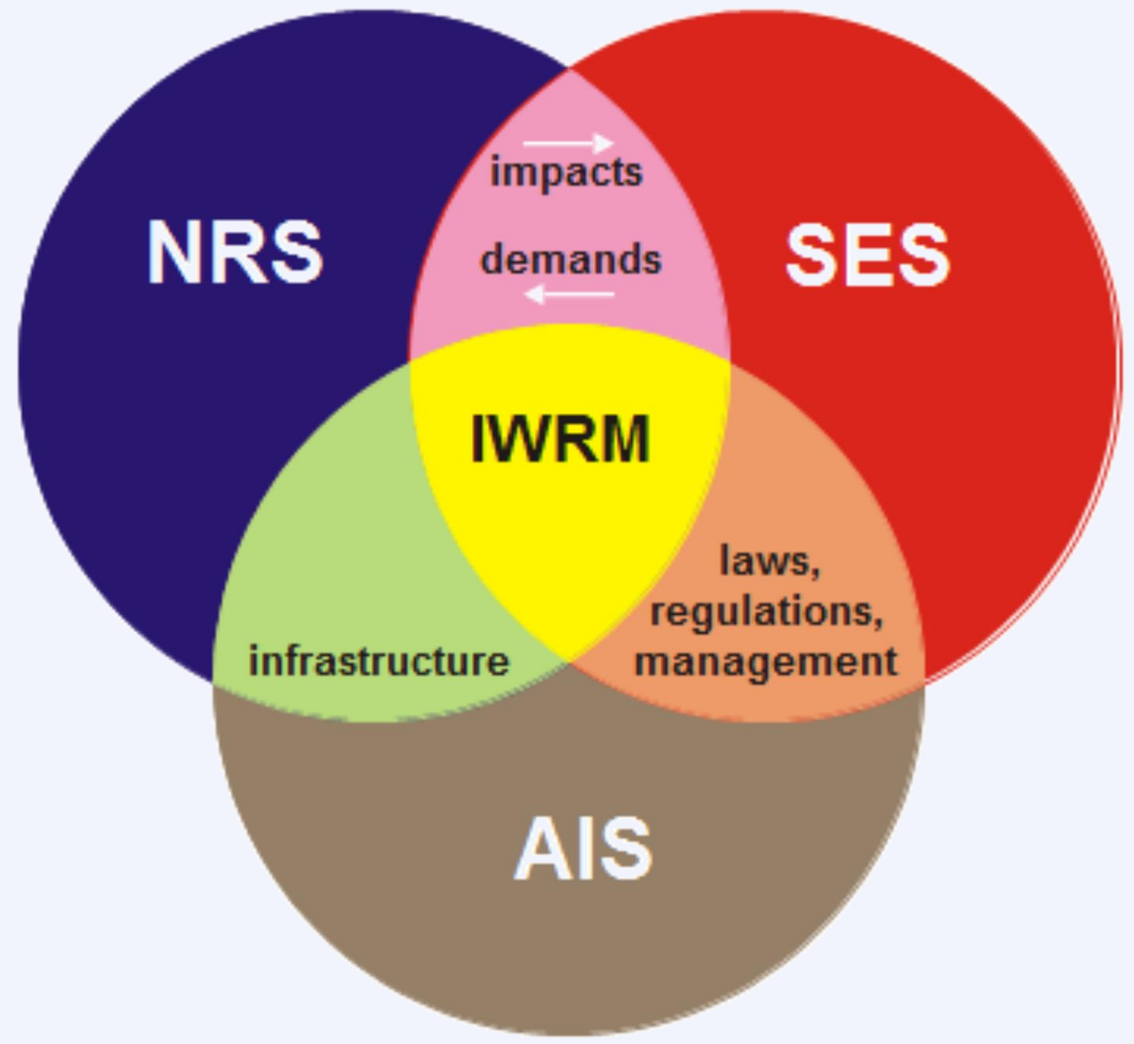
To help achieve the Sustainable Development Goals (SDGs) and Paris Agreement, WASH facilities need to be part of climate-resilient water resources systems that are healthy and managed sustainably. Water is one of the world's most essential commodities and demand for water services has increased tremendously following population growth, economic development and changing consuming patterns. A paradigm shift is needed to stimulate the necessary responses and investments to achieve climate resilient water security outcomes that deliver (co-)benefits to all, including job creation, public health, and disaster resilience. Such a paradigm shift includes (1) enhancing water conservation, water efficiency and re-use, and (2) strengthening integrated water resources management in the face of uncertainties about the future to:

- protect populations from water-related disasters
- preserve water resources, and
- enhance the resilience of water supply and sanitation services.

As water cuts across many climate-affected sectors including agriculture, food, forests, energy, urban, ecosystems management and infrastructure, one cannot consider WASH services in isolation but must consider their place, sustainability and resilience within a wider context. WASH projects must consider their interactions and cascading impacts with other components of the Water Resources System (WRS) (Box 1).

Only then will WASH services be able to sustainably improve the health, socio-economic situation and resilience of communities across the whole WASH system. And climate resilient WASH systems will contribute to building broader community resilience to the impacts of uncertain climate change by improving water and energy efficiency that achieve both mitigation and adaptation outcomes.

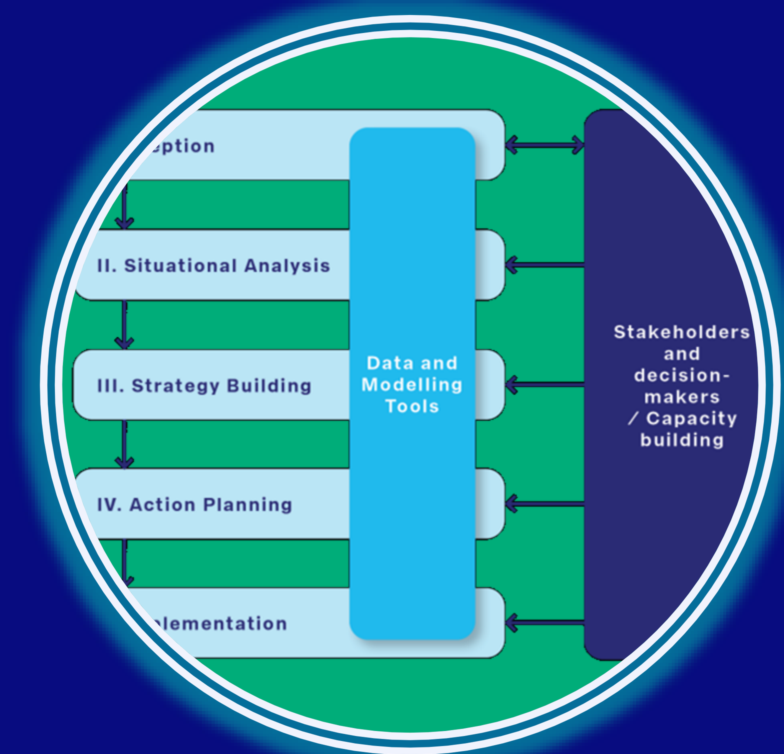
Box 1: Water Resources Systems



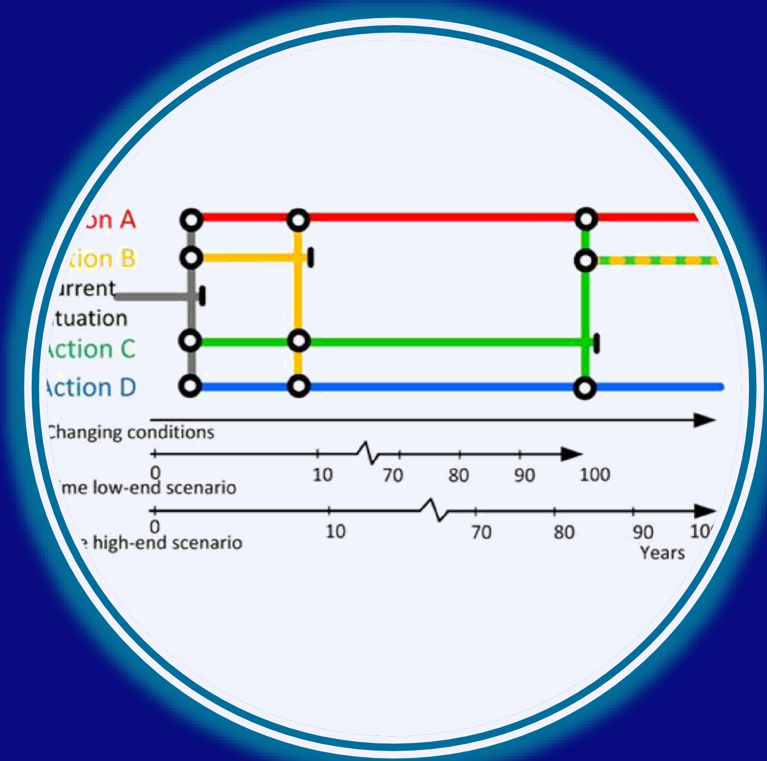
Water resources systems consist of three sub-systems:

- **Natural resource system (NRS):** all streams, rivers, lakes, groundwater aquifers, including all physical, biological and chemical components, and the infrastructure needed to collect, store, treat and transport water and the policies or rules for operating them.
- **Socioeconomic system (SES):** all water-using and water-related activities.
- **Administrative and institutional system (AIS):** all institutions that are responsible for the administration, legislation, and regulation of the supply (NRS) and demand (SES) components. This includes both hard and soft, and formal and informal institutions.

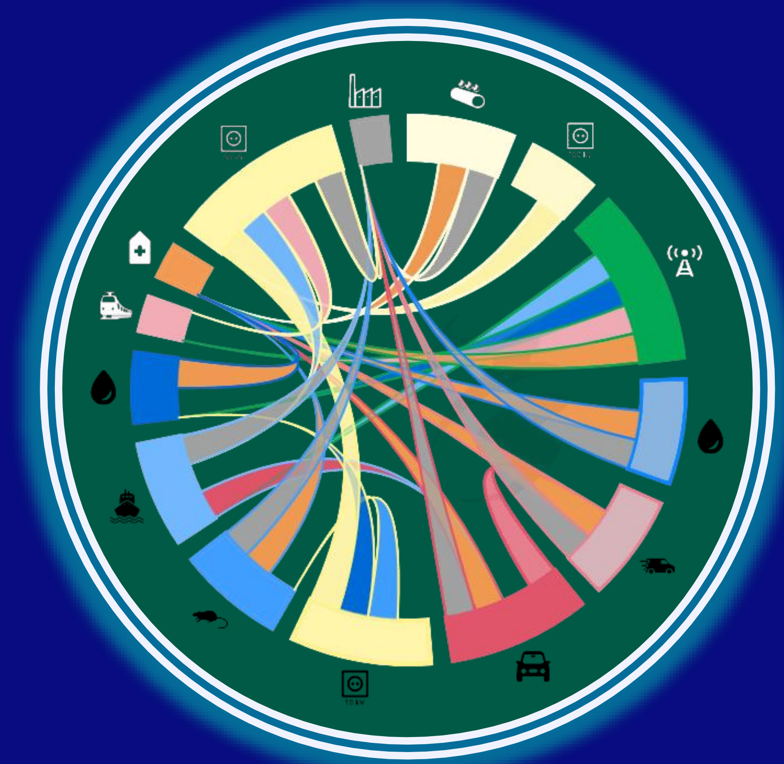
Tools to enable climate-resilient integrated planning and design



IWRM Planning Framework of Analysis



Adaptation Pathways



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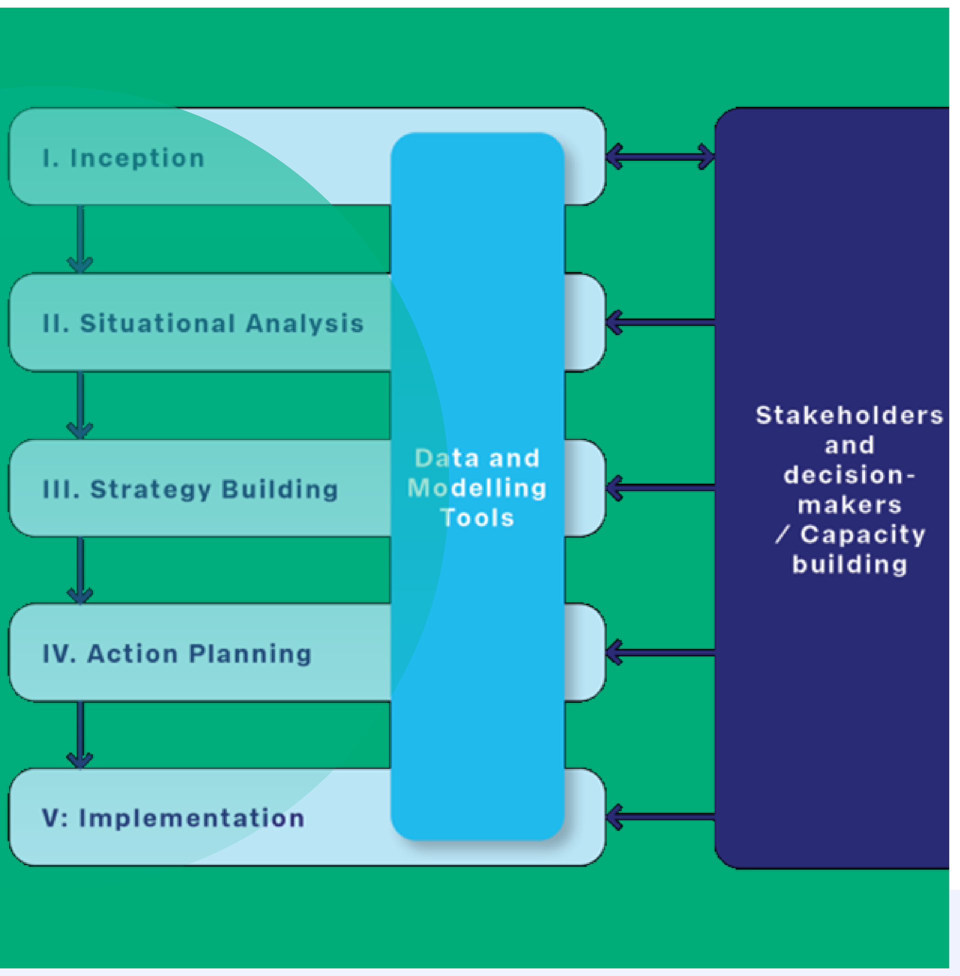


IWRM Planning Framework of Analysis

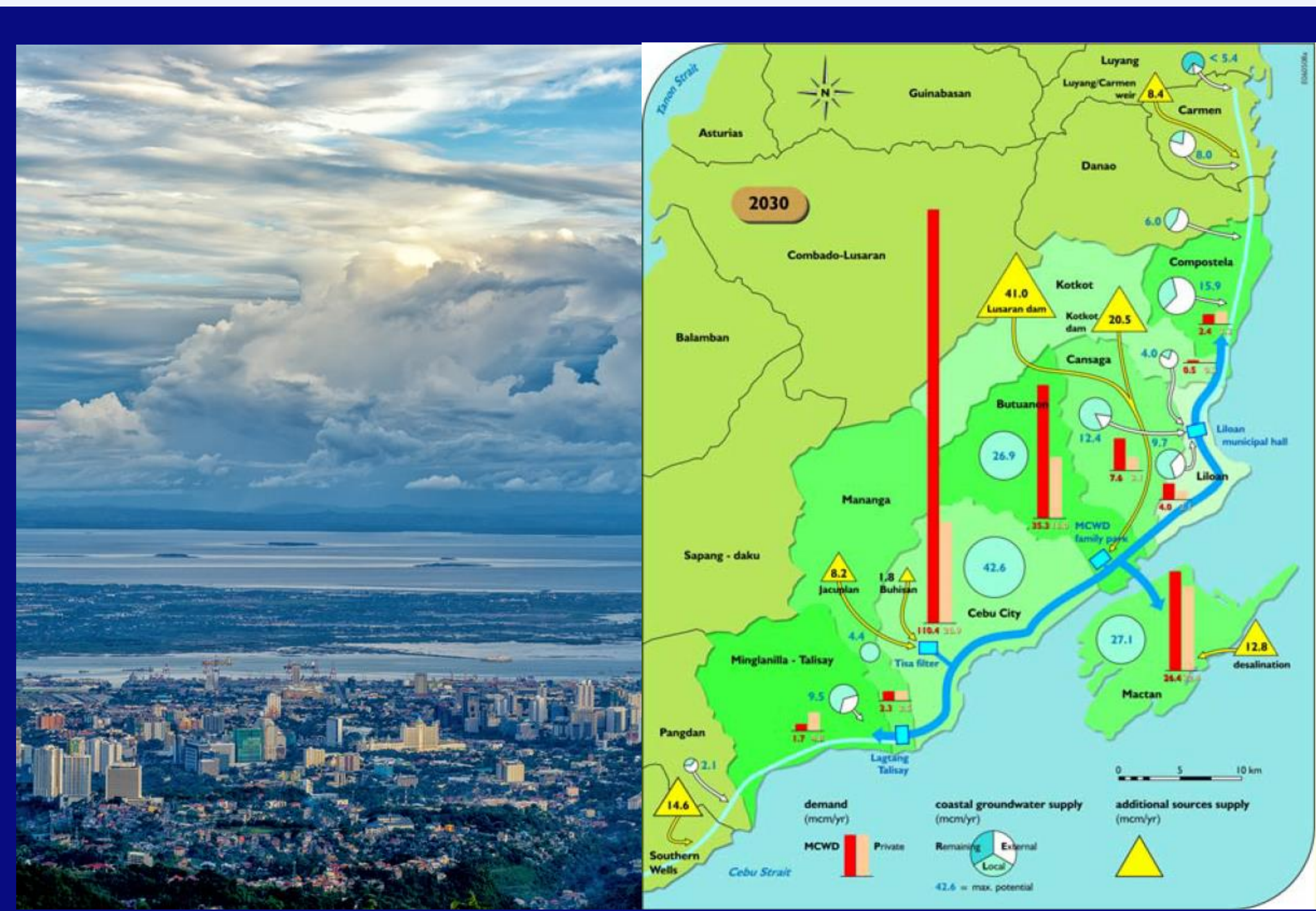
Integrated Water Resources Management (IWRM) is used to manage water, land, and related resources in a coordinated way to equitably and sustainably maximise economic and social welfare (GWP, 2000). Ideally IWRM planning and decision-making is an adaptive process in which decision-makers and stakeholders continuously assess the situation and determine the best way to proceed.

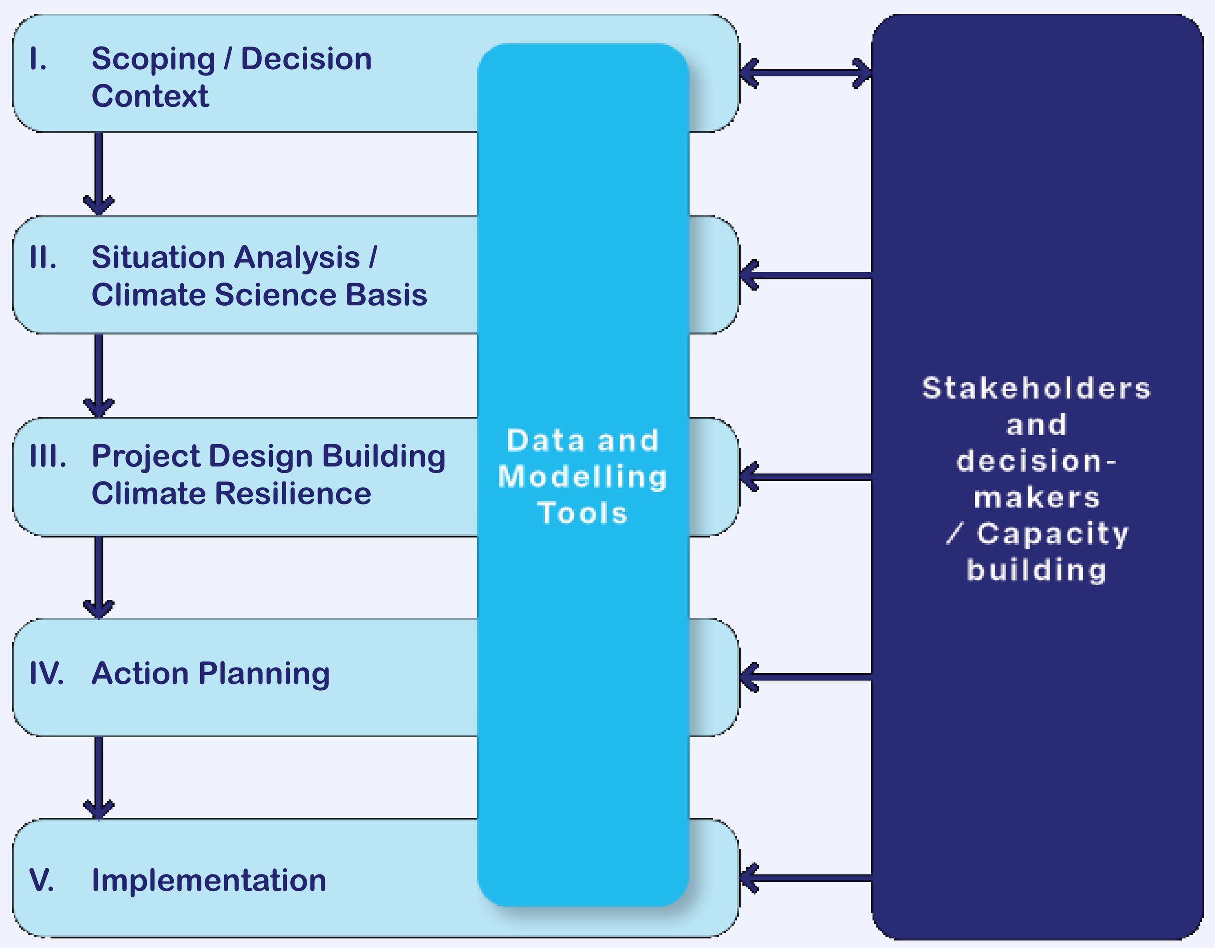
The Deltares approach is based on a proven analysis framework (Loucks and Van Beek, 2017) for IWRM planning consisting of five main phases:

I. **Scoping/Decision context:** to set boundary conditions for the analysis
II. **Situation analysis/Climate science basis:** to assess present and future water resources issues
III. **Project design building climate resilience:** to develop alternative strategies for decision making
IV. **Action planning:** to specify tasks, schedules, and resource requirements
V. **Implementation:** to execute the identified tasks, including monitoring and public consultation

The framework safeguards the thorough completion of planning processes and signposts where and how scientific information, data and models can be used to support the analysis. The levels of detail in the analysis are tailored to the needs and capacities of the country, basin or region.

Using the analysis framework helps to establish a sound understanding of an area's water system, and to describe the importance and benefits of the sustainable management of the available water resources. That leads to knock-on improvements in planning decisions so that they cater to both present and future demand.





IWRM Planning Framework of Analysis helps to structure analyses

IWRM Water Supply Strategy for Central Cebu, Philippines

Growing water demands and increasing water degradation due to saltwater intrusion are stressing the water supply system in Central Cebu, the Philippines. Traditionally, water resources management in the region has only been conducted on a short term basis. However, these changing conditions require more long term planning as well as large scale collaboration across cities and municipalities in the region.

In 2006, a traditional Integrated Water Resources Management (IWRM) planning process was applied to the Central Cebu region with the goal to meet demand for safe municipal water supply and lay the foundation in addressing the related issues of water quality and watershed protection (Deltares, 2006).

To meet these challenges a Management Information System (MIS) and an operational Water Resources Management Framework were developed for the analysis and evaluation of water resources and watershed management measures, aiming at eliminating or reducing shortfalls in water supply and degradation of watersheds. A water resources management action plan was developed through the implementation of small-scale pilot projects.

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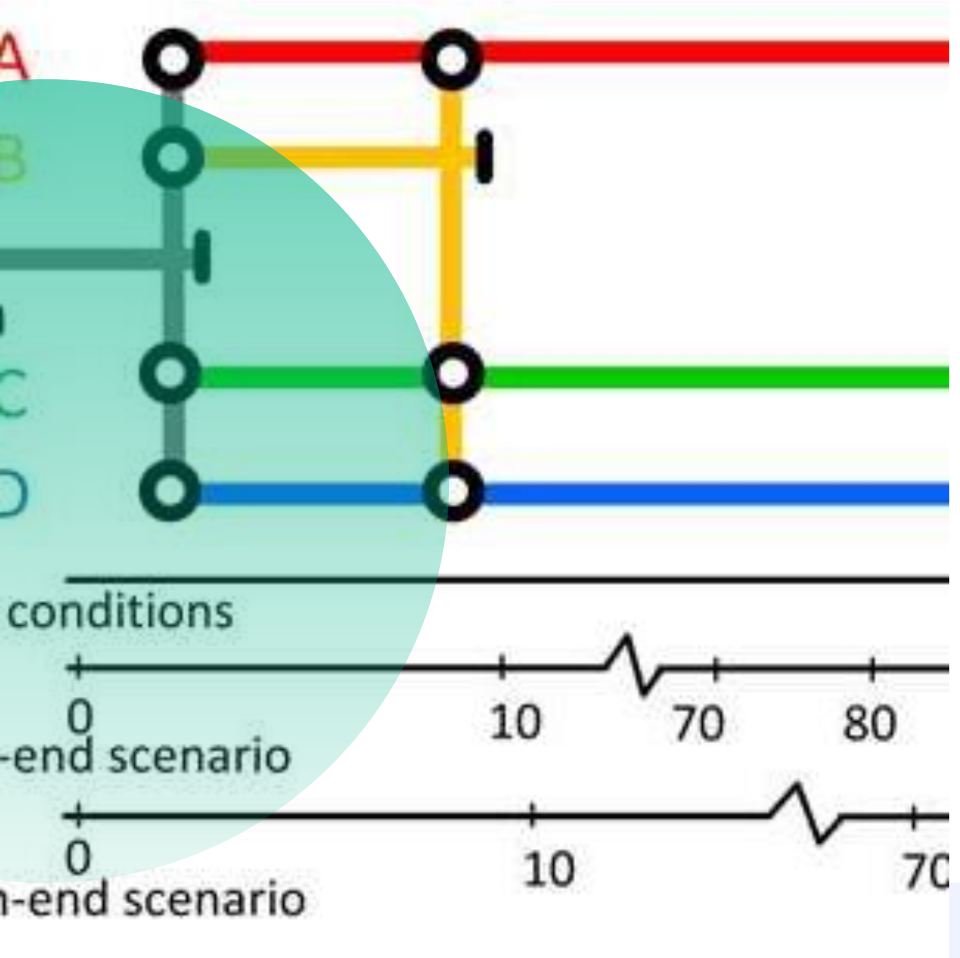
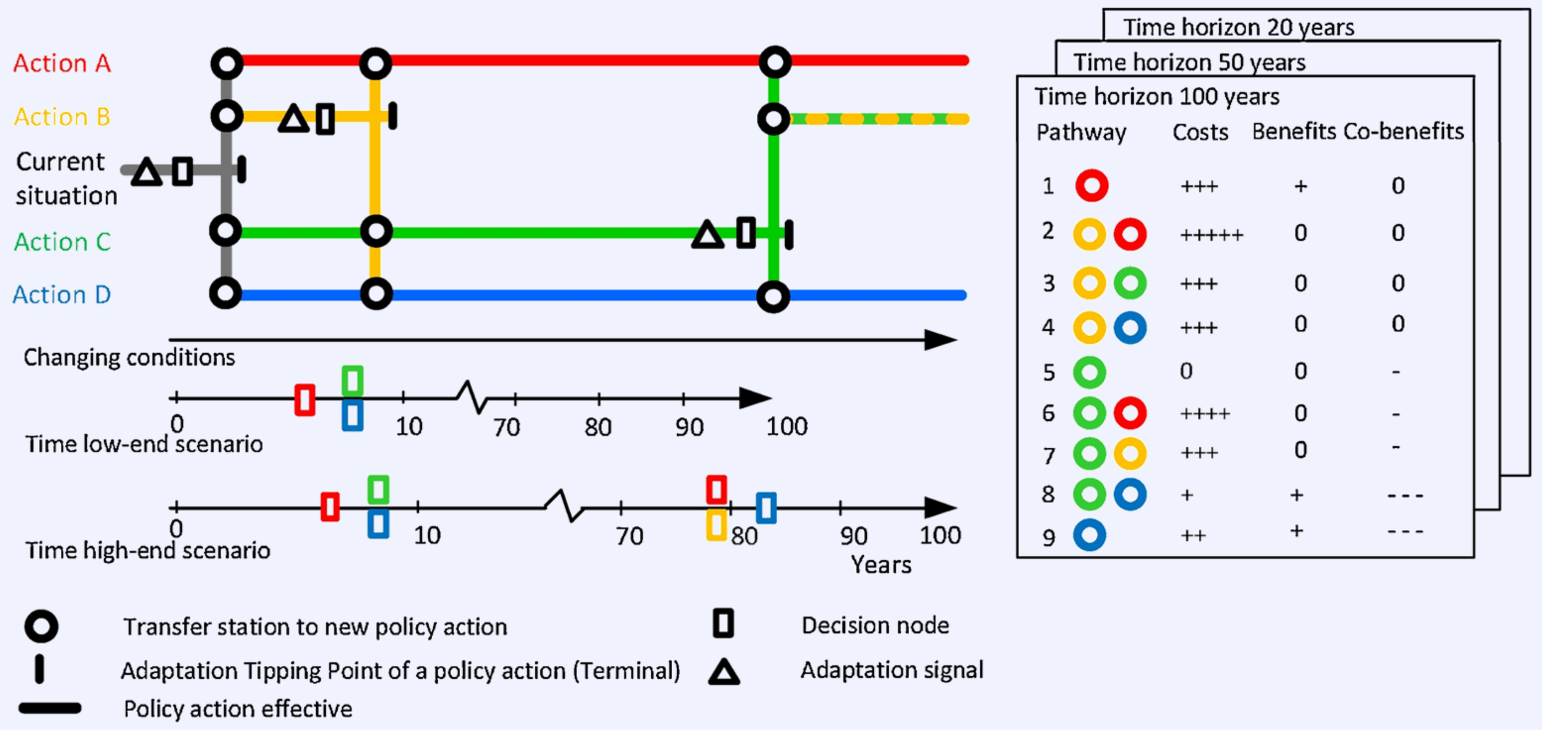


Adaptation Pathways

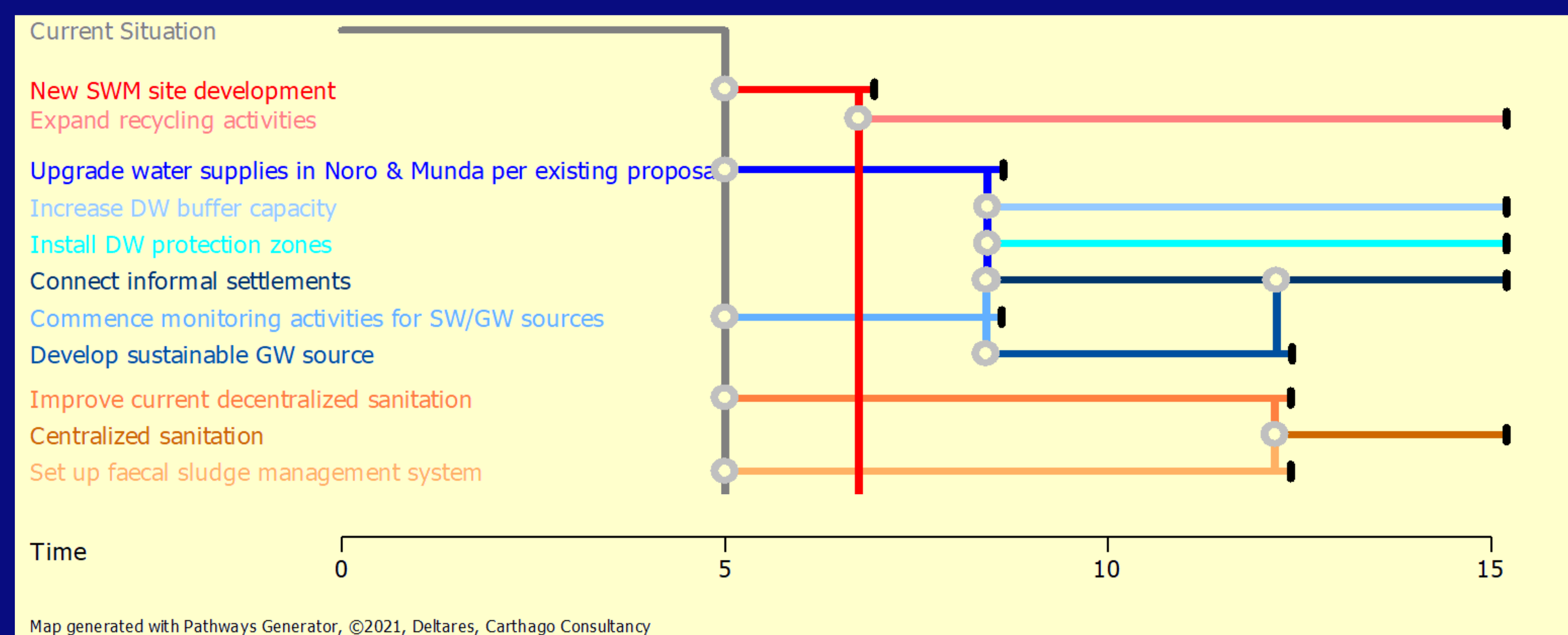
Dealing with uncertainty through adaptive WASH planning

Adaptive planning has emerged in response to the recognition that the future cannot be accurately predicted and is uncertain. WASH plans have traditionally been developed according to an 'assumed' or 'best-guess' vision of what the future water availability and demand might look like, which could turn out to be wrong. Adaptive planning methods rather seek to devise plans that are capable of *flexibly* adapting to the conditions that emerge, while retaining an overall *robustness* to achieving WASH objectives. Central to the concept of adaptive planning is the ongoing identification and monitoring of relevant WASH system parameters to serve as early warning signals or 'signposts' of changes in the system.

Dynamic Adaptive Policy Pathways (DAPP; Haasnoot et al., 2013) is an adaptive planning method that formulates strategies as alternative sequences of actions to be implemented as conditions change. These sequences, or adaptation pathways, serve to connect short-term actions that address immediate challenges with a series of longer-term options to be kept open for the challenges of the future should conditions continue to change. The DAPP approach identifies tipping points that determine when a certain policy or intervention is no longer acceptable, and another intervention is needed. By exploring possible interventions, adaptation pathways can be developed which minimize regret. The exploration of adaptation pathways is one of the main features of an adaptive plan. A monitoring system collects information to identify early warning signals for implementation of actions or for the reassessment of the plan.



Adaptation pathways. The left side of the figure provides an overview of possible pathways and the right provides a (very simplified) 'score-card' which helps to evaluate the options.



Set of adaptation pathways developed for Noro-Munda for solid waste management and WASH services. Note these pathways serve as an initial foundation upon which longer-term pathways may be formulated, subject to further assessment.

Developing climate resilient pathways for Noro-Munda

An initial set of climate resilient investment pathways for two adjacent regional cites in the Solomon Islands were identified for three integrated development priorities, including WASH. A qualitative risk analysis was performed and future uncertainties in external drivers were represented by a high and low scenario covering a plausible range in projected climate change and socio-economic development.

Noro and Munda are presently well positioned for green and resilient development. The simple pathways identified seize existing opportunities and confront potential risks. The pathways commence with short term actions that offer a low potential for future regret: they are often cheap, respond to urgent present development needs while delivering many co-benefits, and keep options open for further development and resilience building when climate change or socio-economic growth may accelerate.

For WASH services, water supplies in both towns should be upgraded per existing proposals, before being extended to presently unserved populations (subject to additional technical assessment). Sanitation systems would be improved by supporting residents presently without improved sanitation to install an improved latrine, in combination with the provision of public sludge management services. These investments are needed regardless of the climate and socioeconomic future that emerges, will advance public and environmental health and ecological outcomes in the two towns, and offer minimal restrictions the implementation of additional investments in the future.

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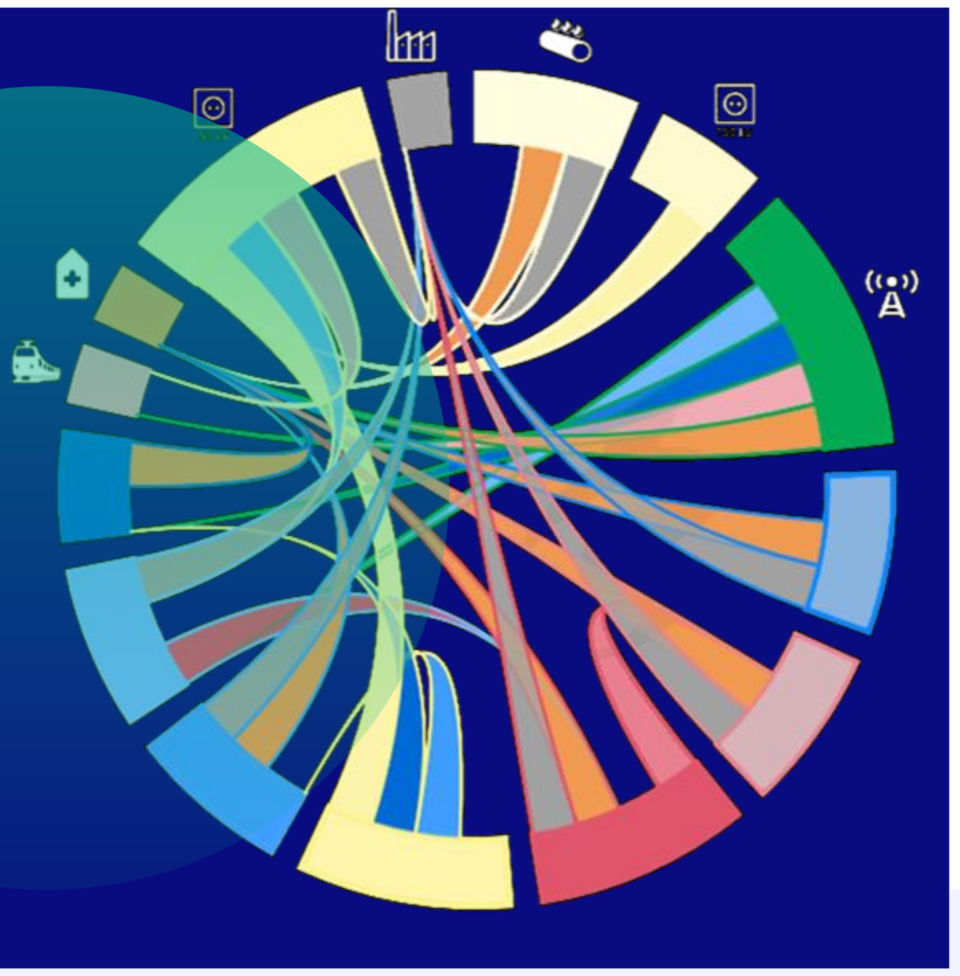

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CIrcle: Critical Infrastructure

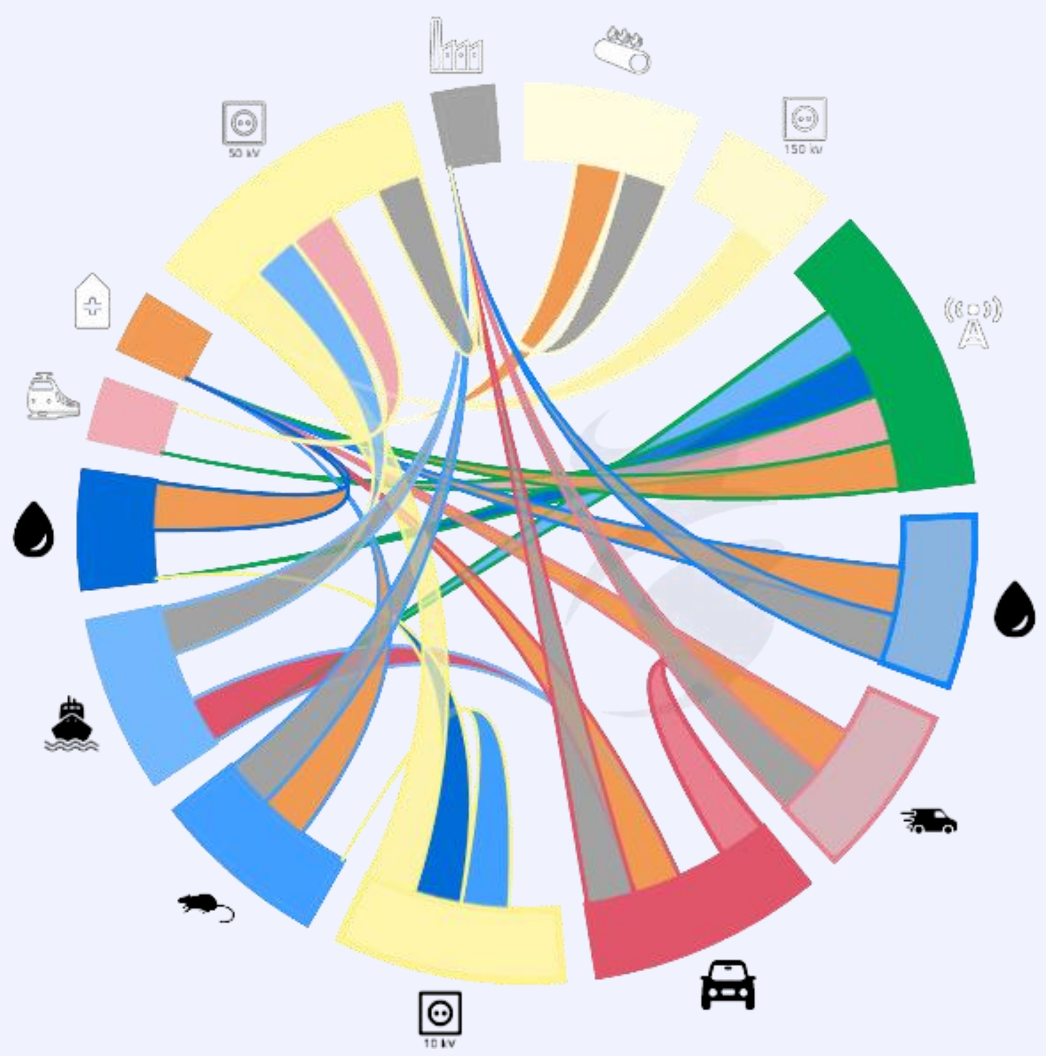
Understand connections. Simulate partnerships. Prepare for the future

Extreme flood events can cause devasting effects when critical infrastructure networks such as electricity, telecommunications, water supply, wastewater or transportation systems are interrupted, leading to crippling, often long-lasting societal impacts including fatalities and economic losses.

CIrcle (Critical Infrastructures: Relations and Consequences for Life and Environment) is a tool to support the analysis of domino effects of critical infrastructures. With Circle, you collaboratively describe the interactions and dependencies between Critical Infrastructures. The tool facilitates discussions between stakeholders that are dependent on each other, builds trust and stimulates future partnerships.

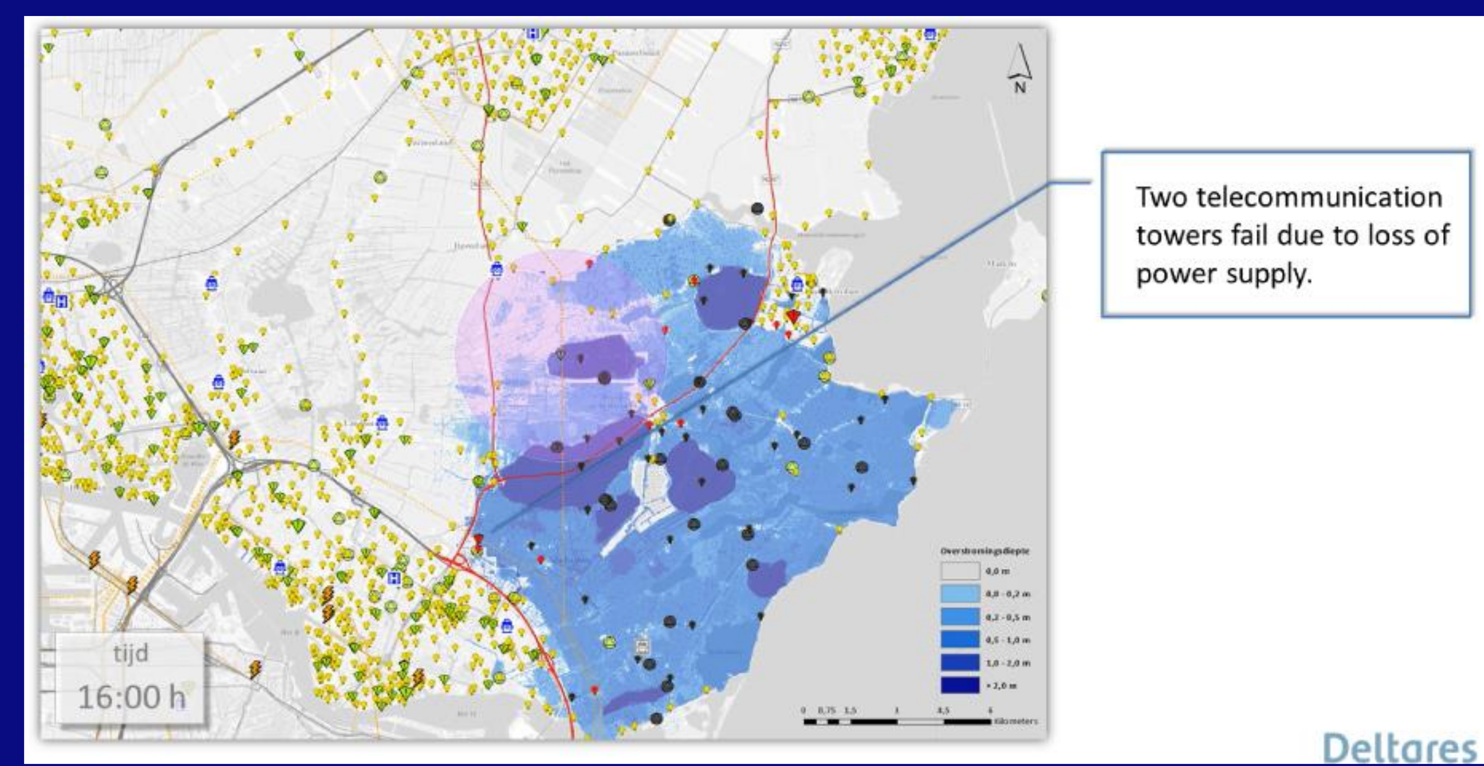
A CIrcle analysis typically follows the below process:

1. Gather (e.g., OpenStreetMap) data on CI and vulnerable objects (Quick Scan approach)
2. Gather expert knowledge on direct impacts, infrastructure system interactions and dependencies (CIrcle Workshop)
3. Combine data with expert knowledge to conduct cascading effect analyses (CI Analysis)
4. Complement (flood) risk assessments with gained insights on indirect effects
5. Implement measures to increase resilience and assess their impacts
6. Collect new knowledge in the Knowledge Database to improve understanding of cascading effects



The CIRCLE diagram helps organize and visualize the dependencies between critical infrastructure

Cascading effects in Amsterdam - Waterland



Two case studies were carried out in the Netherlands to research the cascading effects of critical infrastructure based on open data. One studied the anticipated present-day cascading effects of a historical dike breach in the Amsterdam-Waterland region. As the available data alone was insufficient to analyze cascading effects, the very first CIrcle workshops were held with network operators and other stakeholders to determine additional impacts. The results from the workshop proved extremely valuable for understanding cascading effects and gave insights in how open data could be used at best.

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