

IMPLEMENTING SURFACE FLOW CONSTRUCTED WETLANDS IN DENMARK USING A NEW LAYOUT DESIGN

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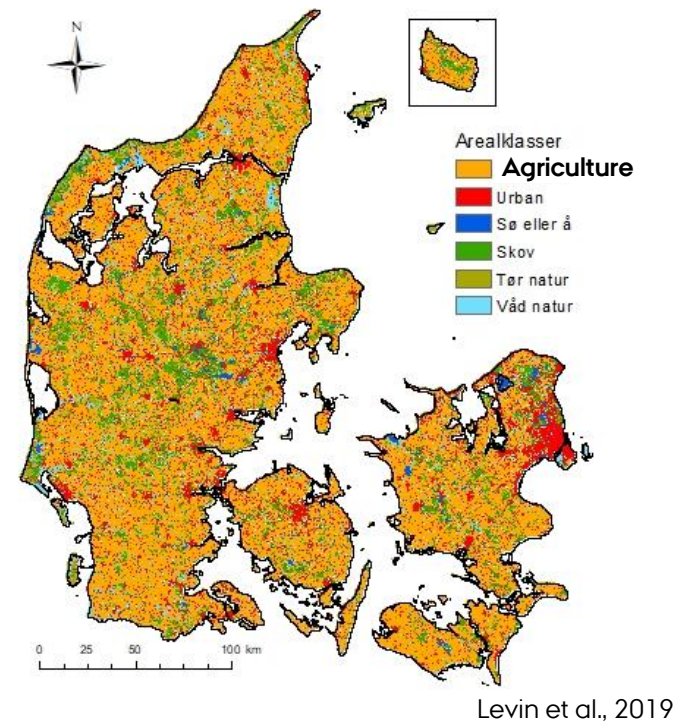
BACKGROUND

Denmark

- Agricultural land: 62% (Statistics Denmark, 2017)
- Drained agricultural land: 50% (Møller et al., 2018)

Legislations

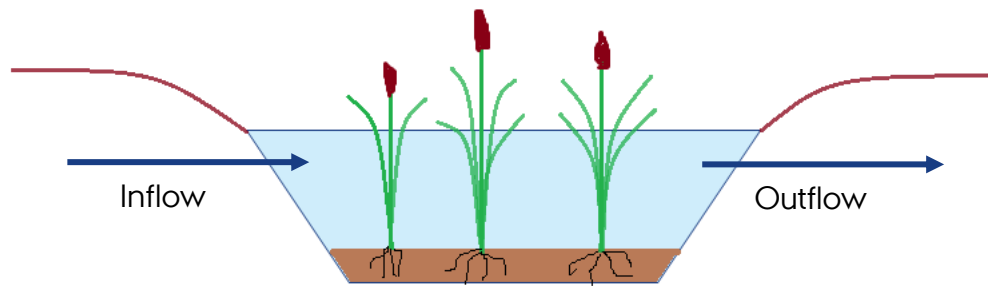
- The Agreement on the Food and Agriculture Package
 - Management based on the local environment
 - Mitigation measures
- EU directives



SURFACE FLOW CONSTRUCTED WETLANDS

A best management practice

- Mimics the processes of a natural wetland



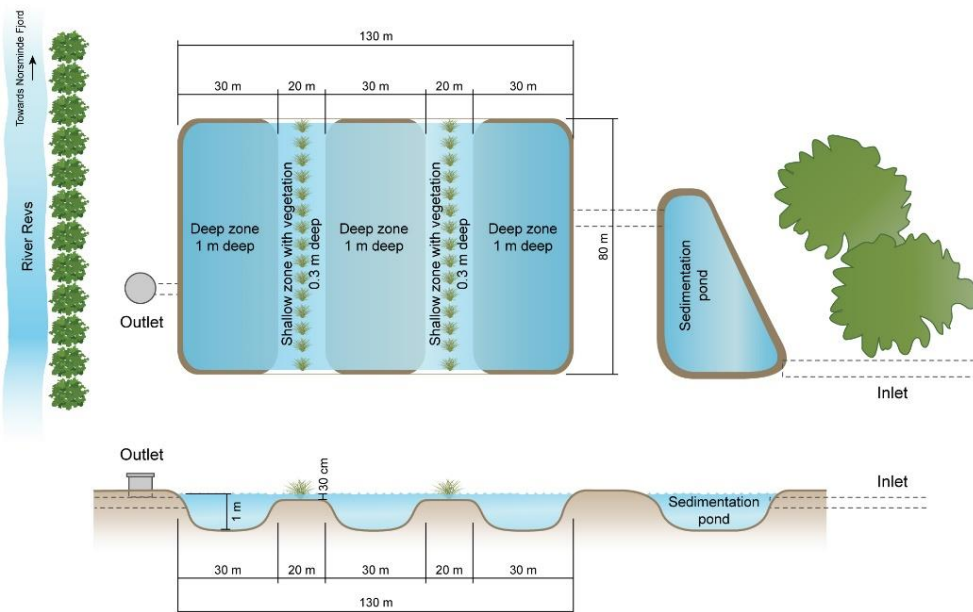
LAYOUT DESIGN - DK



Aim: remove nitrogen from agricultural drainage water.

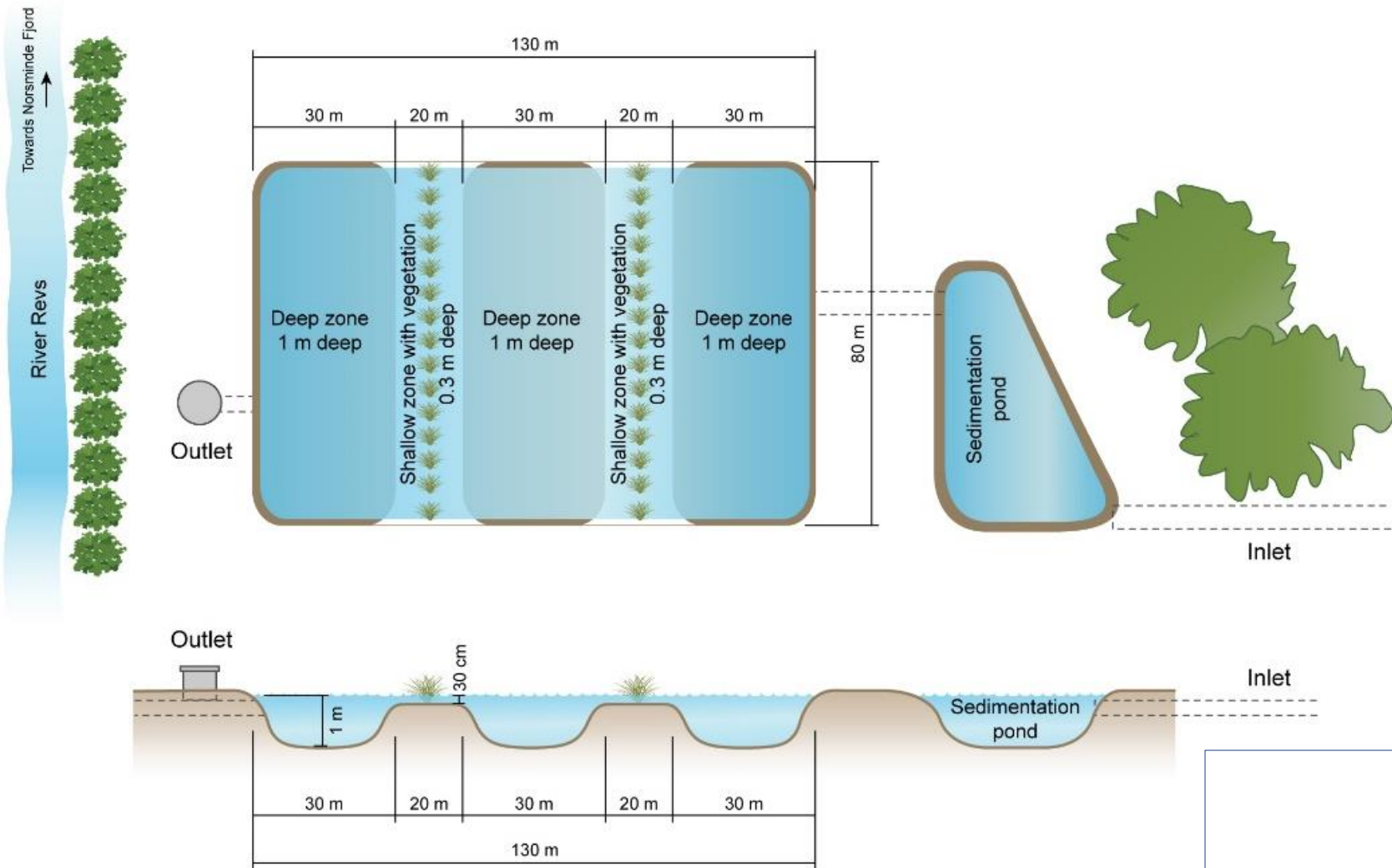
Requirements

- Size: 1-1.5% of the upland area
- Layout design
 - 1) Sedimentation pond
 - 2) CW with deep and shallow zones



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LAYOUT DESIGN - DK



FULL-SCALE TESTING FACILITIES

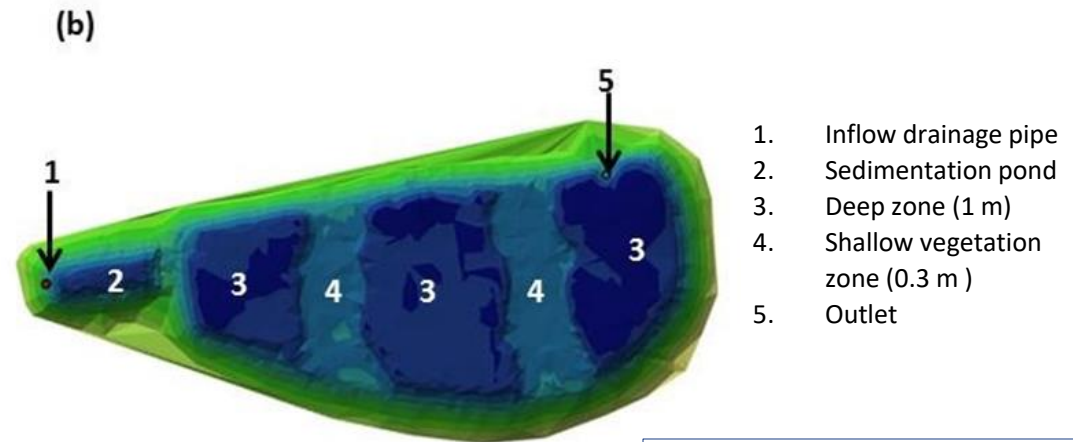
Fillerup

- 2010
- Catchment area: 38 ha
- Ratio: 0.78 %



Fensholt

- 2015
- Catchment area: 33 ha
- Ratio: 0.74 %



EFFICIENCIES

	TN (%)	TP (%)	TN (%)	TP (%)
	Average 2013-2017*		Range 2017-2020	
Fillerup	33	54	6.3-26	-3.6-60
Fensholt	-	-	13-19	36-62

*Kjærgaard et al. 2017

Table 2. Total nitrogen (TN) removal and total phosphorus (TP) retention at the surface flow constructed wetlands of Fillerup and Fensholt, Jutland, Denmark.

Study site	Period	TN removal (kg/ha)	TN-removal (%)	TP retention (kg/ha)	TP retention (%)
Fillerup	07/17-12/17	560	26	17.8	47
	02/19-06/19	44	6.3	3.36	60
	07/19-12/19	289	12	14.8	55
	01/20-06/20	235	16	-1.0	-3.6
Fensholt	07/17-12/17	437	19	31.8	36
	02/19-06/19	212	15	8.16	40
	07/19-12/19	327	13	24.9	43
	01/20-06/20	314	19	53.1	62

EFFICIENCIES – IN GENERAL



Table 1. Overview of absolute and relative nutrient removal efficiency (mean $\pm$ sd) of Danish surface flow constructed wetlands.

Sites (n)	Years	Removal rate (kg ha ⁻¹ y ⁻¹)		Removal efficiency (%)	
		TN	TP	TN	TP
13	44	472 $\pm$ 372	31 $\pm$ 26	23 $\pm$ 10	45 $\pm$ 20

Years: no. of years monitored. After Hoffmann et al., 2020.

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Promilleafgiftsfonden for landbrug



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