

TERESA – Urban Water Management: German Expertise for Kazakh Cities

CLIENT II – International Partnerships for Sustainable Innovation

The vulnerability to floods and the increasing need for potable water affect the urban areas of Kazakhstan in particular. Tackling both problems at once requires integrated water management that combines surface water management (stormwater catchment, flood protection) with groundwater management (recharge measures, recovery for different uses). TERESA will develop nature-based solutions for urban catchments in Kazakhstan by combining the advantages of sustainable urban drainage solutions and managed aquifer recharge systems.

The goal of TERESA

The overall goal of TERESA is to use and enhance natural processes such as water retention and infiltration to reduce the impacts of urbanisation and climate change on the natural water cycle. The multifunctional solutions proposed aim to decrease the stormwater runoff and increase groundwater recharge to mitigate urban flooding and protect groundwater-dependent urban ecosystems.



Urban landscape in Nur-Sultan, Kazakhstan.

Sustainable urban drainage solutions (SUDS) are a collection of water management practices that align modern drainage systems with natural water processes. Their application increases water evaporation and storage as well as the area for infiltration and thus supports flood risk management while maintaining and protecting the natural water cycle. Further advantages include the improvement of water quality and the creation of overall better living conditions for people and nature.

To improve their efficiency and cope with the increasing seasonality of water availability, the underlying aquifers provide additional water storage capacities. Site-specific solutions aimed at managing the recharge of the aquifers through enhanced infiltration will further reduce the area needed and provide for more flexibility when integrating SUDS into urban planning strategies. The intentional recharge of the aquifers with water collected and retained through SUDS allows for potential reuse of water for other urban needs, such as irrigation of green areas during summer, etc.

Virtual urban model using modern simulation tools

To support stakeholders in Kazakhstan in designing and adopting sustainable water management solutions, the project will develop a virtual urban development model using modern simulation tools. The model will focus on scenario-based assessments of engineered drainage systems and natural water balances in selected areas of Nur-Sultan, using smart, sensor-based monitoring approaches to keep up with the rapid development of the city.

To achieve this, TERESA uses a combined approach to integrate a sewer network model with a surface flow model and a groundwater flow model. The IT infrastructure proposed will extend the existing software solutions developed by project partners TUD and itwh and will be integrated into the Astana Smart City concept developed by Astana Innovations JSC.

Participative urban planning

To realise the virtual urban model and simulate the impact of the solutions proposed, the project team will use various planning typologies and guidelines that will be validated in workshops and meetings with Kazakh partners. In the course of this, the team will focus on different land uses and their hydrologic characteristics; the degree of urbanization expressed in the demand for an engineered water infrastructure; as well as the potential connectivity to adjacent areas and regions.

As a virtual model, the approach can be used to replicate existing urban developments in Nur-Sultan and other cities or as a scientific basis when planning new urban agglomerations to estimate their future water footprints.



Rapid urbanization and climate change are putting severe pressure on water resources in Nur-Sultan, Kazakhstan.

Funding initiative

CLIENT II – International Partnerships for Sustainable Innovation

Project title

TERESA – Urban Water Management: German Expertise for Kazakh Cities

Duration

01.02.2021–31.03.2024

Funding code

02WCL1552

Funding volume

899,500 Euro

Contact

Dr. Catalin Stefan
Technische Universität Dresden
Helmholtzstr. 10
01069 Dresden, Germany
Phone: +49 351 46344144
E-mail: catalin.stefan@tu-dresden.de

Project partner

Institut für technisch-wissenschaftliche Hydrologie GmbH;
Nazarbayev University, Kazakhstan; Astana Innovations,
Kazakhstan

Internet

bmbf-client.de

Published by

Bundesministerium für Bildung und Forschung/
Federal Ministry of Education and Research (BMBF)
Division Global Change – Climate, Biodiversity
53170 Bonn, Germany

January 2024

Editing and layout

Project Management Jülich, Forschungszentrum Jülich GmbH;
adelphi research GmbH

Photo credits

pixabay