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Infrastructure and adaptive management in an eco-hydrological Delta: Lessons learned from design and construction of the Haringvliet Sluices

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Consequences of climate change include an increase in extreme weather events in North-West Europe. The Netherlands is directly affected by these extreme events, in particular in water management practices. Large investments in infrastructure were made ever since the floods of 1953, leading to a higher level of protection against flooding from the sea and to a managed eco-hydrological Delta.

Adaptive water management is presented as an approach to deal with challenges in water allocation and flood protection. One challenge to adaptive water management relates to infrastructure. Large works are often inevitable and essential in flood protection. Hydraulic infrastructure however tends to be inflexible by nature and requires a level of robustness to deliver the desired performance over time. In this study, we focus on the relation between desired performance of infrastructure and adaptation to environmental change and evolving social demands.

The objective of this study is to gain an understanding of the evolution of the desired performance of water management infrastructure. This serves two purposes: an increased understanding of design and construction of existing infrastructure, and potential lessons learned for future hydraulic infrastructure in the context of adaptive management.

A qualitative approach was used to evaluate over 130 reports on all stages of the design, planning and construction of the Haringvliet sluices as part of the realization of the Delta Works. The time frame is set between 1950 and 1970. The main source of information is a set of quarterly reports to the Dutch parliament, published between 1956 and 1988, and which provided detailed information on design, construction, maintenance, system behavior, policy needs, social demands and stakeholders.

The original objectives of the infrastructure were reflected in its design: protection against flooding, protection against salt intrusion and discharge of water and ice – all with a desired ease of operations of the gates of the infrastructure. The dimensions of the Haringvliet sluices thank their uniqueness to the requirements to discharge both ice and water. Upon completion of the Haringvliet sluices in 1970, two main observations can be made. First, environmental issues were hardly considered, while the focus was on protection against flooding and salt from the sea. Second, during the construction phase, experimentation, learning and adaptation were reported. Changes were made during the construction and based on extreme weather events and lessons learned from construction activities elsewhere.

These observations prompt the question whether an experimental approach as applied during the construction of the Haringvliet sluices would be allowed for in modern infrastructure projects of comparable impact, size and costs. A second question to be studied should be what happened after the completion of the Haringvliet sluices, when this infrastructure had to be operated and in a context in which environmental issues gradually became more prominent and eventually integrated into the water management practice.