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STORM WATER MANAGEMENT AT ARLANDA AIRPORT

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ABSTRACT

Vatten och Samhällsteknik has since 1985 been deeply engaged in developing purification systems for polluted waters by the use of constructed wetlands. Such wetlands can be designed in extensive or intensive way depending on the local situation (polluting parameters) and environmentally demands.

Example of pollutions can come from
- Agriculture, especially nitrogen and phosphorus
- Storm water from cities, especially heavy metals and oil rest products
- Leachate from landfills, especially organic substances, nitrogen and heavy metals
- Storm water from Airports, especially organic substances and heavy metals

The possible purification in a constructed wetland of such pollutions can be based on a lot of different processes depending of the design, such as:
- Aeration
- Sedimentation
- Growth and harvest of water plants/algae
- Filtration
- Micro organisms

This abstract will focus on storm water from airports and the case Arlanda Airport.

The specific pollution at airports in Sweden and other northern countries is the result of winter operation. At most northern airports formiat is used to clear the runways from ice. Snow will mainly be removed in mechanic ways and also warm sand can be part of a winter operation. In some special occasions and at some airports also urea (concentrated ammonia) might be used. For de-icing the aircrafts different sorts of glycol normally is used. Both formiat and glycol are organic substances, very effective to melt the ice, but they will be broken down rather quickly and during this process demand oxygen. The result in a recipient will be that existing oxygen in the water will end and living fauna rapidly die.

At Arlanda Airport the storm water management together with the total operation has been proven by the Environmental Court (now in a higher court). Swedavia has promised and already built four plants for managing of the storm water pollutions, especially from the

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runways and terminal areas. Kättstabäckens dagvattenanläggning has been in use for some years and Halmsjöbäckens dagvattenanläggning is now ready to use.

Halmsjöbäckens dagvattenanläggning, see ***fig 1***, will take care of the storm water mainly from runway 3. The Environmental Court has decided that the results from the four plants shall be tested and optimised during a test period of three years.

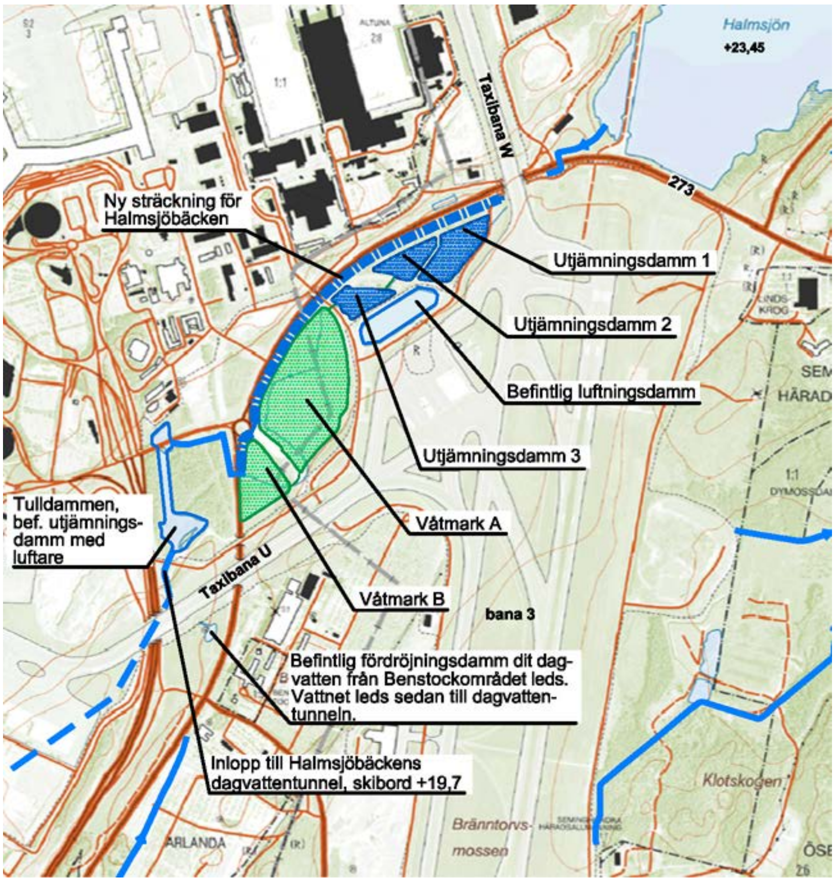


Fig 1. *Halmsjöbäckens dagvattenanläggning*

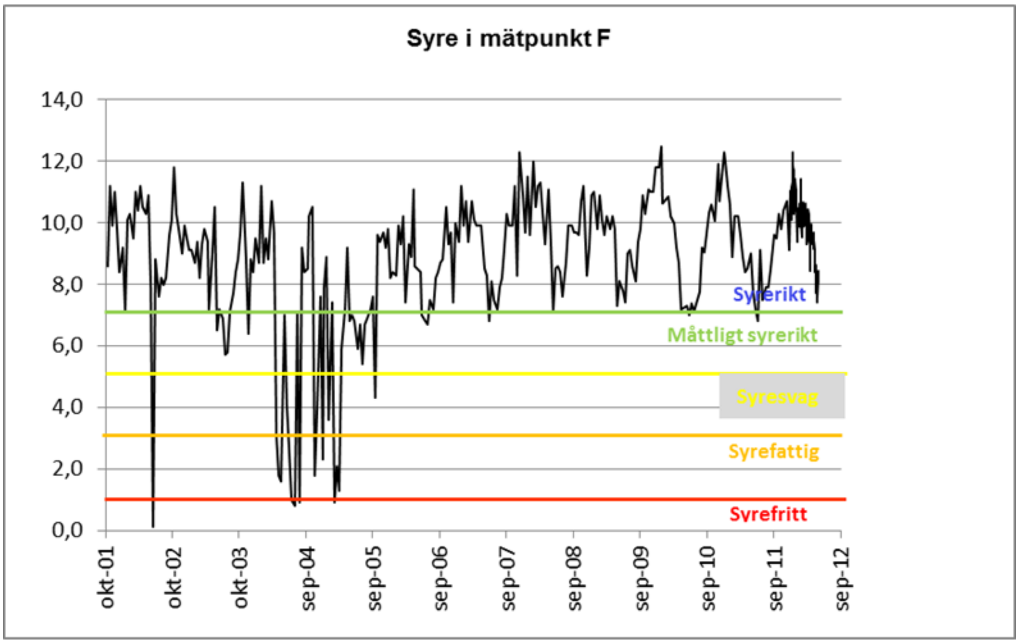
Halmsjöbäckens dagvattenanläggning is constructed for different processes, mainly:

- Dams as compensation from winter to summer
- Aeration to continuously add oxygen
- Sedimentation of oxides of metals and organically fixed phosphorous
- Denitrification

The demands from the Environmental Court are:

- Organic substances shall be decreased from more than 150 mg/l to about TOC 16 mg/l
- The oxygen content in the recipient down streams shall be at least 5 mg/l
- The heavy metals shall be less than what is said in EU:s framework of waters
- The nitrogen and phosphorous content shall be decreased to make it possible to fulfil the ecological goals for the recipient

Some of the results from monitoring the treatment of storm water are illustrated in the following figures.



Concentration of oxygen at section F.

Concentration of heavy metals at section F

Datum	Pb µg/l	Pb * µg/l	Cd µg/l	Cd * µg/l	Cu µg/l	Cu * µg/l	Cr µg/l	Cr * µg/l	Ni µg/l	Ni * µg/l	Zn µg/l	Zn * µg/l
090416	<1,2	<0,5	<0,12	<0,05	6,0	4,2	4,7	1,00	6,3	3,9	20	6
090514	<0,5		<0,12		4,4		1,4		4,1		10	
090609	0,60	<0,5	<0,05	<0,05	4,8	4,5	1,6	1,50	2,7	2,3	9	<5
090723	<1,2		<0,12		3,0		1,9		5,6		54	
090817	<1,2	<0,5	<0,12	<0,05	5,9	3,9	<1,2	0,70	5,5	3,7	12	<5
090918	1,80		<0,05		3,0		1,8		4,9		11	
091014	<3,1	<0,5	<0,05	<0,05	7,2	3,8	3,4	1,80	5,2	4,9	33	7
091111	<1,2		<0,12		6,2		1,8		5,9		13	
091208	<1,2	<0,5	<0,12	<0,05	6,5	4,1	2,8	2,70	5,1	5	17	8
100108	<1,2		<0,12		4,0		6,7		4,0		<12	
100217	<1,2	<0,5	<0,12	<0,05	3,4	1,8	4,2	7,90**	4,0	3	<12	<5
100317	<1,2		<0,12		5,4		1,7		4,7		<12	
100415	<1,2	<0,5	<0,12	<0,05	5,7	4,7	1,5	<0,5	4,7	3,5	<12	8
100512	<1,2		<0,12		3,1		1,5		3,1		<12	
100609	<1,2	<0,5	<0,12	<0,05	3,1	1,7	4,2	2,00	3,6	2,2	<12	<5
100722	1,70		<0,12		5,4		4,1		3,0		21	
100818	<1,2	<0,5	<0,12	<0,05	5,7	3,0	2,3	13**	3,4	2,6	<12	<5
100915	<1,2		<0,12		4,8		2,1		3,1		<12	
medel hyd. år 09/10					5,0	3,2	3,0	1,8	4,2	3,5	15	6
max hyd. år 09/10					7,2	4,7	6,7	2,7	5,9	5,0	33	8
101013	<1,2	<0,5	<0,12	<0,05	3,3	2,0	1,8	<0,5	5,8	10**	<12	5
101109	<1,2		<0,12		4,0		1,7		3,8		<12	
101208	<1,2	<0,5	<0,12	<0,05	3,3	2,6	2,0	2,20	3,5	2,8	<12	6
110105	<1,2		<0,12		3,2		1,8		2,7		14	
110216	<1,2	<0,5	<0,12	<0,05	3,1	1,3	2,3	1,70	2,6	2,1	66	6
110315	<1,2		<0,12		7,9		2,4		4,1		<12	
110413	<1,2	<1,2	<0,12	<0,12	5,9	4,3	2,9	<1,2	3,4	2,3	22	17
110511	<1,2		<0,12		3,5		1,4		2,1		18	
110609	1,80	<1,2	<0,12	<0,12	4,5	2,3	3,2	1,6	3,5	2,6	14	18
110715	1,40		0,02		1,8		0,6		3,3		7	
110817	0,31	<1,3	0,01	<0,13	3,0	2,9	0,6	<1,3	2,6	<1,3	6	<13
110915	0,41		0,02		4,9		0,7		4,2		8	
medel hyd. år 10/11					4,0	2,6	1,8	1,4	3,5	2,2	17	11
max hyd. år 10/11					7,9	4,3	3,2	2,2	5,8	2,8	66	18
111011		0,03		<0,01		3,4		0,15		3,2		4
111026		0,02		<0,01		3,5		0,17		3,6		3
111108		0,02		<0,01		7,3		0,17		3,8		4
111123		0,02		0,01		4,8		0,20		4,1		3
111207		0,03		<0,01		5,2		0,20		3,3		3
111222		0,05		0,02		3,8		0,24		3,3		5
120206		<0,2		<0,02		3,9		<0,5		3,9		<5
120229		0,04		0,03		3,1		0,81		9,9		10
120330		0,08		0,02		3,0		0,32		4		4
120502		0,11		0,01		3,1		0,34		3,5		3
120607		0,06		<0,01		2,9		0,27		3,2		3
120702		0,05		<0,01		2,9		0,22		3,4		2
120801		0,06		<0,01		2,6		0,17		3,4		2
120912		0,06		<0,01		3,1		0,13		2,7		1
medel hyd. år 11/12						3,8		0,35		4,3		4
max hyd. år 11/12						3,9		0,81		9,9		10

Tillståndsklassning sjöar och vattendrag. NV rapport 4913***

Mkt låg	<0,2	<0,2	<0,01	<0,01	<0,5	<0,5	<3	<3	<0,7	<0,7	<5	<5
Låg	0,2	0,2	0,01	0,01	0,5	0,5	3	3	0,7	0,7	5	5
Måttlig	1	1	0,1	0,1	3	3	5	5	15	15	20	20
Hög	3	3	0,3	0,3	9	9	15	15	45	45	60	60
Mkt hög	15	15	1,5	1,5	45	45	75	75	225	225	300	300

Tillståndsklassning förorenat ytvatten. NV rapport 4918

Mindre allvarligt	3		0,3		9		15		45		60	

God ekologisk status						**4**		**3**				**8**
MKN kemisk status		**7,2**		**0,08**						**20**		

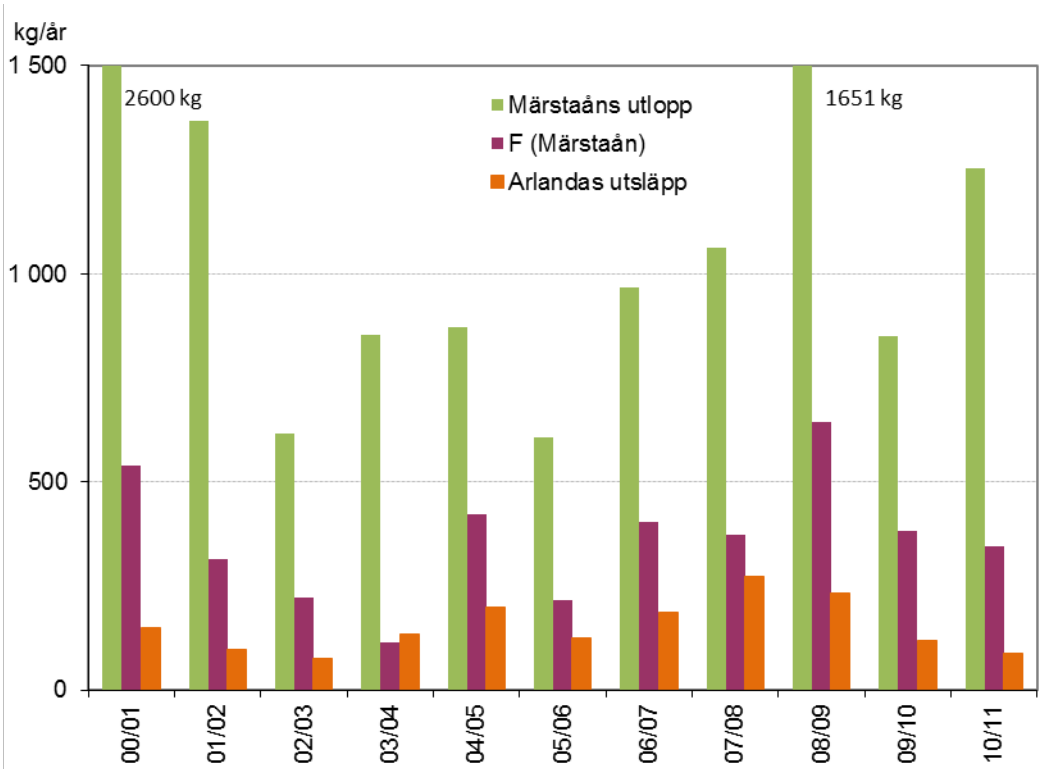
Storm Tac	20		1		22		5		8,5		140	

* Filtrerat prov

** Troligen någon form av analysfel, ej medtagen i medel- och maxvärdet eller i jmf med bedömningsvärdet.

*** Bedömningsvärdena är satta för ofiltrerade prov.

Load of tot-P at different sections



So far the results from Kättstabäckens dagvattenanläggning (KDA), that has been in operation for some year, show that the expectations are possible to fulfil.