Mitigating hydropeaking impacts and enhancing fish habitat by hydromorphological adaptions of the river bathymetry

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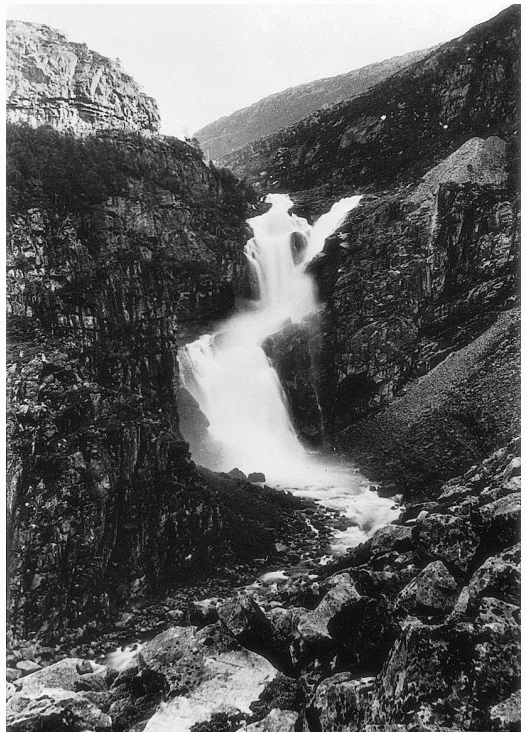
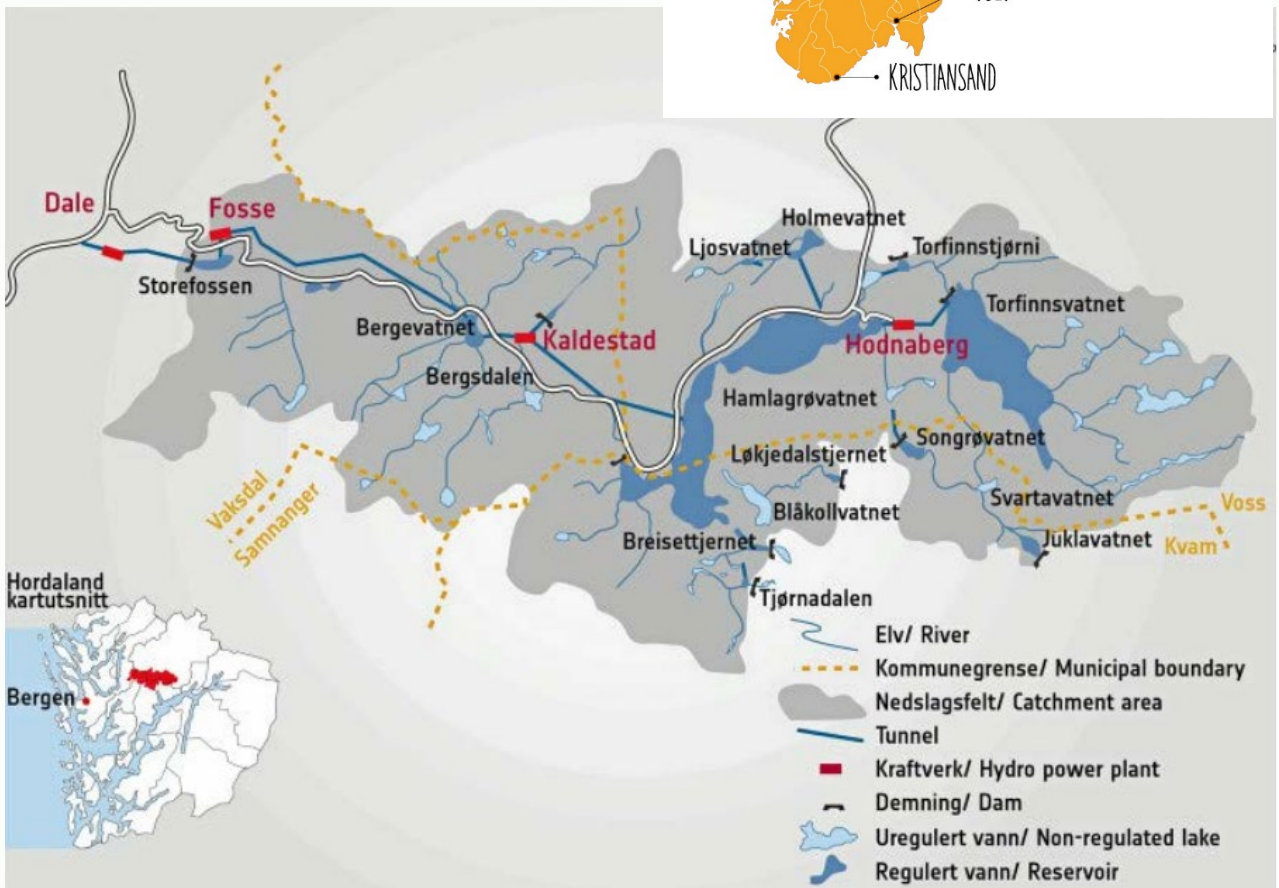
Dale hydropower plant

- Dale river has bees regulated since 1927
- Today Dale is the lowest of 4 hydropower plant
- 2 francis (113 and 30 MW)
- Annual production ca 700 GWh
- operates between 5 and 43 m^3/s

- 3 m^3/s minimum waterflow when no production





Ramping and environment

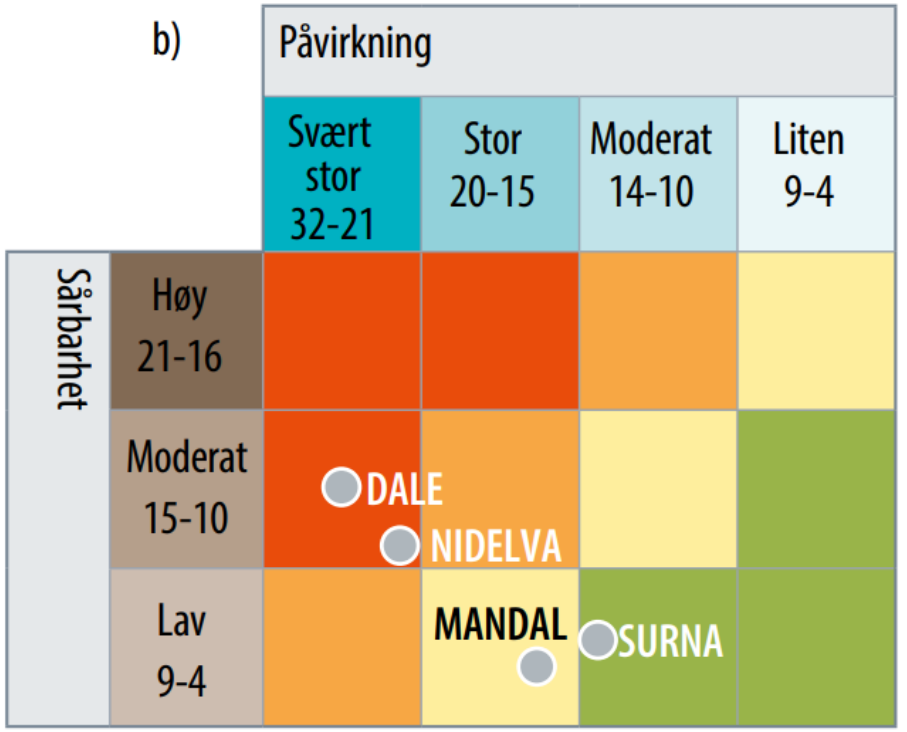
		production	Dale hydropower plant		Holmen	Dale estuary	
ramping down (cm/h)	Mean	2.9	27.3	43.1	4.2	12.1	33.5
	Median	0.3	18	30	0.9	9	30
	Maks	53.9	831	690	217.8	156	180
Ramping up (cm/h)	Mean	3.3	27.2	43.8	4.6	12.9	39.2
	Median	0.2	18	30	0.9	9	30
	Maks	55.5	1041	2280	933	714	600

Dale river today

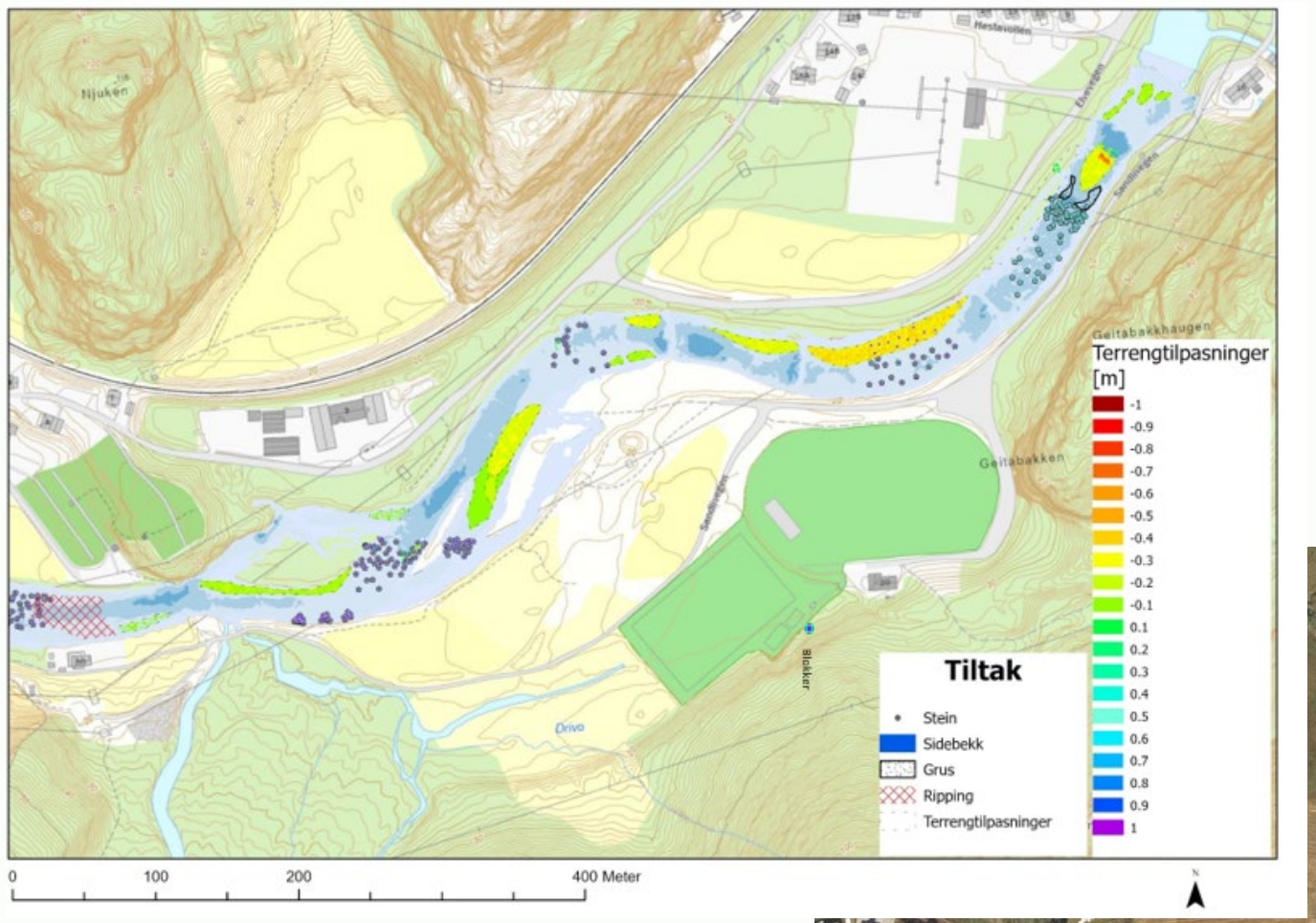
Heavy hydropeaking (Envipeak-study from Cedren 2016)

- 2 km stretch above the outlet with minimum flow all year.
- Several wires to prevent erosions.
- Pipe and canal to serve affected area with water to prevent dry falls.
- Spawning gravel in several spot
- Groups with boulders

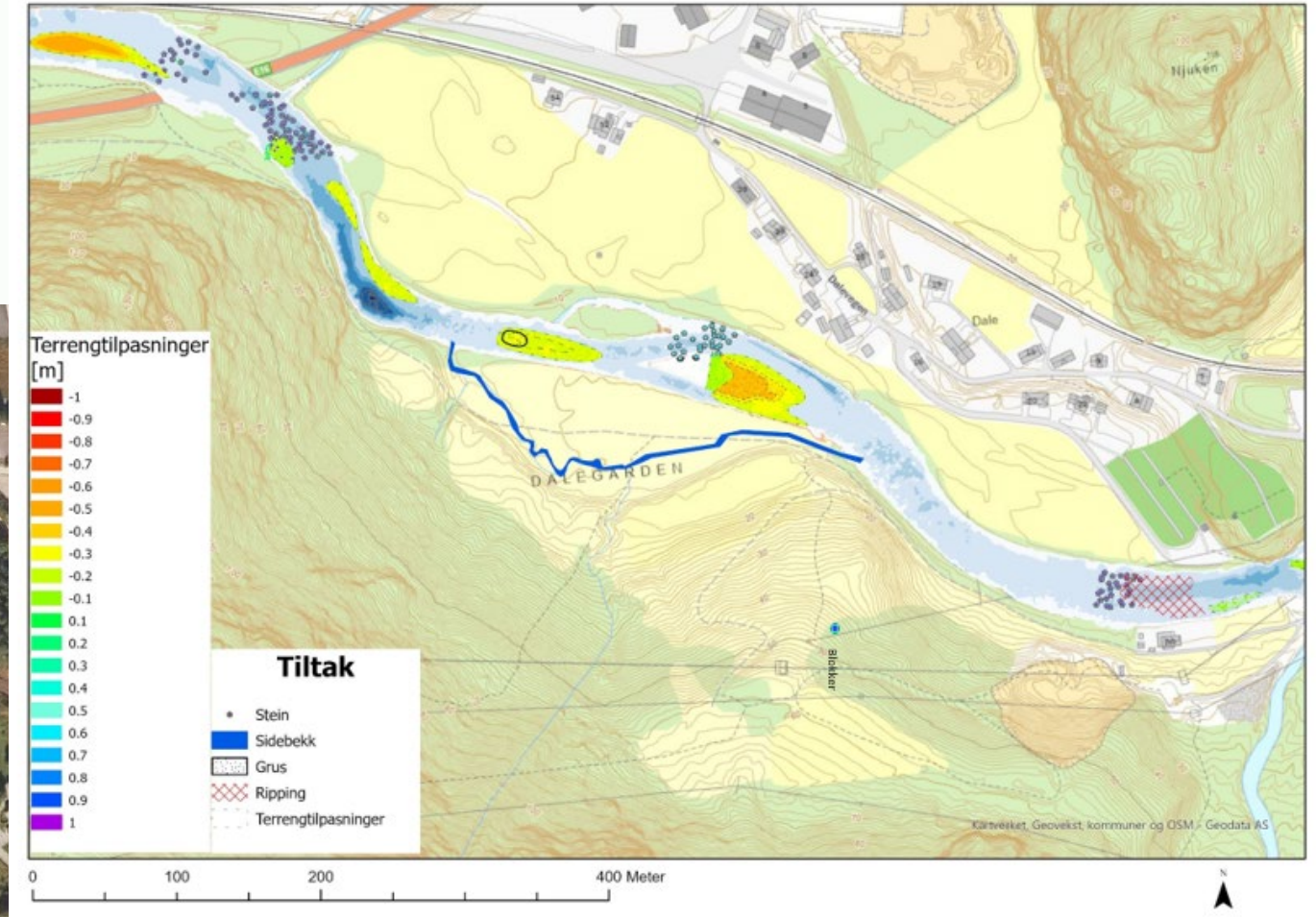
Sustainable smolt production: 9000-14000 yearly.



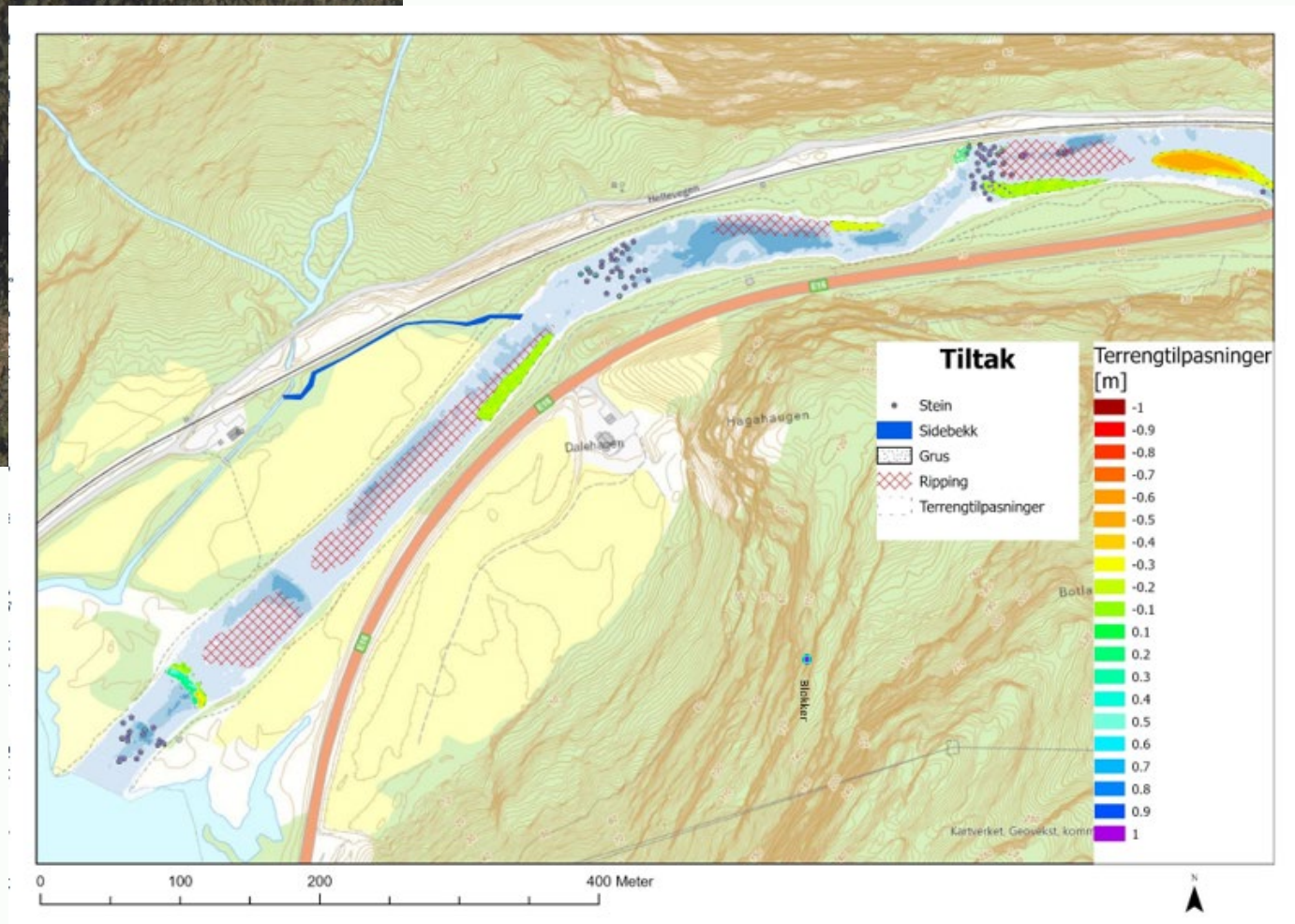
The upper part of the river



Middle part of the river

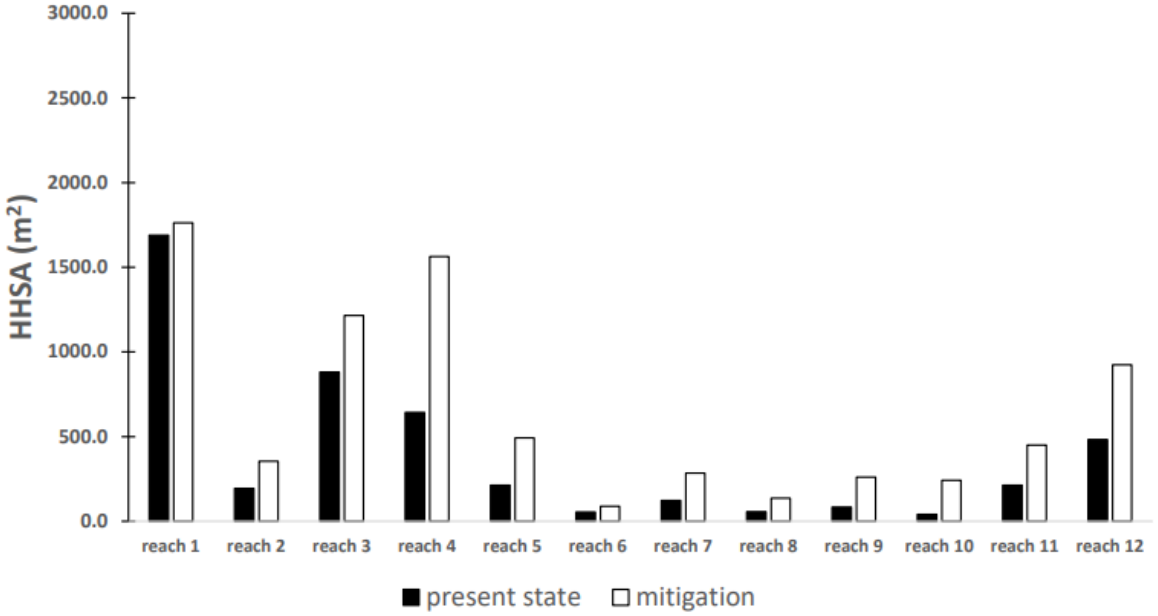


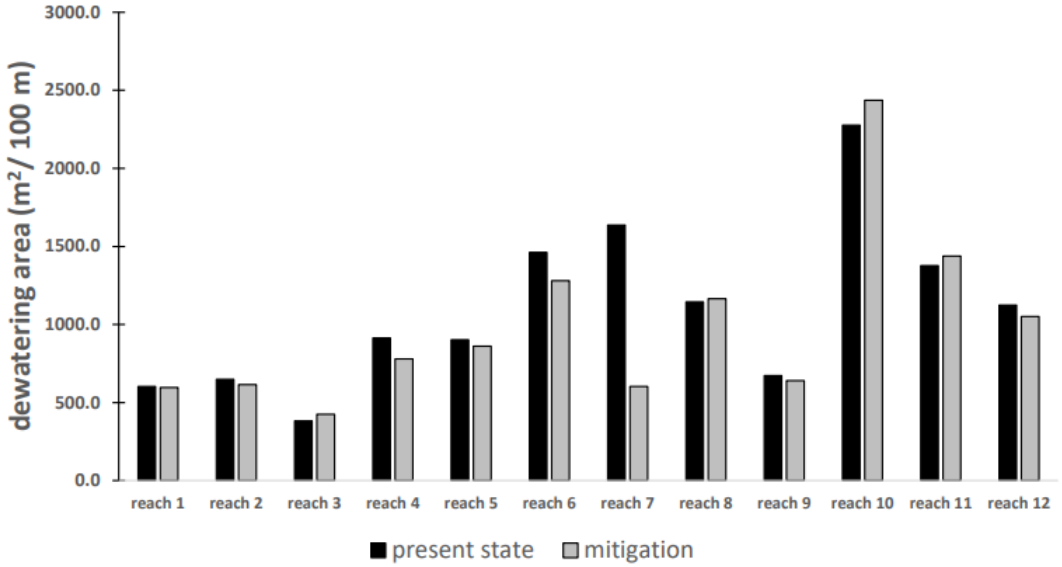
Lower part and estuary



The HEM-PEAK model

- More Hydraulic Habitat Stability areas (HHSA) (65%)
- A small change in dewatering (10%)
- The model has been tested in 12 reach along the river,
- The HHSA will improve in all reach
- The most importent areas for dewatering will be improve





Results

- the most important spawning and living areas will be secured
- Dewatering will be minimiced to narrow strips (>4m)
- Hydraulic stable habitats are increases by 65%
- Ripping will make more of the river basin suitable for the fish.

Conclutions

- The analyses confirm that the river Dale, from the power outlet to the estuary is highly affected by hydropeaking.

But:

The smolt production is good today, and it will be even better with the mitigations that will:

- reduce areas with dry falls.
- increase the hydraulic stable habitats without compromising hydropeaking or flood safety.

eviny