

## Room for the River Regge, Netherlands - restoring the river dynamics <sup>[1]</sup>

Image from Climate Adapt about this case study

[2]

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Historically, the Regge was a free-flowing shallow lowland river which meandered through a landscape containing marshes, wet meadows and sandy levees. To facilitate shipping, from 1848 onwards the river was straightened by cutting off meanders, and the river channel was deepened and widened. Dams were built to better regulate the river flow, and the floodplain was embanked to protect the adjacent land from flooding. In 1935, the river was almost completely canalised, reducing its length from roughly 70 km to 50 km. Most old meanders in the (former) floodplain were filled up to make room for agriculture. As a consequence, natural flow dynamics and associated morphological processes were lost and the flow velocity decreased substantially. In these conditions, heavy rainfalls caused flooding in large areas in the valley of the river. In dry periods, on the contrary, agriculture and the wetlands suffered from the lack of water. Due to these problems and considering that climate change is expected to aggravate them, in 1998 a re-naturalisation programme for the entire river, the 'Reggevisie' was launched by the local water authorities (Water Board Vechtstromen, formerly Water Board Regge en Dinkel). It aims at: (i) reintroducing river dynamics, (ii) creating more space for water buffering during peak discharges, (iii) facilitating nature development in the floodplain of the river, (iv) making the river more attractive from a recreation perspective. The programme is still ongoing and expected to be finished in 2025.

### Case Study Description

#### **Challenges:**

Until 1848, the Regge river was a meandering river. Starting in the 19th century, the first bends were cut and over the years the Regge was largely turned into a canal. Under flooding conditions, large areas in the valley of the Regge river were flooded and in some places the floods were a mile wide. In severe drought situations, however, the river was no more than a coherent set of stationary eddies. Before the renaturalisation, the main stream regularly cut off meanders, which were still recognizable in the landscape. The river formed a landscape that provided an insufficient basis for a scenic and ecologically well-functioning Regge basin.

The Water Board Regge and Dinkel (successively merged into the Water Board Vechtstromen) was committed, together with the province of Overijssel, relevant municipalities, landowners and various interest groups, to gradually change this situation and transform about 50 km of the highly artificialized waterway into a natural river. The 'climate buffer' Regge was planned to provide more space to store the water in periods of flooding by re-meandering. Moreover, this transformation was intended to increase the sponge effect of the soil, preserving more water for dry periods. The challenge of the transformation programme, which includes several projects, was to turn the catchment into a network of habitats for plants and animals, and into a beautiful 'backdrop' for tourists and holidaymakers to cross by bicycle, boat or on foot and where to spend a few days. The aspiration of farmers to broaden their businesses was also connected with this programme.

The renaturalisation of the river gains special importance in the light of climate change. In the Netherlands precipitation patterns are projected to change: mean annual precipitation is expected to increase by up to 5% and extreme events (10-day amount exceeded once in 10 years) are expected to increase by up to 17% in

winter and up to 22% in summer by 2050 ([KNMI, 2015](#) [3]). Increased winter rainfall is likely to increase peak discharges and flood risk. Hot summer days with maximum temperatures over 25°C are expected to increase by up to 70% by 2050 and consequently also droughts (e.g. highest precipitation deficits exceeded once in 10 years by up to 25% by 2050). This will lead to an increasing need for water retention for nature and agriculture. With the old modified river structure, such precipitation patterns would have led to severe problems and water retention would have been very limited.

### **Objectives:**

The overall objective was to make the Regge 'climate resilient'. This implied accounting for the impacts of the actual climate variability while also taking into consideration the projected future situation. In the Reggevisie programme, the canalized river was restored to a dynamic and resilient, meandering river at different places, taking into account the protection of the residents against flooding. In general, the Regge restoration pursues the following objectives:

- Moderating discharge peaks to prevent flooding downstream;
- Restoring natural stream processes and stream character: (i) inundations, (ii) natural drainage course, (iii) smaller profiles (summer bed), (iv) higher flow rates;
- Combating droughts: (i) with downstream smaller sections so that the drainage base can be placed higher and the flux of groundwater to surface water can be reduced in size; (ii) by reconnecting old streams back to the river Regge in order to provide more irrigation water to farmers and drinking water for the drinking water industry and ensure enough water at the weirs for the functioning of the fish ladders.
- Improving water quality by: (i) sedimentation and purification on the spot (green cleansing), (ii) realizing (as long as possible) a certain flow rate downstream, (iii) developing (wet) natural and landscape values, for instance as a stepping stone in the ecological structure.

Climate change projections were taken into account in the projects part of the Reggevisie programme to ensure that the abovementioned aspects will also remain valid under projected changing conditions.

### **Solutions:**

Within the Reggevisie programme the river dynamics of the river Regge have been improved and more room has been created to buffer peak discharges and improve water retention during dry periods. These processes gain special importance in the light of climate change since flood peaks and droughts are expected to increase.

To create extra capacity to handle flood water, part of the canalised river course has been maintained and a flood canal has been created parallel to the meandering river, along the lower and middle Regge. Barriers just below the floodplain level separate the canal from the meandering river. During average flow conditions, flow is routed only through the river meanders. During flood periods, flow is routed over the barriers and through the flood canal as well. This design reduces and delays the peak discharge. The peak discharge is reduced because the inundation area has increased significantly from the reference situation. Overall, the delay is due to the greater length of the Regge river system and the increased inundation area. After building the flood canal, so far, increased water levels have not caused any flooding in the Regge.

In the lowland Regge a wide flood plain has been created by reconnecting the old meanders which are often the starting point for new meandering. The profile of the Regge has been adjusted to provide the desired flow in the summer and sufficient variation in morphology, erosion and sedimentation processes. Moreover, to increase groundwater levels in dry periods, the surface water levels were raised. The design was adapted by increasing the flow width by 20%, resulting in a higher bottom level of the Regge, which leads to a reduced draining effect from the groundwater to the river.

The Water Board Vechtstromen is continuing the Reggevisie programme which is supposed to be completed by 2025. In particular, some of the projects in the middle and lower Regge are still ongoing.

### **Importance and relevance of the adaptation:**

#### Additional Details

##### **Stakeholder engagement:**

The Water Board Vechtstromen cooperates with a wide number of stakeholders for the Reggevisie programme, which are consulted along the entire stretch of the river. In particular, the Reggevisie programme is realized in collaboration with:

- Private landowners and users;
- Municipalities of Ommen, Twenterand, Hellendoorn, Wierden and Rijssen-Holtten and courtyard of Twente;
- The Province of Overijssel;
- The Department of Public Works;
- Twente region;
- Conservation organizations, as: Landscape Overijssel, Natuurmonumenten, Forestry Commission.

In all projects part of the programme, the consultation has led to local support. The Water Board throughout the implementation phase works to actively involve the public by providing information and through integrated design processes for the redevelopment projects. Stakeholder consultation is continuing as part of the on-going work to complete the programme, expected to finish by 2025.

##### **Success and limiting factors:**

Success factors include the following points:

- The Water Board Regge and Dinkel and the newly formed Water Board Vechtstromen had and have a strong drive towards integrated water management;
- The vision for the Regge was formally adopted by the Water Board;
- National and European legislation and policy (WFD and Natura 2000 in particular) helped developing and implementing the Reggevisie programme ;
- The re-meandering projects are all integrated projects with multiple purposes;
- The implemented measures are based on research and science-based evidence;
- The EU Water Framework Directive (WFD) objectives are not the only ones for the projects, which also aim for restoration of fluvial habitats;
- The integrated approach adopted and combining objectives has led to cost-efficiency;
- All projects have sufficient support from the local communities;
- The Water Board had initially only limited insight about the effectiveness of the restructuring measures for ecological goals, but the results in the last years indicate a very good ecological development e.g. of the macro-fauna.

In some places, private landownership hindered the implementation of the restoration projects and in some cases expropriation was required.

##### **Budget, funding and additional benefits:**

Total cost of the various projects has been estimated in about 25 million euro.

Significant benefits are related to the improved protection from flood events and improved conditions during drought conditions. The enhancement of the natural design and conditions of the Regge was and is an integral part of many of the projects part of the Reggevisie programme. The creation of an ecological corridor along the river aimed at increasing the connection of natural areas and allowing plants and animals to naturally spread. In addition, space is created for viable and profitable agriculture around the Regge valley. The enhanced natural design of the Regge has boosted and is boosting recreation activities and tourism in the municipalities through which the Regge flows.

##### **Legal aspects:**

The projects part of the Reggevisie programme were based on the 4th National Policy Document on Water

Management (1998), the European Water Framework Directive (2000), the National Water Policy for the 21st Century (2000), the National Water Plan (2009) and Natura 2000 Directives.

**Implementation time:**

The implementation of the Reggevisie started in 2010 and will continue until 2025.

**Reference Information****Contact:**

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**Websites:**

<https://www.klimaatbuffers.nl/projecten/regge> [5]

<https://www.landschapoverijssel.nl/gebieden/gebiedenregge> [6]

<https://youtu.be/RSKaquTkws> [7]

[https://youtu.be/\\_SzBeOYP7sQ](https://youtu.be/_SzBeOYP7sQ) [8]

<https://www.vechtstromen.nl/buurt/projecten/> [9]

**Sources:**

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