Fifty years of shallowing former sand- and gravel pits in the Netherlands: from win-win opportunity to major headache.

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Conference theme number(s): 5

Introduction:
What around 2008 looked like a win-win situation for applying soil and sediment from dredging rivers and later water safety measures grew to be major headache for Dutch governments. Wouter Klein Koerkamp demonstrates in his master thesis that more than 35 years of research experience of making novel lakes shallow (shallowing) was not used in 2008 for policymaking. The licensing requirement abolished in 2008 will return in 2023 aiming at more careful consideration for shallowing [1]. This presentation provides an overview of known (policy-) solutions for today's problems, that can possibly help to improve future policy.

Methods: The study is executed by mapping assumptions and its (in)consistencies under the shallowing policy in the period 1973-2023. The major juridical aspects of beneficial use for shallowing, were not studied before. For this study over 70 policy documents were coded into over 700 individual relevant text segments. As a result, dominant actors, knowledge, interactions and external events could be outlined over a period of 50 years of policy making.

Results:
The final results of the reconstruction are expected in the summer of 2023. The first results show that the main driver for the 2008 policy was the task of storing sediment (dredging rivers for navigable rivers) combined with a spatial problem (lack of possibilities) and the request for water safety. The shallowing of lakes seemed to result in a win-win situation because of the narrative of ecological quality of shallow lakes compared to deep lakes in line with the EU Water Frame Directive. However, the beneficial ecological impact of shallowing of deep lakes became a point for debate in later years [2]. Additionally the still existing 2008 policy for quarry lakes are basis for a favorable business case of the industry of mining aggregates. After mining sand and gravel it grew to be a second revenue model by applying moderately contaminated (foreign) material. Further unwanted effects are diverse, ranging from negative impact on ground water quality to loss of ecosystem services, both as a result of the application of dry soil under water in lakes [3, 4].

Discussion:
Whereas nearly 500 pitlakes emerged from the production of sand and gravel, in recent years 10-20 % of the yearly production of dredging and construction works was applied in about 100 lakes [5]. The 2023 compulsory license is expected to lead to a decrease of new initiatives for shallowing [1]. On the short-term, capacity for application is available in ongoing initiatives. The problem of lack on possibilities for application of material will probably arise again. Meanwhile, other 'new' aspects of the problem became more urgent such as greenhouse gas emissions from transportation of material [6]. For over 35 years policymakers searched for solutions for handling dredged material ultimately leading to the cost-efficient solution of application in lakes. This study makes clear that policymakers cannot avoid lessons learned from the pre-2008 when making integrated policies for dealing with dredged material and shallowing of lakes.

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