Polluted sediments in Bjørvika – the submerged tunnel project

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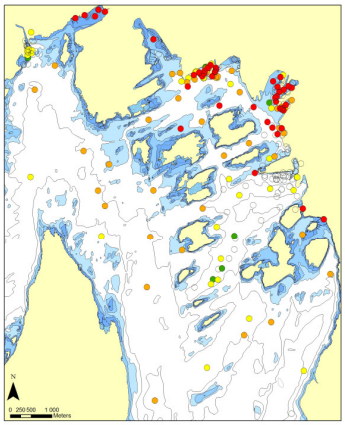
- Pollution history
- The submerged tunnel project
- Pollution in the tunnel alignment
- The Norwegian EPA permit concerning the construction work
- Monitoring and challenges
- Conclusions and lessons learned

PCB in sediments

- insignificantly polluted
- moderately polluted
- markedly polluted
- severely polluted
- extremely polluted



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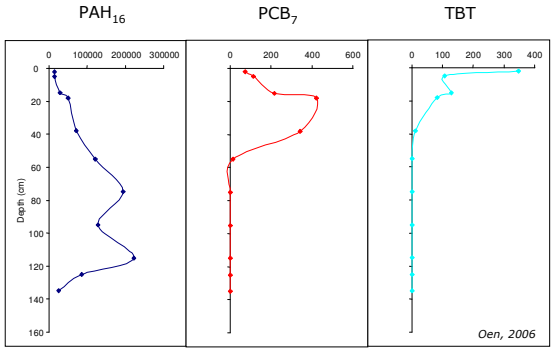
Rambøll Norge A

Vertical profile of pollutants in Bjørvika sediments prior to dredging



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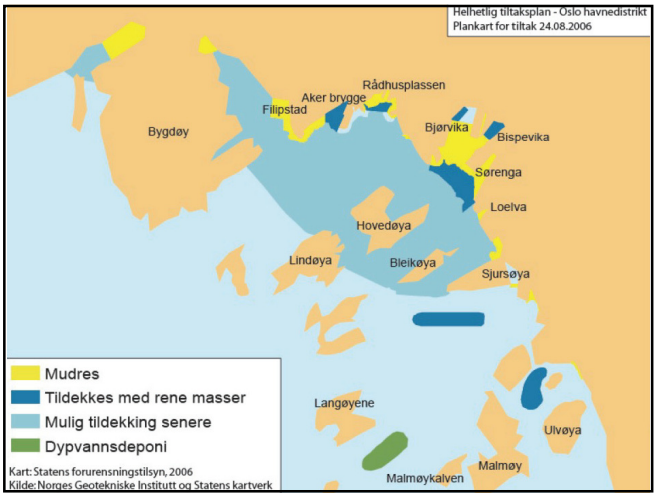
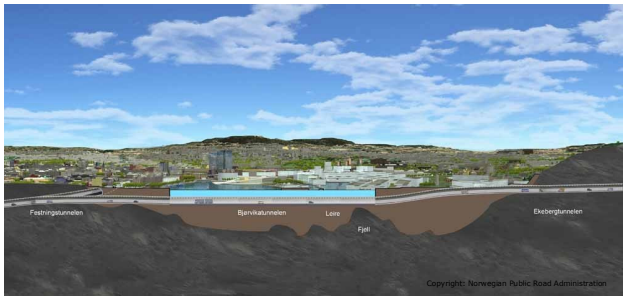
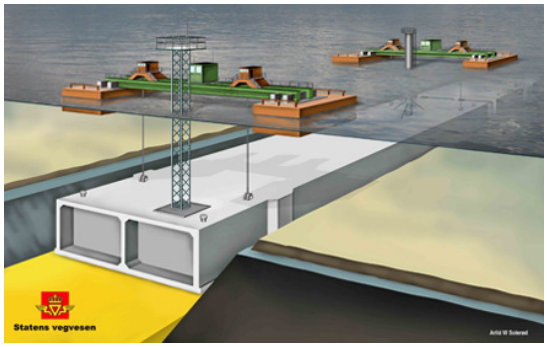


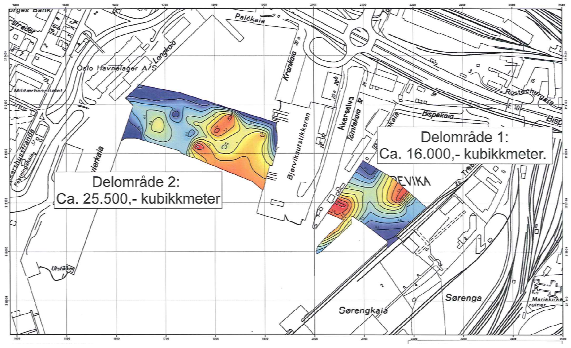
Sub bottom profile



Tunnel elements

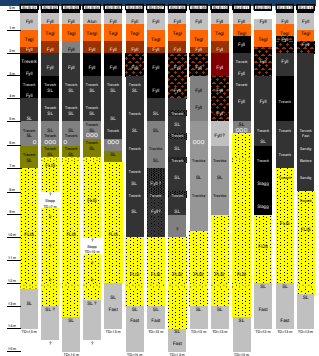


Thickness of polluted sediments

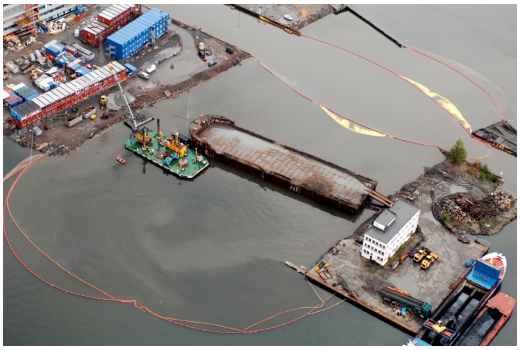


Vertical profiles through Paulsen utstikkeren

- Fillings, remnants from city development (6-7 m)
- Log houses filled with rock and deris (2 m)
- Saw dust (8 m)
- Marine clay



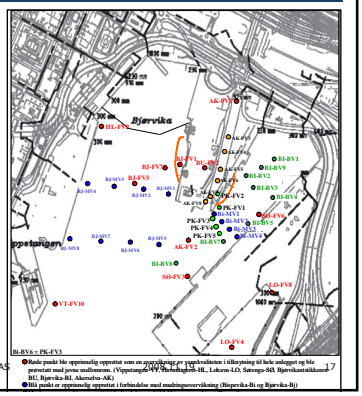
Silt curtains



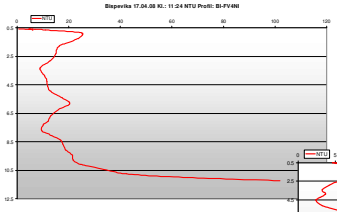
Dreding and filtration of water

Monitoring stations

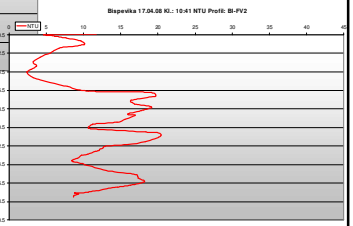
- Different colours - different operations



Turbiditity monitoring



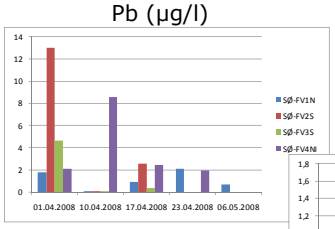
Inside silt curtain



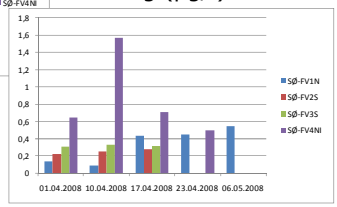
Outside silt curtain

Monitoring of water quality

Pb (µg/l)

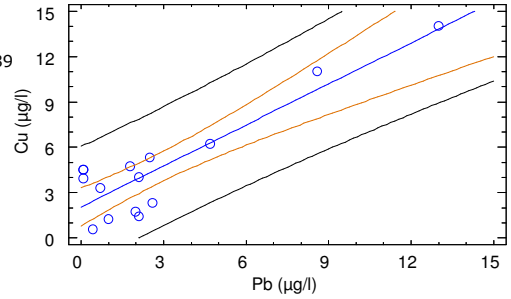


Hg (µg/l)



Correlation between Cu & Pb (total sample)

p=0.0000
Cor.coef=0.89



Unfiltered / Filtered

Station	Pb	Cr	Hg	Zn
SØ-FV1N	10	2,48	1,1	1,5
SØ-FV1N	7	2,04	1,1	1,4
SØ-FV1N	21	4,4	1,5	2,5
SØ-FV2S	26	6	1,3	1,9
SØ-FV3S	4,4	1	1,1	1,6
SØ-FV4NI	21	4,8	1,1	1,8
SØ-FV4NI	86	23,2	1,6	4,8
SØ-FV4NI	25	6,8	1,1	2,3
SØ-FV4NI	20	13,2	1,0	4,8

Conclusions and lessons learned

- Improved sediment quality
- Particle spreading within the permit
- Turidity monitoring
  - fixed positions one depth vs. profiling measurements
- Turbidity a measure of particle spreading, but not always a measure of micro pollutant spreading
- The importance of linking preinvestigations to operational plans