Interreg
North Sea Region
NON-STOP
European Regional Development Fund

EUROPEAN UNION

Digital monitoring of microbiological living conditions in the Port of Emden

Webinar NON-STOP

6th of May 2021

Niedersachsen Ports

Agenda

1. Introduction
   - Port of Emden and its key characteristics
   - Fluid mud and recirculation dredging
2. Port of Emden pilot in NON-STOP
   - Overall project goals
   - Master thesis project
   - Beyond master thesis project

Niedersachsen Ports

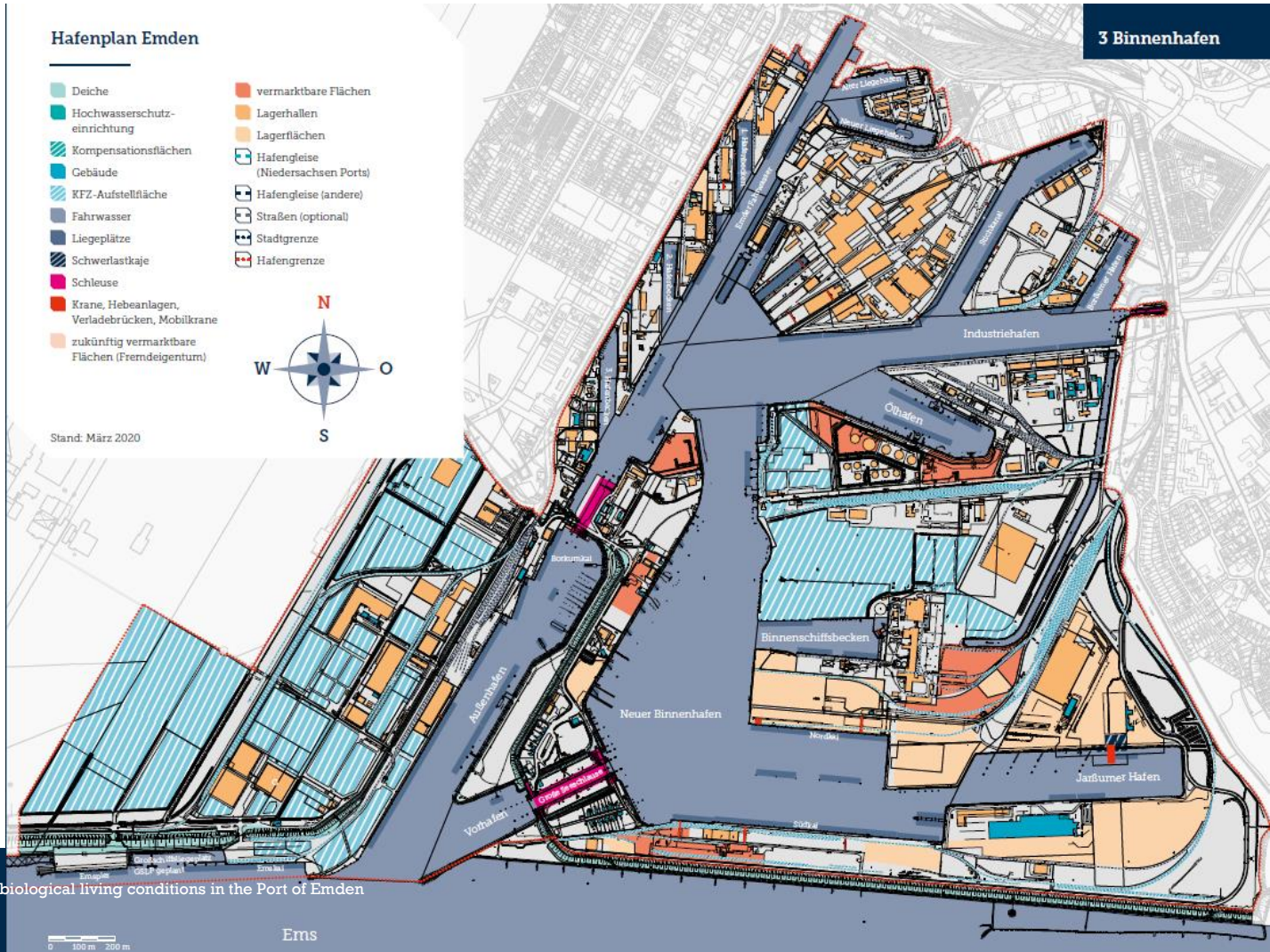
Niedersachsen Ports

Our ports

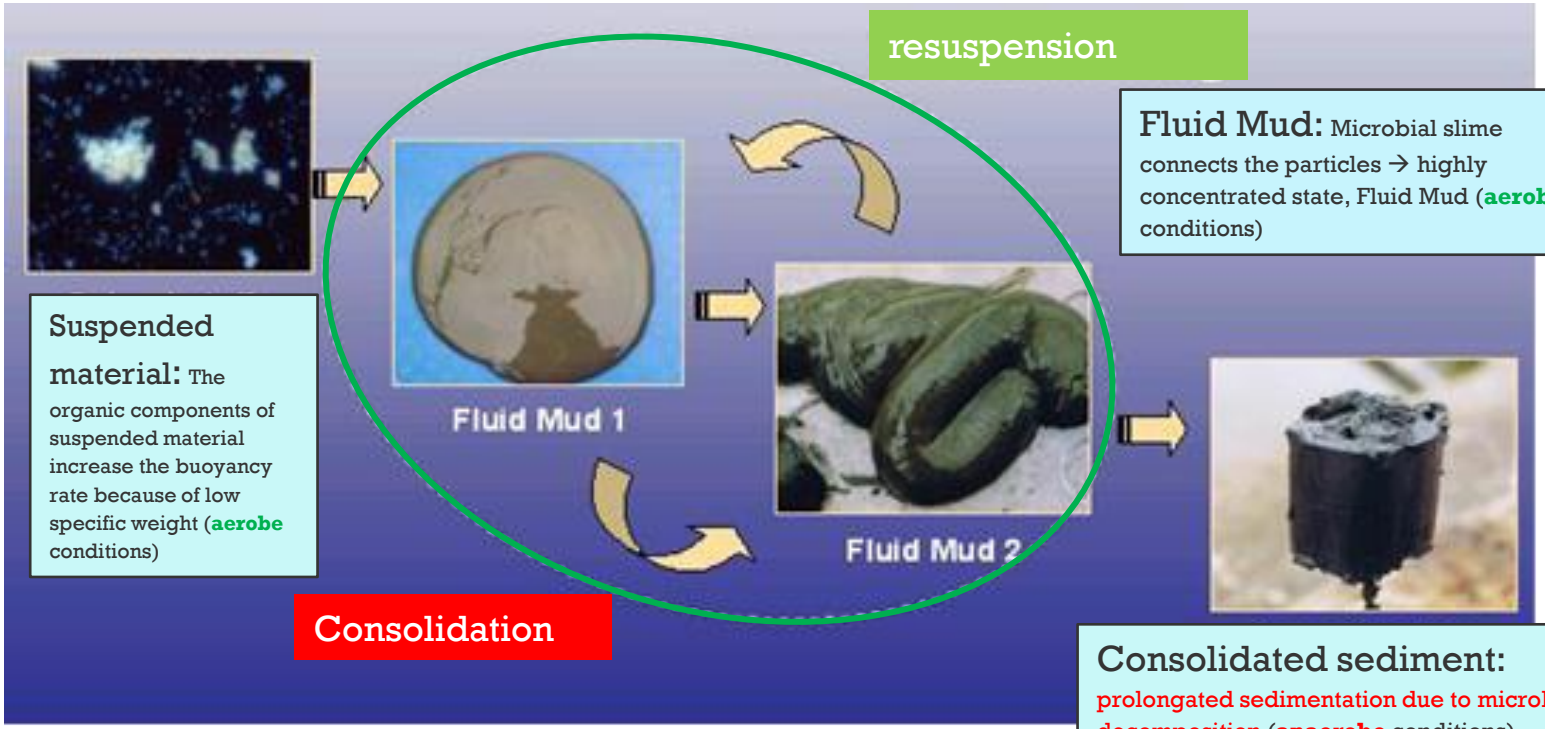
Port of Emden

Key characteristics

- 1.163 ha (of which 963 ha land and 201 ha water)
- Tidal outer port / non-tidal inner port
- Nodal point between hinterland and river Ems
- 3 locks, 1 pumping station
- Fluid Mud
- Recirculation dredging



Fluid Mud and principles of recirculation



Port of Emden pilot in NON-STOP

Intelligent sediment and water management

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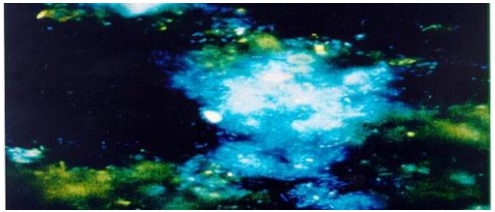
Project goals NON-STOP pilot

1. Reducing sediment influx from river Ems into inner port of Emden

2. Supporting long-term hinterland drainage capacities



3. Long-term support of recirculation dredging

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Project goal No. 2

Supporting long-term hinterland drainage capacities

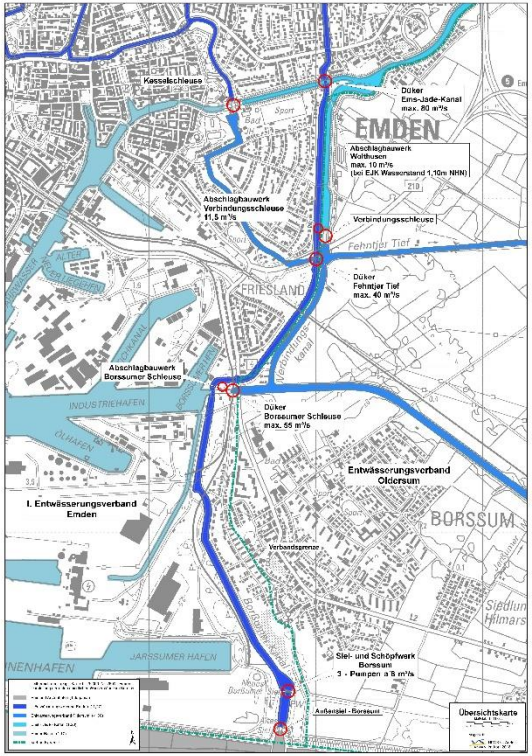
Climate change demands further strengthening of drainage system

- Port of Emden already used for draining away excessive water volumes from the city of Aurich via Ems-Jade-Channel into river Ems
- But can the integration of the Port of Emden as one crucial element in the hinterland drainage system be optimized?

Key question: effects of more freshwater influx on Fluid Mud bacteria?

Measures in order to answer the question:

- Microbiological investigation (March 2021 – February 2022)
- **Sensor-based water monitoring system (partly within master thesis)**
- Additional water inlets as well as water outlets (i. e. pumps)
- Digital system integration through dashboard concept



Source: NLWKN Aurich, 2018

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Master thesis project

„A sensor-based water monitoring in the port of Emden: concept development and testing“

Background and motivation:

- Already frequent measurements of dredging-relevant parameters (e.g. density & shear forces) in the fluid mud body
- But no possibility yet to draw direct inferences from long-term water measurements on actual (real-time) living conditions of fluid mud bacteria

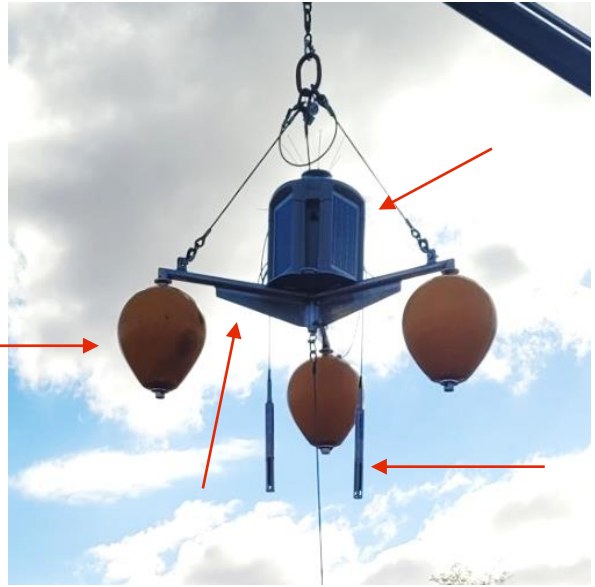
Goals:

- Theoretical conceptualisation: which core aspects would a long-term, sensor-based water monitoring system in the port of Emden generally need to respect?
- Practical testing of a pilot measuring system: which inferences can be drawn from field-measurements in the port of Emden (e.g. concerning shipping, wave variability, turbid water or fluid mud itself)

Results: first groundwork on how a long-term, sensor-based water monitoring system could be implemented in the port of Emden in order to monitor living conditions of the fluid mud bacteria

Master thesis project

What has been done?



1. Development of general water monitoring theory for this specific use case
- Based on the literature, the steps for water monitoring were worked out and applied to the case port of Emden.

2. Practical testing of a pilot measuring system in the port of Emden
- A measuring buoy was built, which consists of the following components:
    - Aluminium frame
    - Three fender buoys
    - Solar charging module
    - Data logger
    - Mulitparameter probe
- A multiparameter probe was used to measure pH, conductivity, temperature and oxygen concentration
- With the data logger, the measured values can be transferred via the mobile network to a data storage software where they can be retrieved.

Master thesis project

The steps while doing the practical testing

- First step was to check the functionality of the measuring buoy and do some adaptations if necessary
    - A rod was added to prevent the buoy from tipping over

- The next step was to do initial measurements in different port sections for a few days
    - Different locations were selected, which are frequented by shipping in different ways
    - It was tested if it is possible to collect data (fluid mud, power supply, long-term etc.)
    - The Handling of the measuring buoy was tested

Master thesis pr

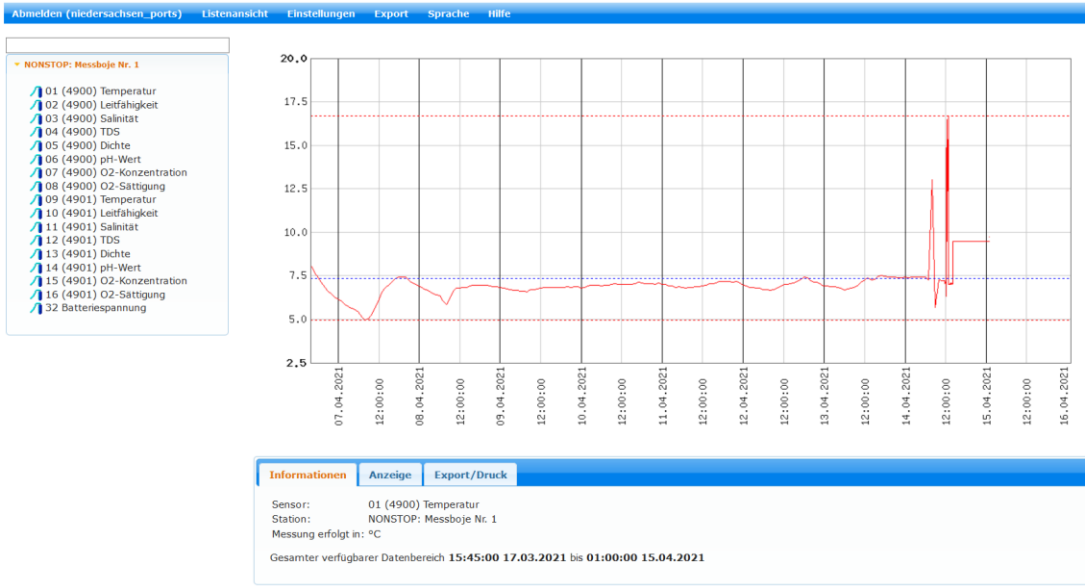
The measuring buoy lo

	Location	Measuri… Duration
1.	Jarßum port	5 days
2.	Borssum port	3 days
3.	Turning area inland port	3 hours
4.	Turning area new inland port	1 ½ hours

Data transfer

Data storage software

- The collected measurement data is transferred via the mobile network to the data storage software and visualized
- It is possible to switch between the individual probes and the individual measured values
- The measurement settings of the probes can also be adjusted and changed via the mobile network, conveniently from the office.



Beyond master thesis project

Results and what is envisaged?

Results:

- Measurements in Emden harbour were possible over several days and values were successfully taken, also in the Fluid mud via the measuring buoy

What is envisaged:

- Detailed validation of the measuring system
- Implementing a more extensive water monitoring system (multiple measuring sites)
- Simultaneous real-time monitoring in suitable intervalls in 2 - 3 water depths
- Long-term monitoring of the living conditions of the bacteria
    - Enable timely responses to changes in living conditions, for example through increased freshwater supply from Emden hinterland
- Visualisation of measured values (as part of a dashboard)
    - Presentation and placing of the measurement data in the context of drainage from the hinterland (line no. 2) in the dashboard with recommended actions

Source: https://shavitech.com/download-dashboard-software-for-your-mac-os-x/

Thank you for your attention!

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