01 | Engineered dams

Environmental impact 2/3
Risk protection 2/3
Durability 3/3
Affordability 1/3

Intro

Dams, dikes, and levees are engineered structures with an impervious core (which in most cases makes the difference with vernacular dams) that support flood control and the protection of built and agricultural areas. They are usually located along or across rivers, deltas, or seashores *(see Measure [06])*.

Dams

Dams represent engineered, mostly large barriers for water control, storage, and supply during times of drought. Dams can also impound other liquids, such as wastewater. They come often with complex control systems *(e.g., spillways or control gates)*. This compendium does not refer to dams for hydroelectricity production.

Dikes and levees

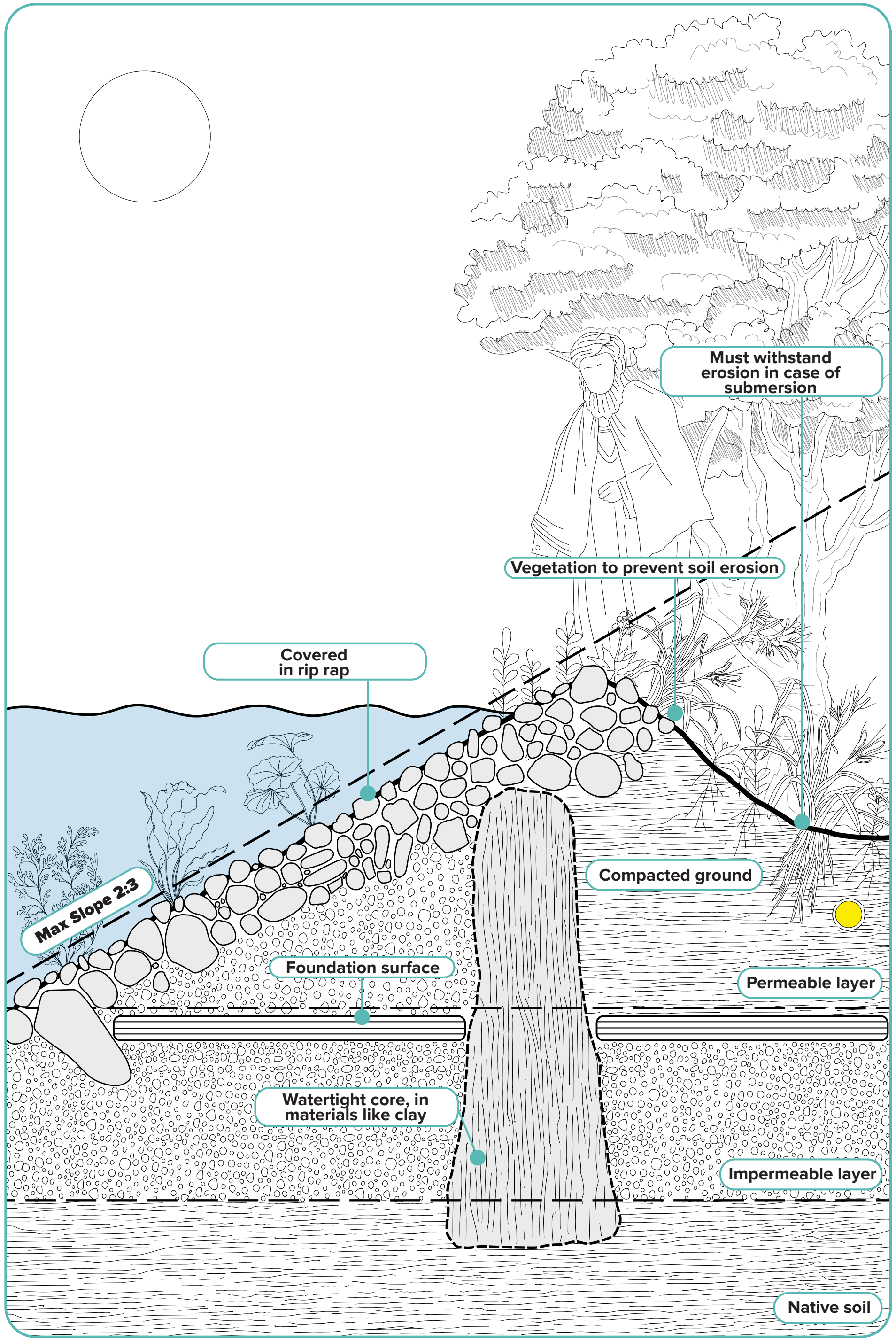
The main purpose of dikes and levees *(also: embankments)* is to act as a barrier for diverting, redirecting, or confining flood waters. In contrast to dams, dikes and levees usually do not have complex water control mechanisms. There are also non-engineered types of dikes and levees that do not have an impervious core *(see Measure [02])*. The impervious core, which is built deeper than the dike base, aims at avoiding the water infiltration trough the soil. The crest and the inner wall must be designed *(at least in some strategic places)* to withstand the submersion, avoiding a total collapse of the dike during a flood. Moreover, geotextile containers and tubes come increasingly into use as a hybrid form of embankment or to support the structure of dams, dikes, or levees *(see Measure [03])*. Note that the goal of the dike contradicts the drainage necessities *(see Measure [07])* and therefore must be carefully designed.

Check Dams

Check dams represent a simpler type of dams and describe barriers across channels or rivers. They aim to reduce erosion and sediment accumulation, as well as to fix the stream axis during a flood event. However, in contrast to other dams and dikes, check dams continuously operate and do not only come into effect during flood events. Wooden structures and gabion retention walls can also be used as check dams *(see Measure [05])*.

Benefits and Risk

In general, the construction of dams, dikes and levees should consider the effects of the changing climate and the linked hydrological events. The failure of a dam could cause severe floods. To ensure the safety of dams, it is crucial to apply structural, operative, and emergency planning. Large and concrete dams need comparatively strong monitoring and maintenance. As a result, the risk of failure can be higher regarding smaller dams due to sometimes neglected maintenance and design standards.



Good practice

Dike construction along the White Nile, South Sudan
Heavy rains caused severe floods and resulted in the collapse of a dike along the White Nile in 2021. The incident left the South Sudanese town of Bor in the east of the White Nile wetlands devastated. Most of the town's residents lost their homes and agricultural fields. As a response, the works involved the youth of Bor to fix around 90 spots along the dike with sandbags. In addition, a new dike of 9.4 km has been constructed with the help of excavators while the existing embankments have further been reinforced. Lastly, community-based disaster risk management committees were formed that received training in emergency preparedness and were equipped with response toolkits (Loyce 2021).

Forestry Blog (2023)
Different Types of Check Dams & Design Procedures. Available online at https://forestrybloq.com/different-types-of-check-dams/.

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Innovative Techniques in the Context of Actions for Flood Risk Management: A Review. In Eng 2 (1), pp. 1–11. DOI: 10.3390/eng2010001.

Ward, Philip J.; Ruiter, Marleen C. de; Mård, Johanna; Schröter, Kai; van Loon, Anne; Veldkamp, Ted et al. (2020)
The need to integrate flood and drought disaster risk reduction strategies. In Water Security 11 p. 100070. DOI: 10.1016/j.wasec.2020.100070.

Overview of Criteria

Type of intervention:
Engineered.

Scale of Intervention:
Settlement, Supra-settlement

Materials:
1. Concrete, Rock, Earth-Fill, Timber, Gravel, Sand, Steel (Selection for Dams)
2. Earth-Fill, Compacted Soil, Wood, Sand, Clay, Concrete, Timber, Steel, Rocks, Gravel, Riprap (Selection for Dikes and Levees)

Environmental Impact:
Depending on the scale, type, and location of a dam/dike/levee, the structure can cause the loss of ecosystems and habitats, submersion of large areas of land, the disruption of natural water flows and quality, and the fragmentation of river systems.

Targeted Natural Hazard:
Coastal / Riverine Flood.

Targeted Vulnerable Assets:
Buildings, Transport, Land Cover.

Strategy Type:
Reduce Hazard Magnitude.

Implementation Time:
Long (> 1 year).

Effect Duration:
Long-term (>10 years).

Investment Costs:
High.

Maintenance Costs (yearly):
Medium (10-50%).

Flood Risk in Humanitarian Settlements: Compendium of Mitigation Measures

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