TBT treatment methods from AMORAS treatment plant

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IMMERSE 1st Transnational Exchange Lab
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Gothenburg, Sweden

What am I going to talk about?

Where is the Port of Antwerp;

Why do we dredge;

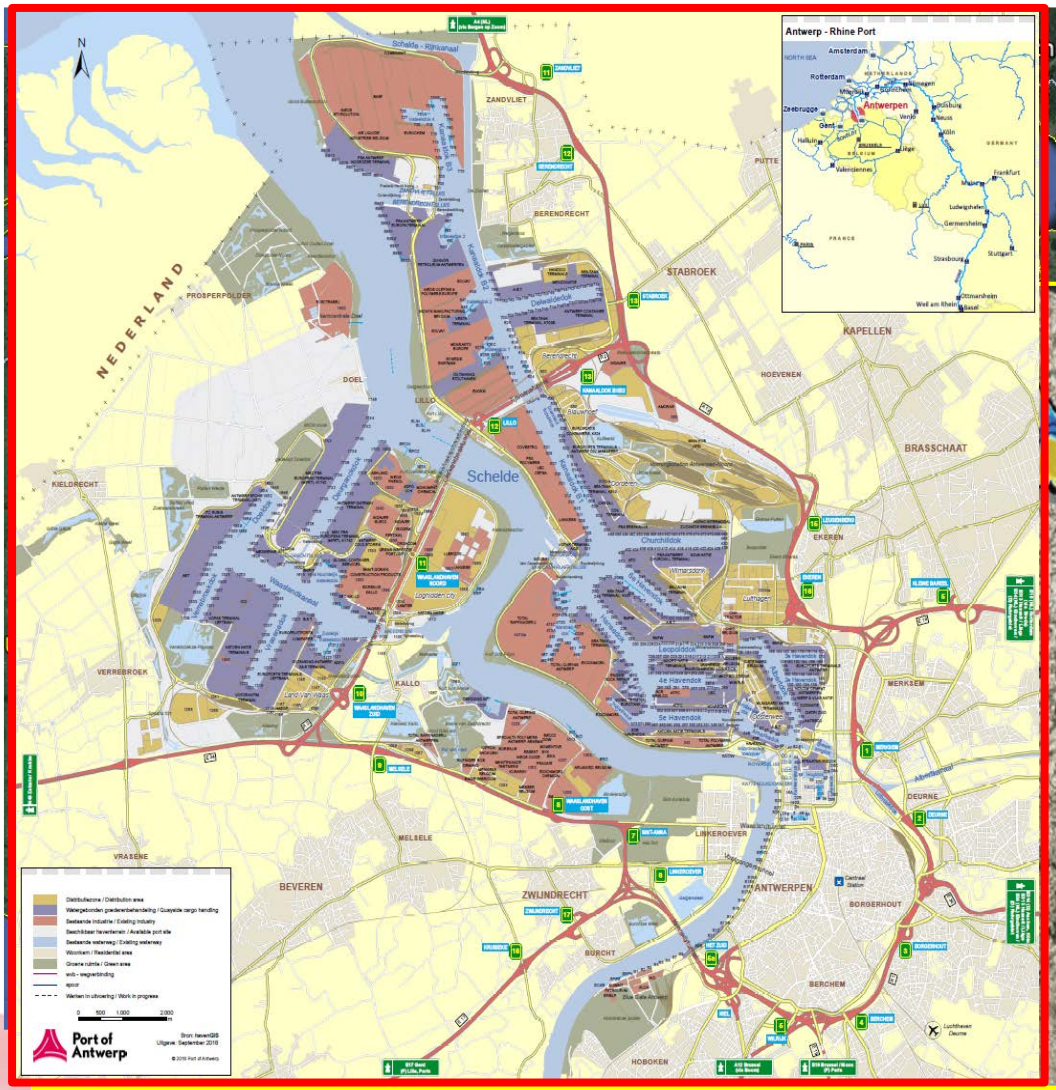
How do deal with sludge;

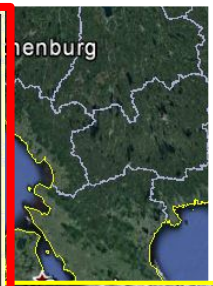
What is AMORAS;

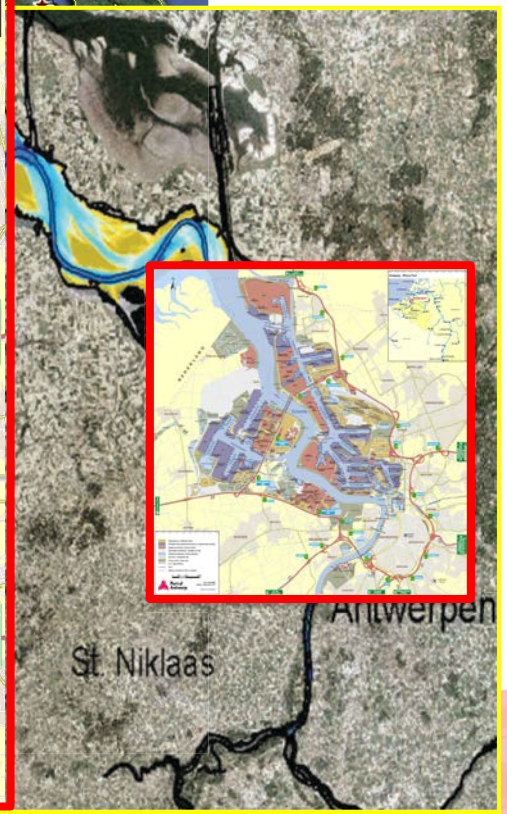
Is TBT an issue;

Milestones and what's next …

Where is the port of Antwerp?







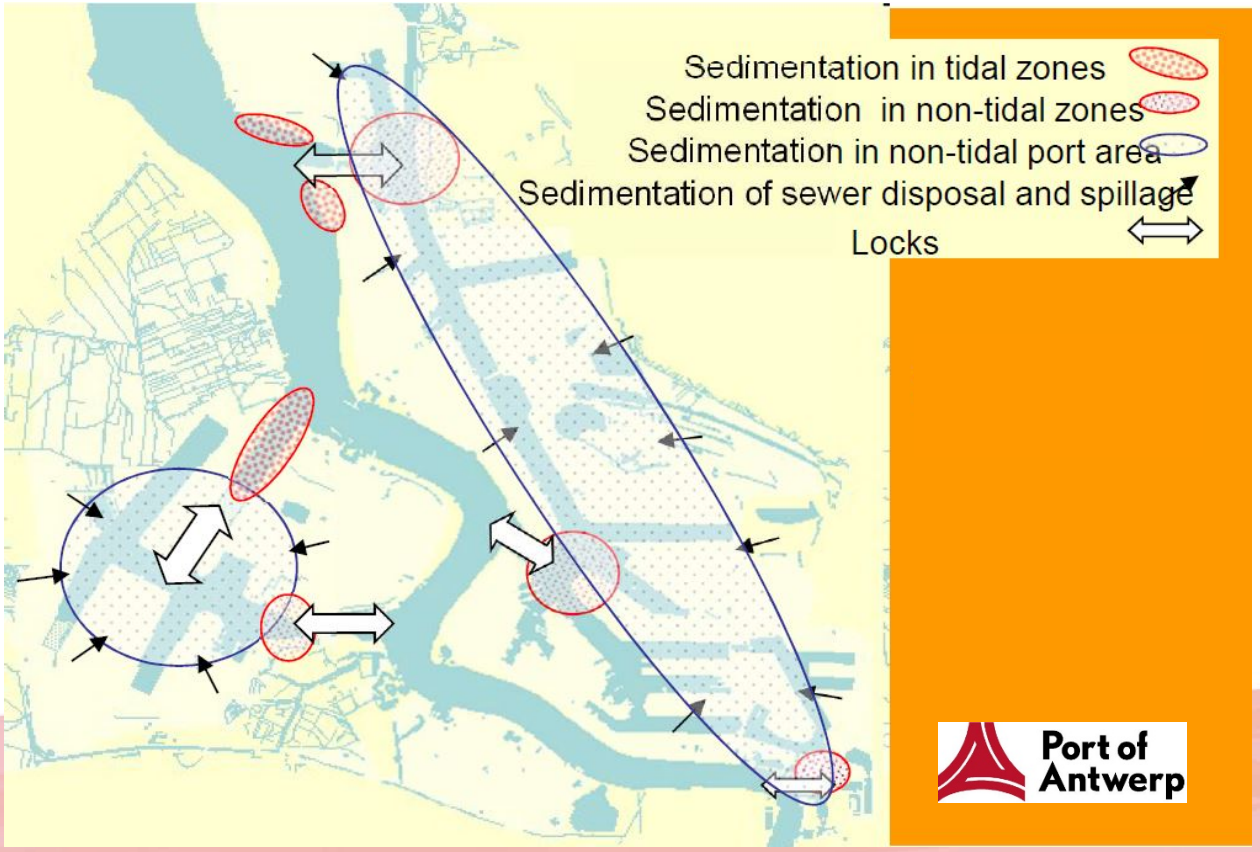
Vlaanderen
is mobiliteit & openbare werken

d. Maritime Access

Why (do we) dredge?

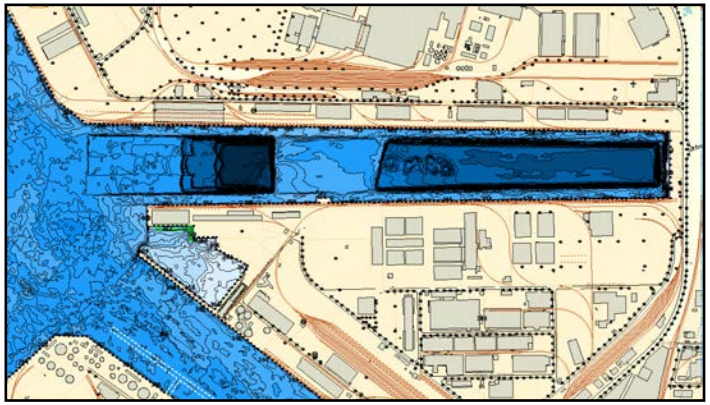
- Create depth [=> remove (mainly) sand]
- Maintain depth [=> remove (mainly) sludge]

  (2004 Flemish Gov.: 500 000 TDM/y in harbour area)



How do we deal with sludge?

In the past:

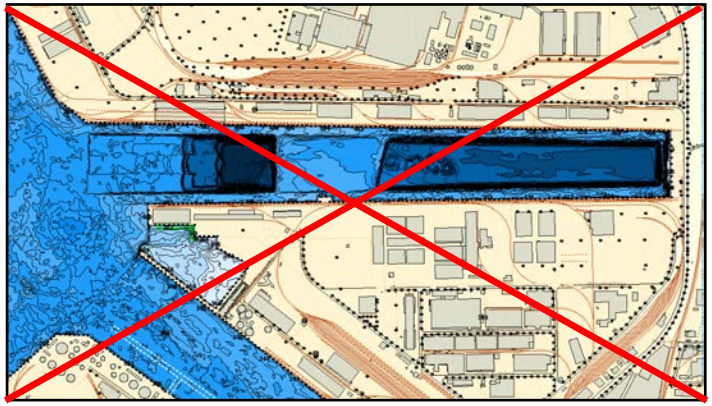


Under water cells

Terrestrial drying (or “laguning”)

How do we deal with sludge?

Due to space limitations … => (2006) Mechanical dewatering of sludge (AMORAS)



Under water cells

Terrestrial drying (or “laguning”)

What is AMORAS?

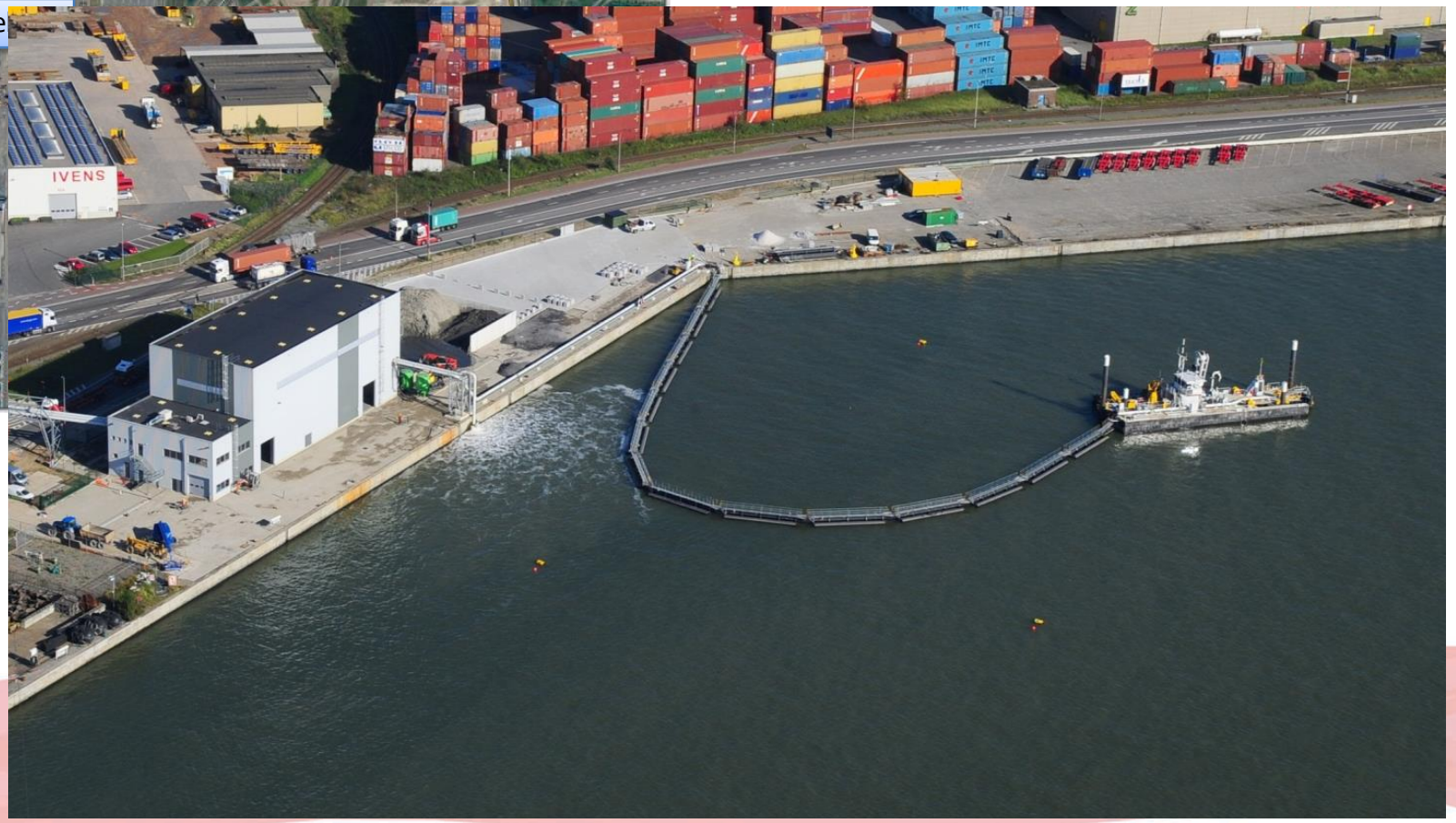
AMORAS: "**A**ntwerpse **M**echanische **O**ntwatering, **R**ecyclage en **A**pplicaties van **S**lib" or "Antwerp Mechanical Dewatering, Recycling and Applications of Sludge"

Concept 2006 - Design 2007 – Construction 2008 - Start of Exploitation 2011

What is AMORAS?

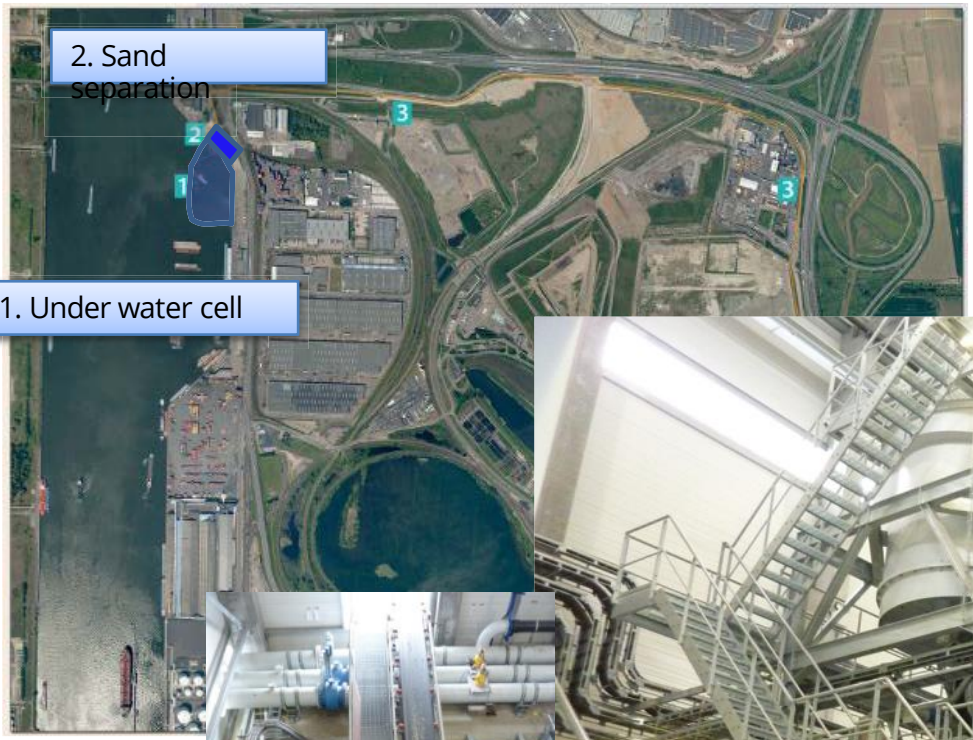
Storage capacity: 325 000 m^3

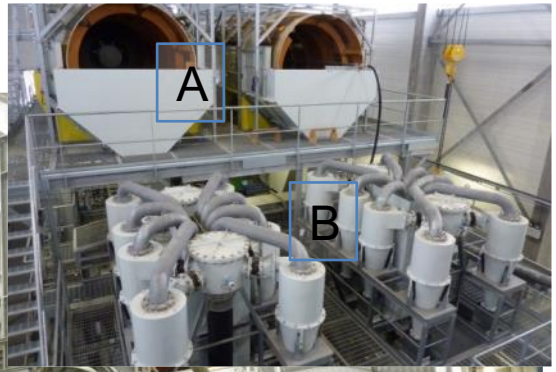
Cutter “Amoris”: 1 500 m^3/h (max 3 000 m^3/h)



What is AMORAS?

A Rotating drum sieves (> 8mm; “debris” GRZR)
B Hydrocyclones (> 63 µm; Sand)





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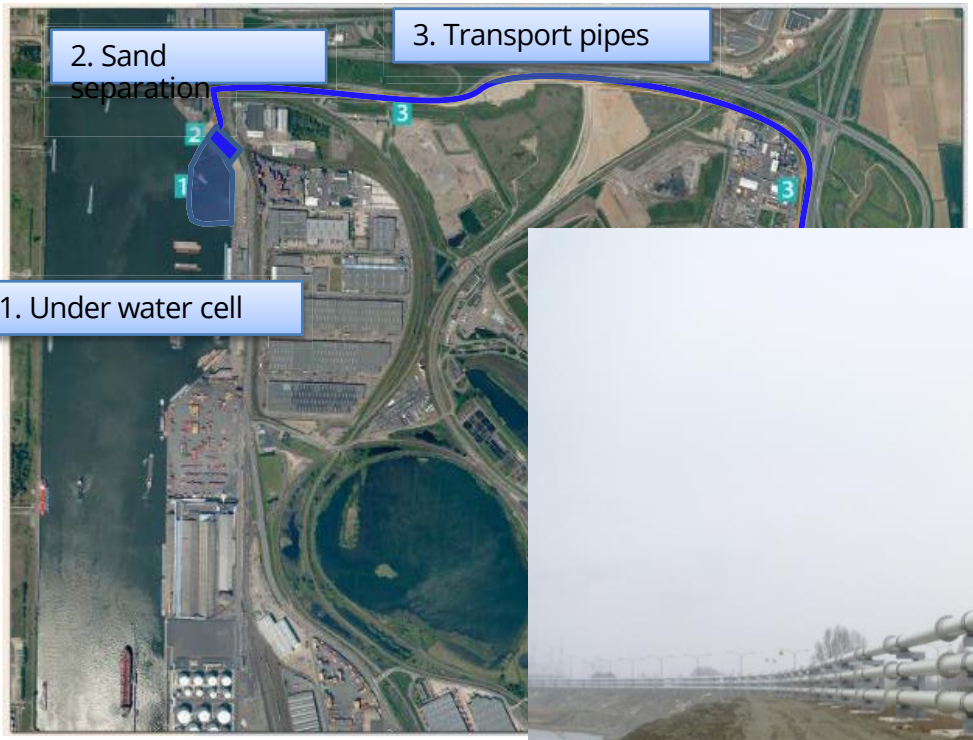

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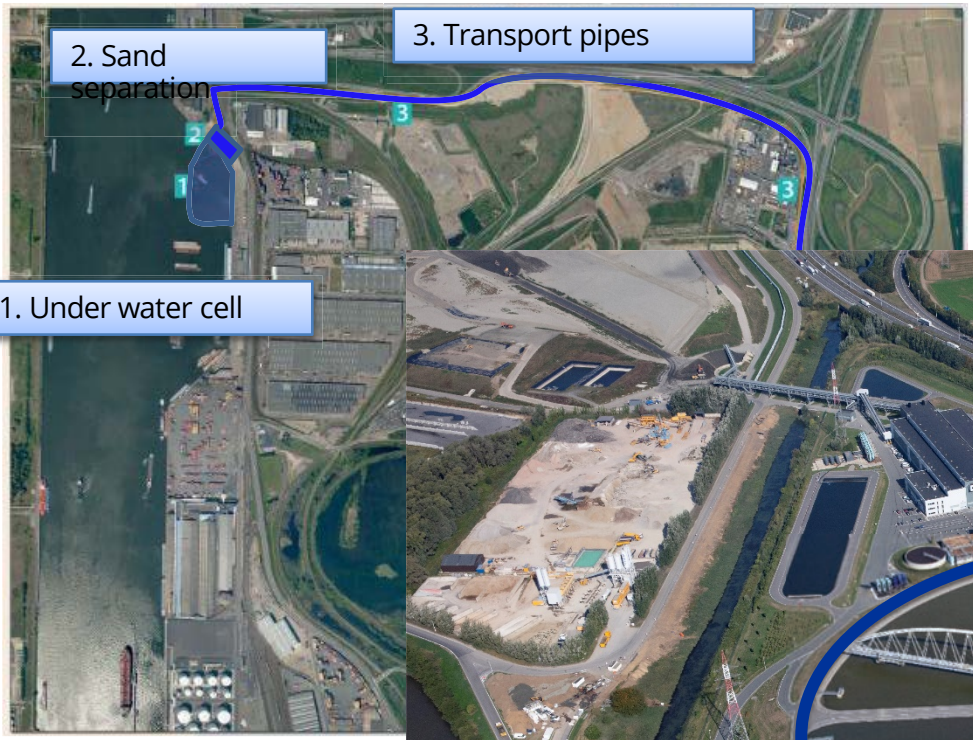
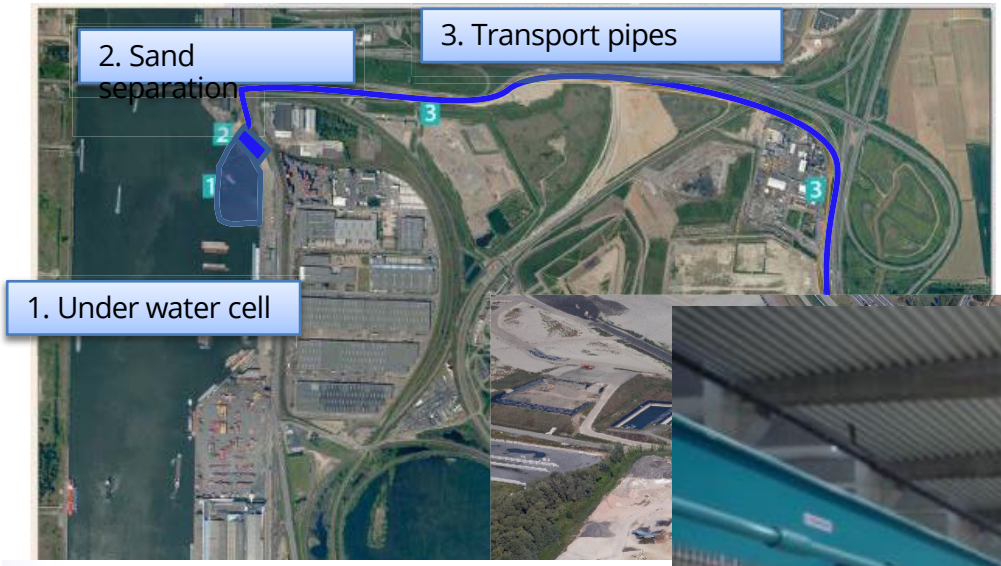


4 quadrants of each 120 000 m^3
Rotating bridge, mobile dredging pumps

What is AMORAS?

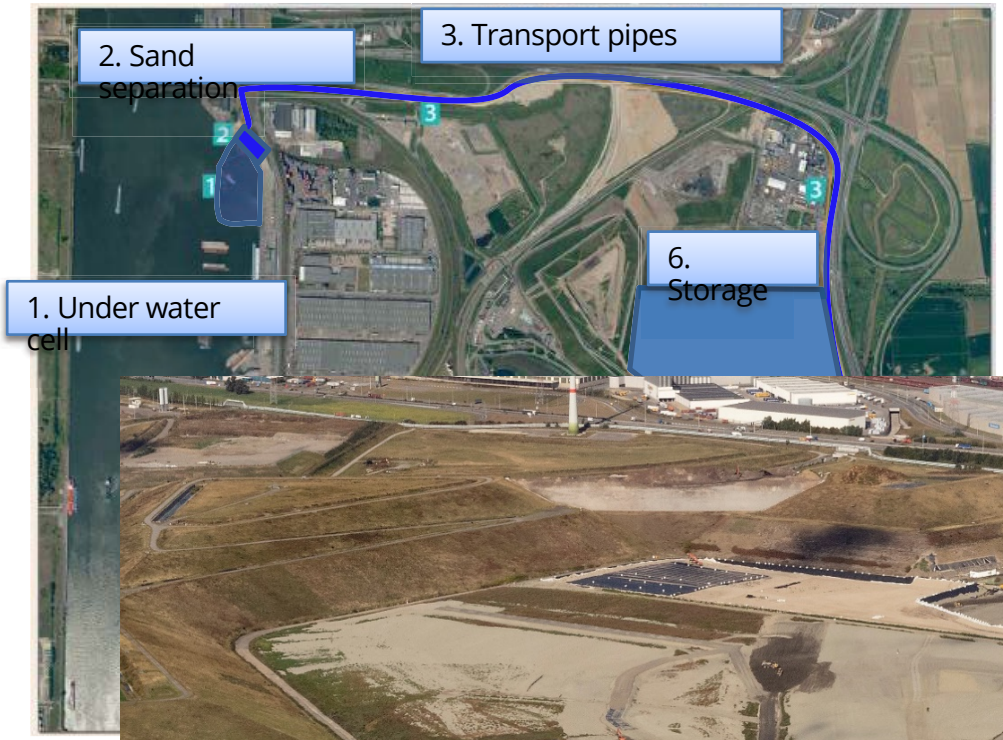


Conditioning with lime
12 membrane filterpresses (min 60% DM)
Max 3000 tDM filtercakes/day

What is AMORAS?

(2 identical and parallel) waste water treatment plant(s): 250m³/h

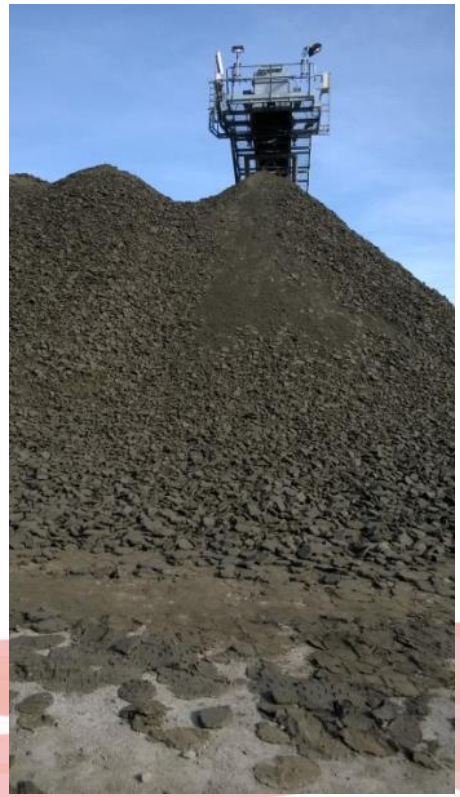
What is AMORAS?



Storage capacity for 30 y production

2 types: - “contaminated” (TBT, mineral oils) and

- “clean” filtercakes



Is TBT an issue?

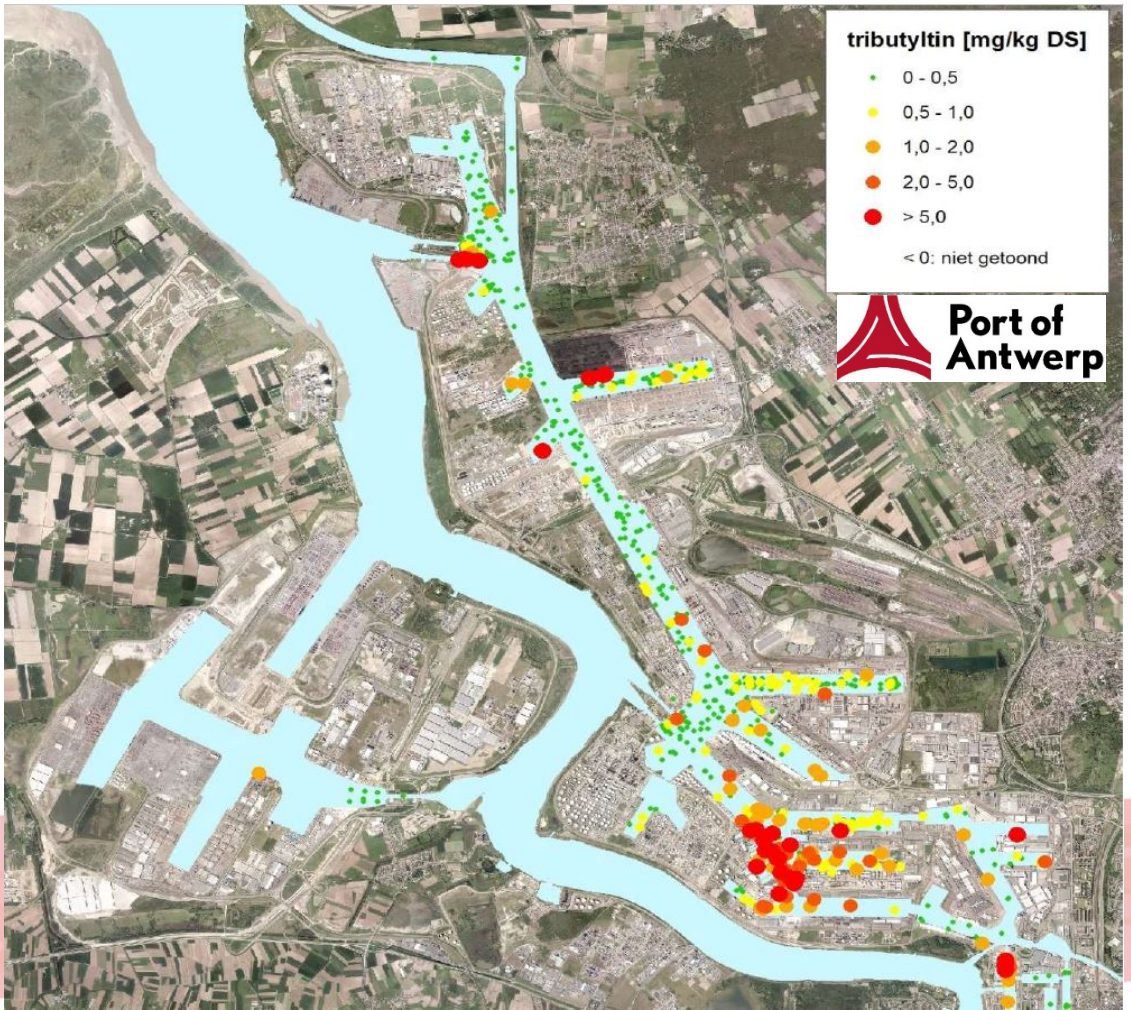
TBT, tributyltin:

Anti-fouling properties used in ship paints (1954);

Harmfull effects on non target organisms (1970s);

Is TBT an issue?

1. In the harbour: **Ecodocks**, model for risk management [of the] sediment pollution within the port of Antwerp



Is TBT an issue?

2. In the operation of AMORAS (test: April 2018 – June 2019):

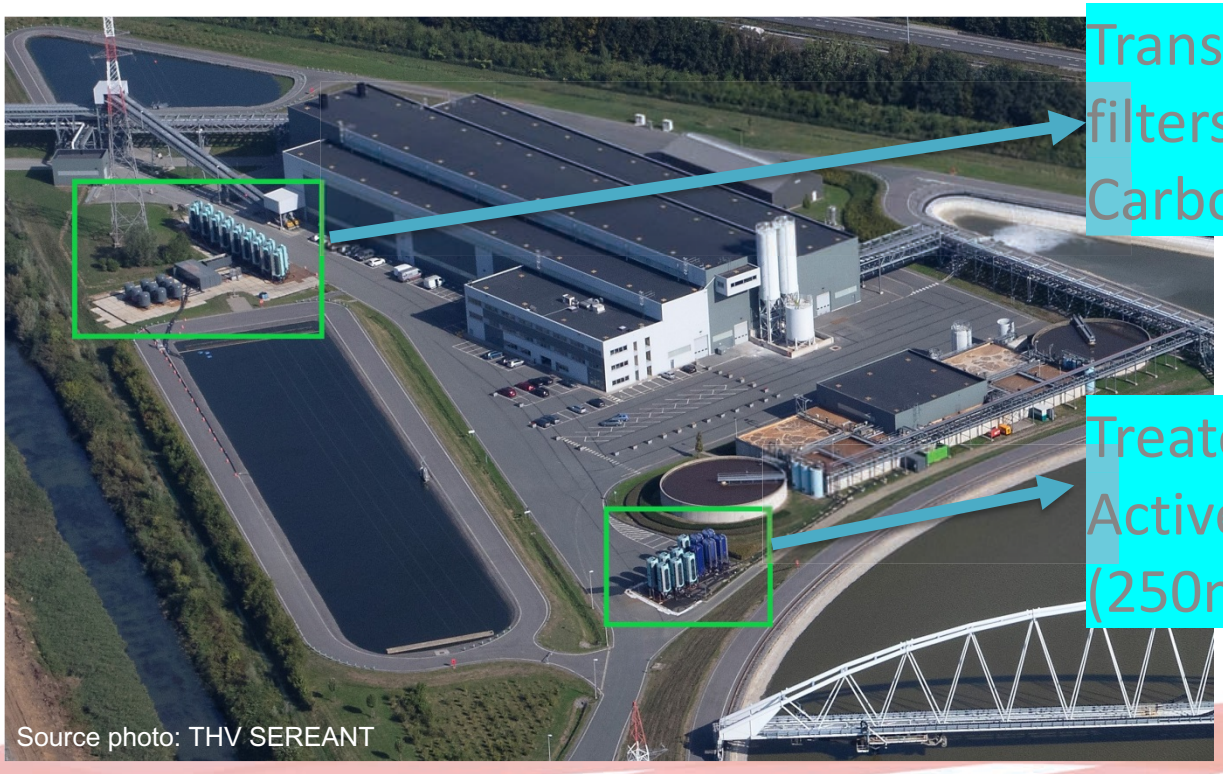
2.1. Delivery of sludge: no more release into under water cell

Is TBT an issue?

2. In the operation of AMORAS (test: April 2018 – June 2019):

2.1. Delivery of sludge;

2.2. Extra treatment of retour water



Is TBT an issue?

2. In the operation of AMORAS (test: April 2018 – June 2019):

2.1. Delivery of sludge;

2.2. Extra treatment of retour water: **preliminary findings**

Location					December	10	11	12	13
TRANSPORTWATER		Unit	Norm	Measurement inaccuracy	Corrected norm	mon	tue	wed	thu
Quadrant settling pond	monobut…								
	dibutylt…								
	tributylt…								
	trifenylt…								
Settling pond	monobut…								
	dibutylt…								
	tributylt…								
	trifenylt…								
After san…									
After active filters	…utylt…								
	tributylt…								
	trifenylt…								
Before outflow (measuring point)	monobut…								
	dibutylt…								
	tributylt…								
	trifenylt…								

Location						dec/18					apr/19		
Water treatment		Unit	Norm	Measurement inaccuracy	Corrected norm						2	3	4
											di	wo	do
Filtrate (after filter press)	monobutyltin	µg/l									0,23		
	dibutyltin	µg/l									5,4		
	tributyltin										1,3		
	trifen…										0,091		
Infl…													
					0,700								
				8%	0,038								
			0,000888	14%	0,001								
	…yltin	µg/l		24%									
	dibutyltin	µg/l	0,588	16%	0,700								
	tributyltin	µg/l	0,035	8%	0,038								
	trifenyltin	µg/l	0,000888	14%	0,001								
Before active carbon filters	monobutyltin	µg/l		24%				0,31				0,091	
	dibutyltin	µg/l	0,588	16%	0,700			0,72				0,62	
	tributyltin	µg/l	0,035	8%	0,038			0,017				0,022	
	trifenyltin	µg/l	0,000888	14%	0,001			<0.01				<0.01	
After active carbon filters	monobutyltin	µg/l		24%				<0.02				<0.02	
	dibutyltin	µg/l	0,588	16%	0,700			<0.01				<0.01	
	tributyltin	µg/l	0,035	8%	0,038			<0.01				<0.01	
	trifenyltin	µg/l	0,000888	14%	0,001			<0.01				<0.01	
Before outflow	monobutyltin	µg/l		24%			0,1		0,15	0,11	<0.02		0,027
(measuring point)	dibutyltin	µg/l	0,588	16%	0,700		0,13		0,21	0,15	0,028		0,039
	tributyltin	µg/l	0,035	8%	0,038		<0.01		<0.01	<0.01	<0.01		<0.01
	trifenyltin	µg/l	0,000888	14%	0,001		<0.01		<0.01	<0.01	<0.01		<0.01

Full report will follow (autumn 2019)

Milestones

1954 Properties of TBT as anti-fouling product in ship paint;

1970s Discovering harmfull effects of TBT on non target organisms;

1991 Governmental ban (BE) for use on small (< 25m) vessels;

2003 General governmental ban (BE) in all ship paints;

2006 Concept of AMORAS;

2011 Start of exploitation of AMORAS;

2013 (OVAM, BE) Deriving a norm for TBT in sludge (0.51 mg / kg DM);

2014 Special norms on DBT and TBT for discharge water of AMORAS by Province of Antwerp;

2016 Lab research on treatment of TBT-rich sludge by AMORAS (by Purazur):

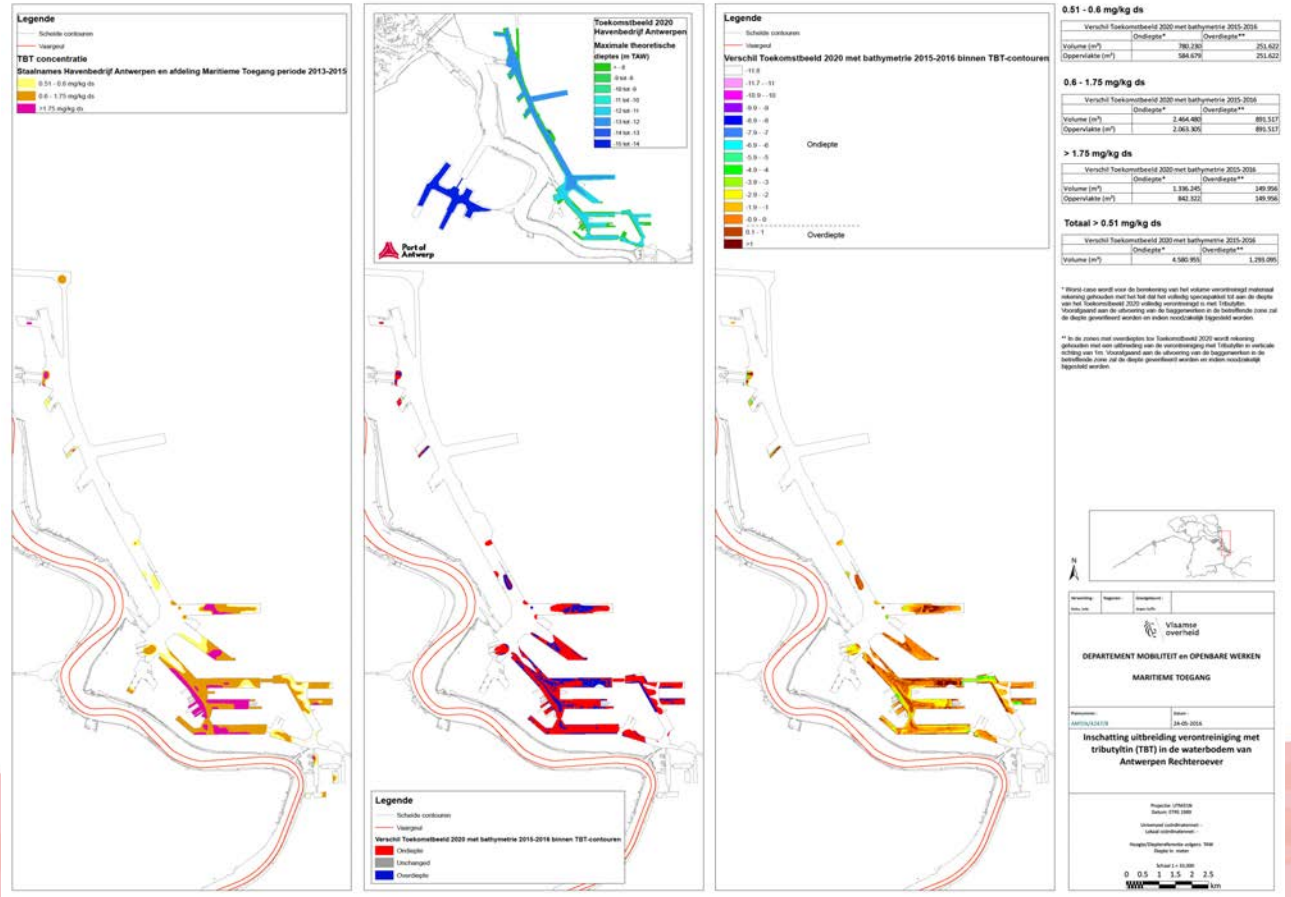
2017 Approval from Environmental Authorities to use “contaminated zone” on landfill site of AMORAS;

2018 Start of “stress test” for use of AMORAS to also treat TBT-contaminated sludge;

Now Evaluating results of first year of treating TBT-contaminated sludge

What's next?

- AMORAS is now ready to accept also TBT-contaminated sludge;
- (Update on the) quantification of the total amount of contaminated sludge in the harbour area that can/should/will be processed at AMORAS;



Interreg North Sea Region IMMERSE
European Regional Development Fund

EUROPEAN UNION

Thank you for your attention

http://maritiemetoegang.be/projecten/amoras

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