DEME

Dredging, Environmental
& Marine Engineering

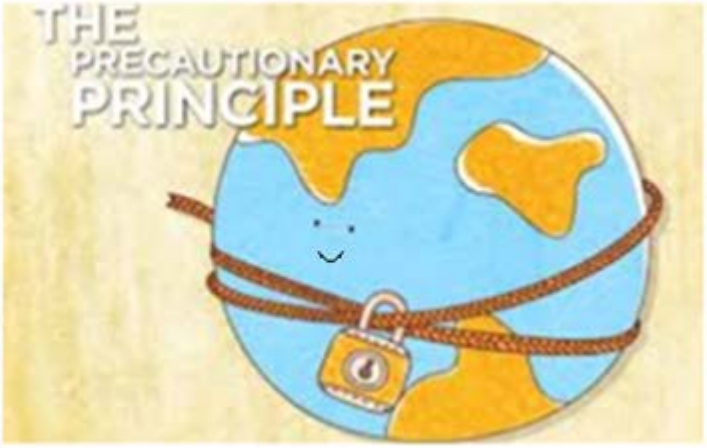
Working in challenging Environments

Dr. ir. Marc Huygens Environmental Manager

Precautionary principle

“Apply international standards and general best practice methods based on best available information, insights and techniques in order to perform the Works in a responsible and sustainable way.”

1992, Rio Declaration
2005, UN COMEST



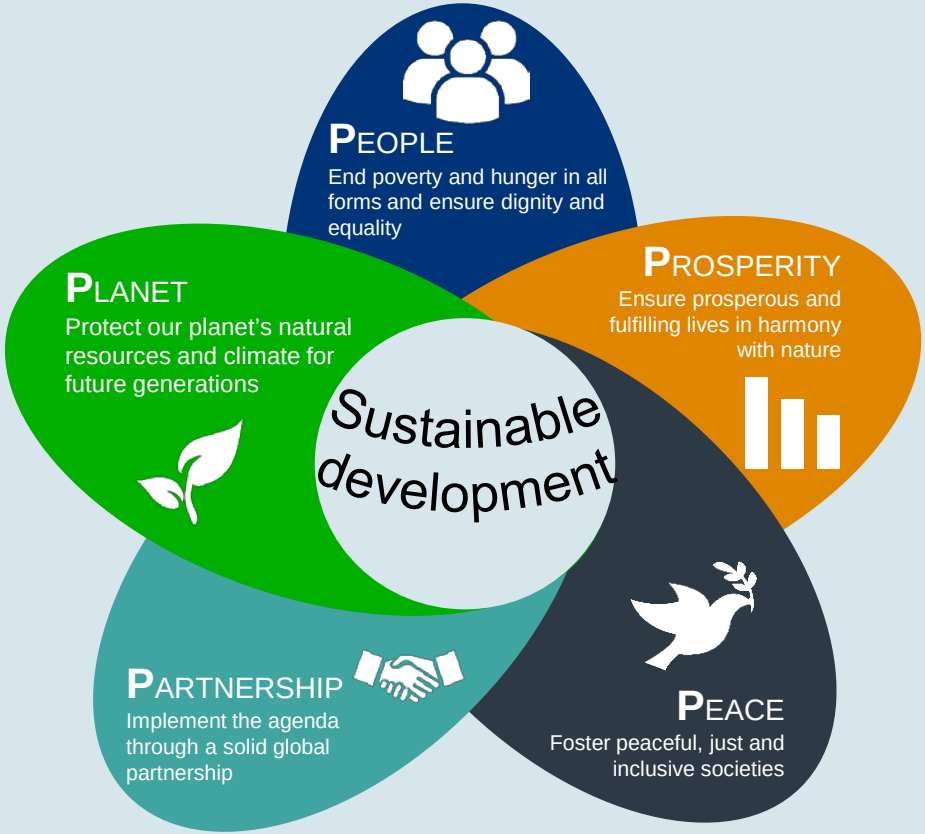
PEOPLE

PROSPERITY

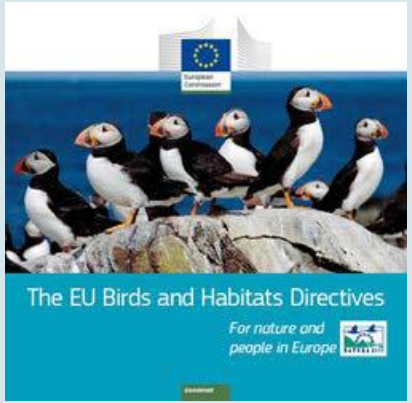
PLANET

PARTNERSHIP

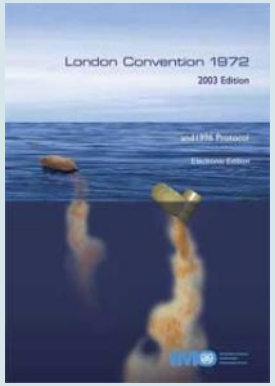
PEACE



IFC's Environmental and Social Performance Standards 2012



OSPAR COMMISSION



HELCOM

IFC International Finance Corporation World Bank Group

OECD

CIRIA

PIANC A.D. 1885 AIPCN NAVIGARE NECESSE

IFC Performance Standards on Environmental and Social Sustainability

Effective January 1, 2012

EQUATOR PRINCIPLES

IADC INTERNATIONAL ASSOCIATION OF DREDGING COMPANIES

WODA World Organisation of Dredging Associations

CEDA Central Dredging Association

Marine Strategy Framework Directive (2008/56/EC)

Qualitative descriptors describe what environment will look like when GES has been achieved.

https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

What about
the rising sea level?

What about the ever growing
population in coastal areas?

What about the scarcity of mineral
resources?

What about
soil & water pollution?

What about the growing
CO2 emissions?

Environmental Impacts → Environmental Effects → Environmental Services

DEME’s choice today is not IF but HOW to manage our sustainability activities

Safety

Technical Leadership

Respect & Integrity

Innovation

Value creation

Environment

strive

Surpassing Compliance to

- explore sustainable business opportunities
- target operational excellence

Changing traditional engineering design into a holistic project approach in which

- the ecosystem and its values are leading
- sustainable values are integrated
- in a interdisciplinary manner

- Socially equitable
- Environmentally acceptable
- Economically viable

for the benefit of current and future generations

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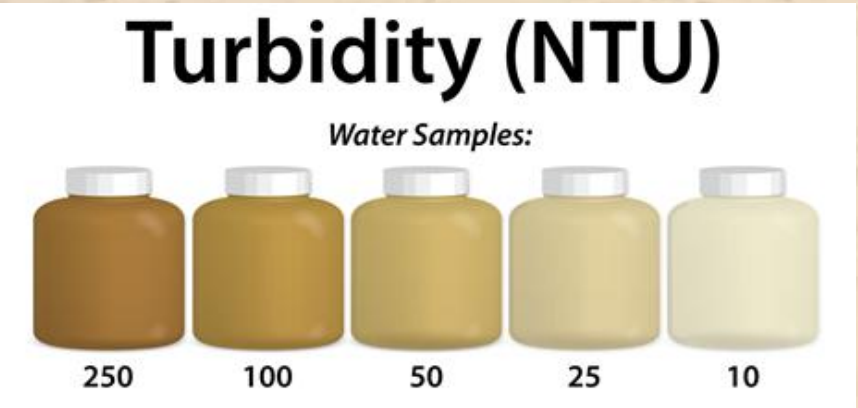
Dredging, Environmental
& Marine Engineering

How to manage turbidity in marine works ?

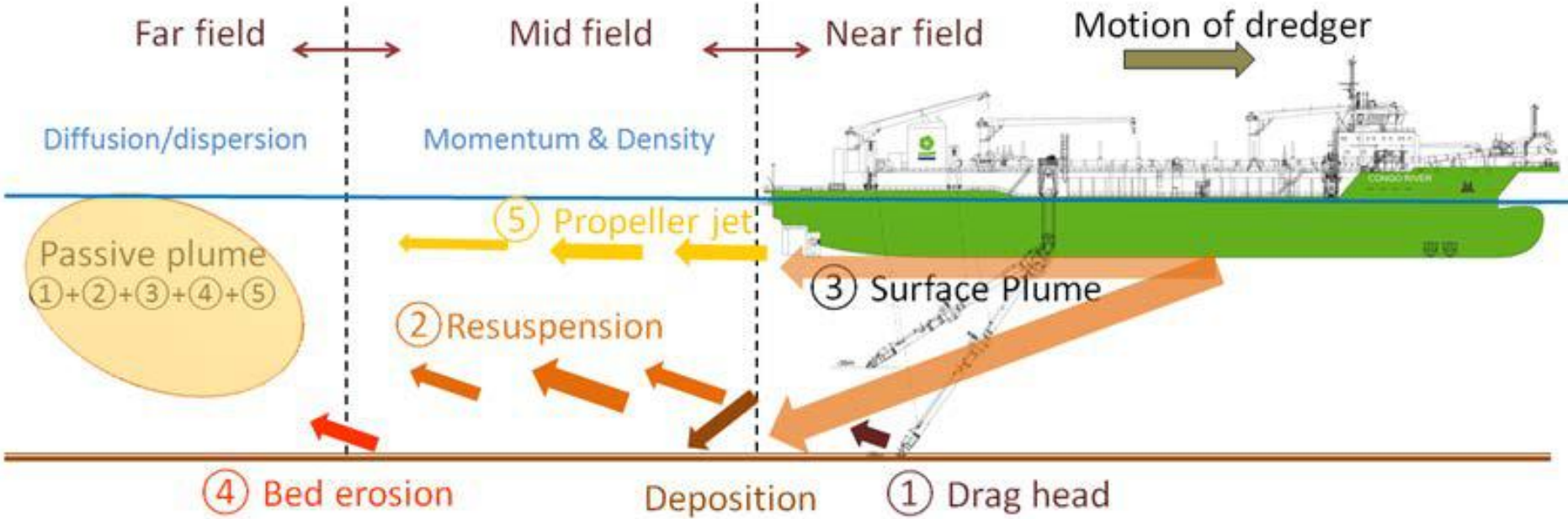
Most common environmental indicator for assessment of dredge impacts in aquatic environment

Scattering of light by suspended particles



Spatial & temporal effects

- Intensity of plume
- Duration of plume
- Sedimentation/re-suspension
- Flocculation
- Migration - Dispersion



Change in turbidity always induces a shift in the natural ecosystem

Environmental Changes ≠ Effects

e.g. change = turbidity ; effect = mortality

Effect

- Both negative (impacts) and positive (services)
- Direct or Indirect
- Short-term / Long term / Permanent

➢ Depending on presence of a (sensitive) receptor

➢ *Most turbidity effects are short-term and reversible, if managed properly.*





Environmental tresholds of relevant receptors (EIA) – **NOT arbitrarily copy-paste**
Natural background turbidity vs project induced turbidity variation

Allowable impacts
Balanced against e.g. technical constraints and economic benefits

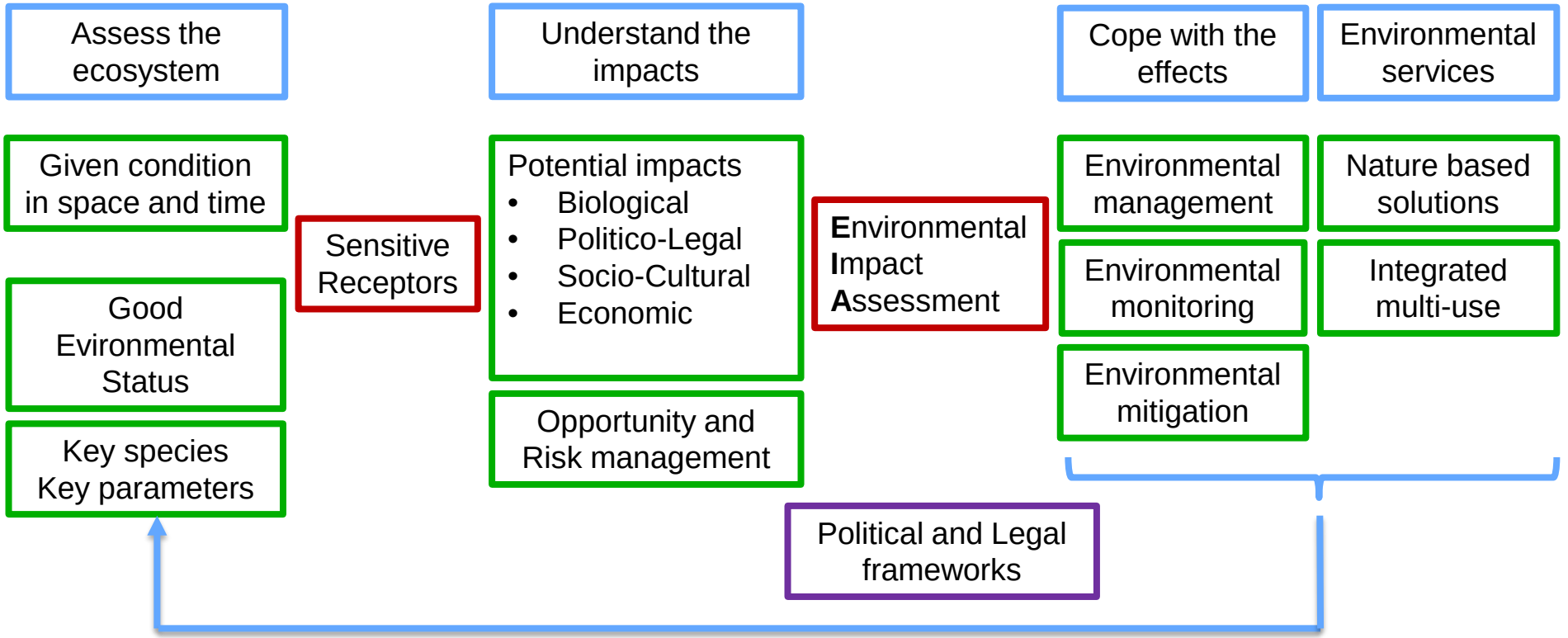
Flexible dredging techniques
Timely and effective project management

Spatial, temporal and cumulative aspects
Flexible compliance

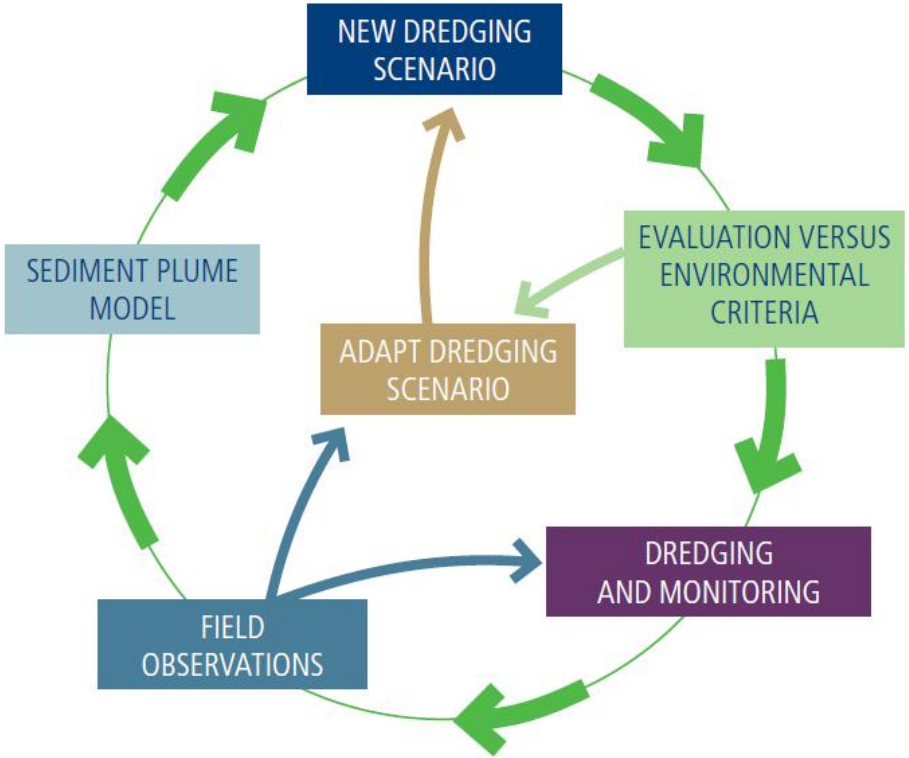




Ecosystem approach to develop operational environmental engineering



Adaptive Proactive Environmental Management



SOFTWARE MODES

Forecast

Evaluate and plan short-term execution activities.

Hindcast

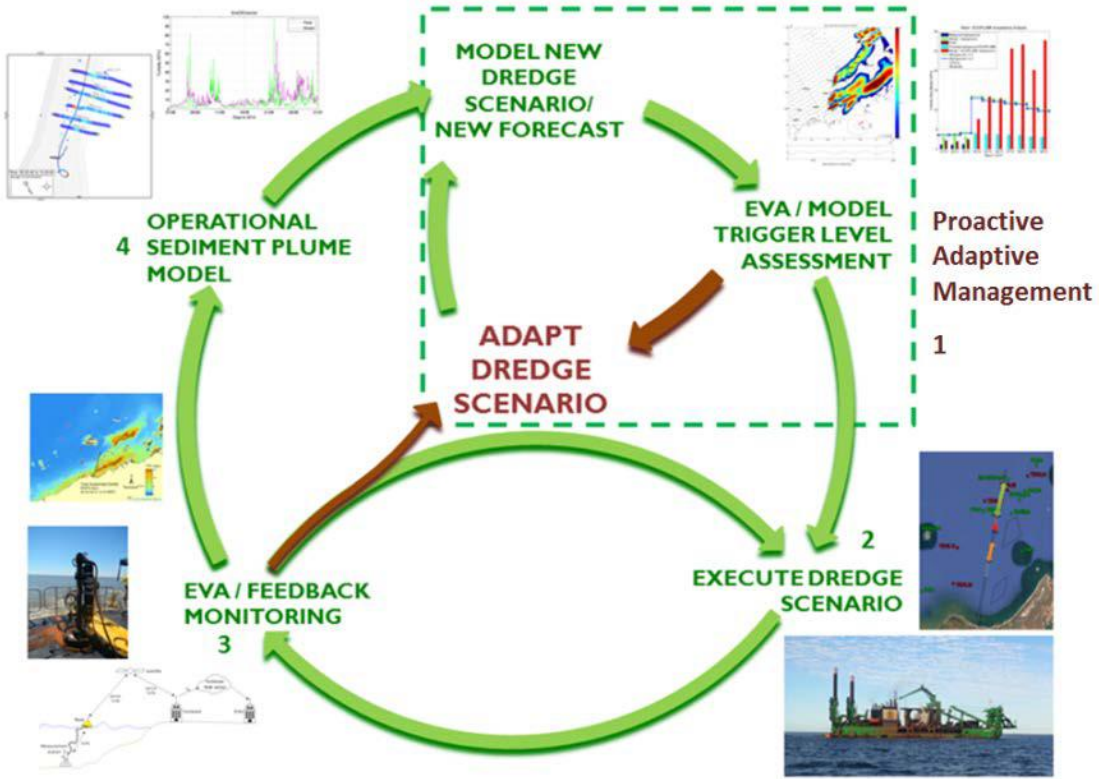
Improve understanding of conditions.

improve reporting and visualisation.

Scenario

Evaluate alternative execution activities, mid-term and in real time. (e.g. the introduction of an extra dredging vessel, …)

Operational Integrated
~~Adaptive~~ Proactive ~~Environmental~~ Management



- Operational
  - “day by day” sequence
  - Forecast-model-decide-dredge-monitor-feedback
- Pro-active
  - Scenarios-predictions-decisions
- Integrated
  - bringing together
    - Dredging operations &
    - Environmental services
  - Involving client & stakeholders
- Environmental
  - Driven by sensitive receptors

Plume Dispersion Model

- Climatic scenarios for different seasons
- Source terms for dredging equipment / operations
- Various alternative dredging scenarios (working schemes)

Assessment of Impact of Dredging & Spoil Placement Activities

- Objectives (compliance +) for various impact zones
- Water Quality criteria developed based on objectives

Optimized Base Case & Playbook Scenarios for Dredging Works

Ecoplume

1. Forecast Modeling as Part of Preventive Management

- Metocean forecasts
- Planned dredging activities

Management of Impact by Dredging Works in Immediate Future

2. Modeling of Alternative Dredging Scenarios for Approval Prior to Implementation

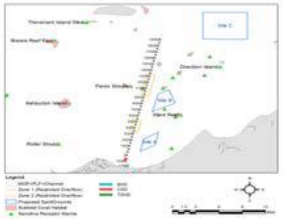
- Change in equipment and/or combination
- Change in dredging and/or dumping location
- Combining different equipment and dredging techniques for different (sensitive) areas, over 200 scenario´s

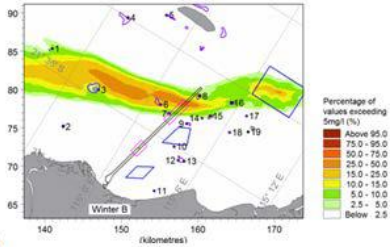
Control Mechanism for Client on Alternative Execution

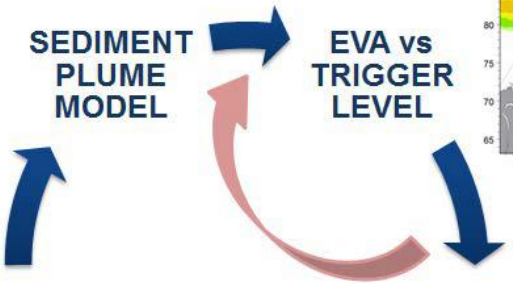
3. Hindcast Modeling as Reporting and Management Tool

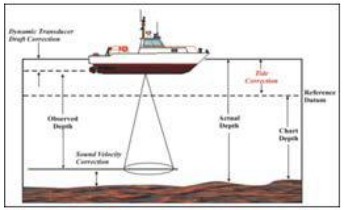
- Hindcast modelling to infer dredge related impacts
- Hindcast modelling to optimize forecast modelling

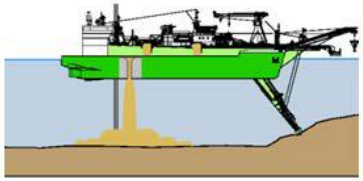
Control Mechanism for Contractor – Monitoring check







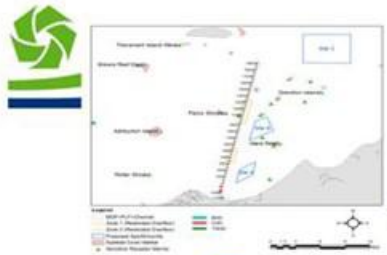




- NO standard software package
- Tailormade development/application/operation
- Dedicated hard-/software & staff
- "Open mind"

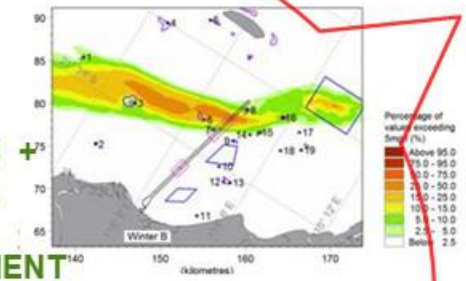
Building blocks

- Weather/metocean forecast
- Numerical hydrodynamic model
- Numerical sediment plume model
- Ecosystem ID – Sensitive receptors
- Dredging characteristics:
  - Source term database
  - Workability
  - Maintenance and repair
  - Soil conditions
- Online field monitoring
- Data management system
- Decision making framework
- Communication tools (GUI, website…)



SEDIMENT PLUME MODEL

EXPERT ANALYSIS + TRIGGER LEVEL ASSESSMENT



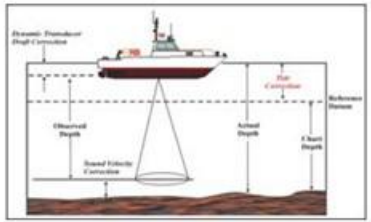
Ecoplume

Assimilation
Calibration
Validation

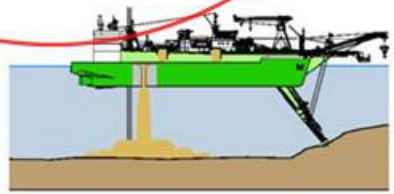
Adjustment of dredging scenario

MEASUREMENT DATA (STATIONS, MODIS)

DREDGING SCENARIO

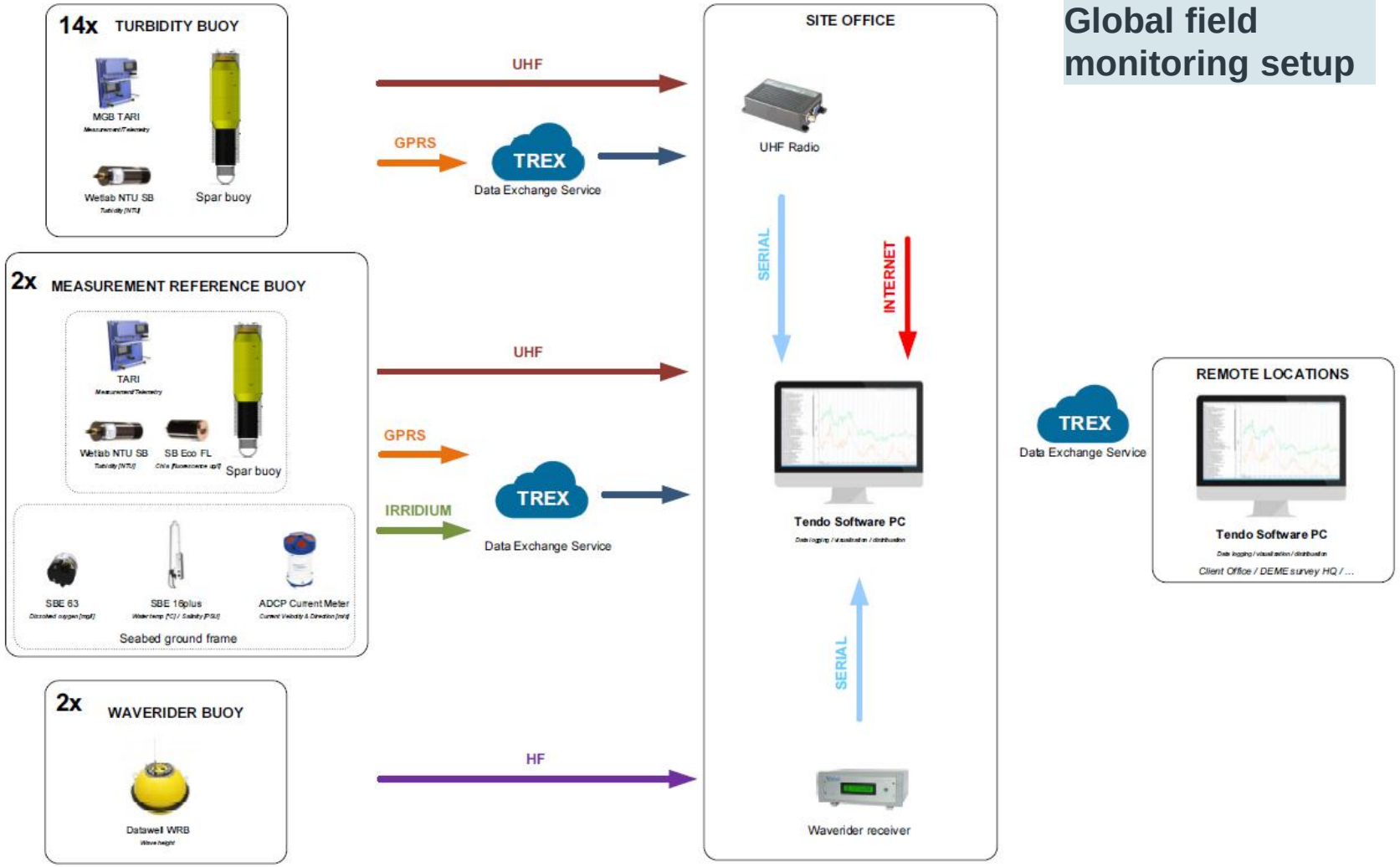


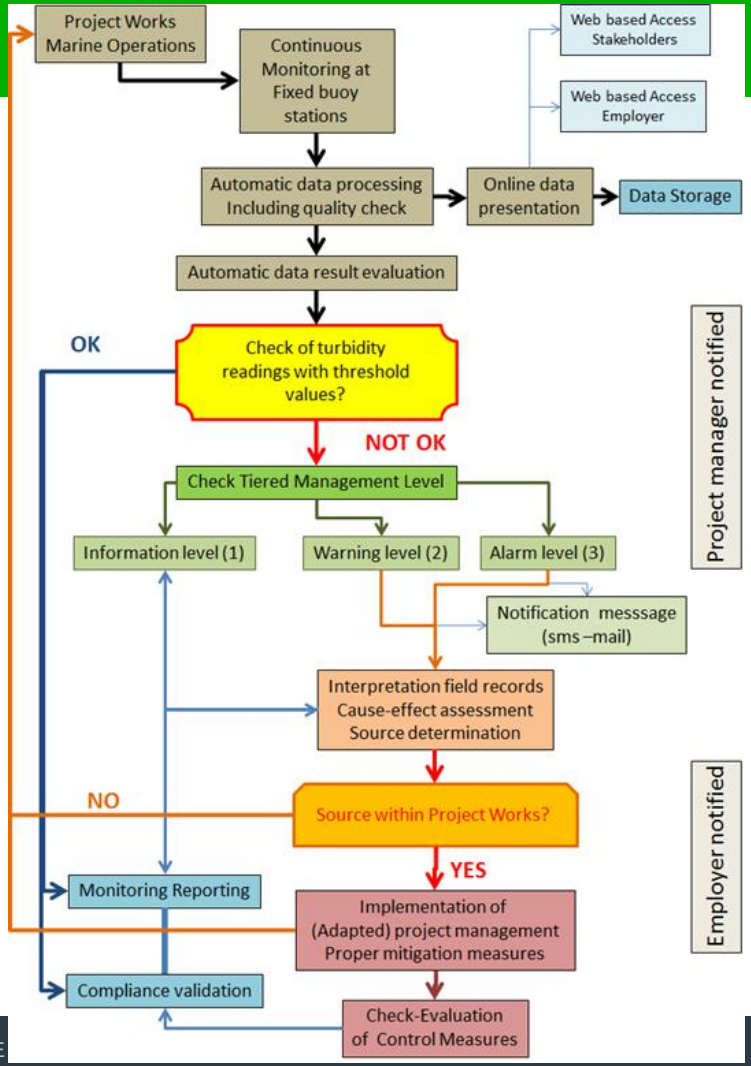
DREDGE & MONITOR



DECISION -MAKING

Global field monitoring setup





3-tiered turbidity management system:

1. **Information level:**
   - Keep all stakeholders informed
   - Equipment monitoring (geofencing, energy usage, ...)

2. **Warning level:**
   - Proactive and adaptive project management
   - Prevent deterioration towards alarm level
   - Moderate contingency measures

3. **Alarm level:**
   - Reactive, compliance project management
   - Contingency measures

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What's next ?

There is much more then turbidity

Marine ecosystem modelling

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Dredging, Environmental & Marine Engineering

Marine ecosystem modelling

- Transdisciplinar-Transparant-Open Access
- Qualitative dedicated field monitoring
- Shared knowledge-Basic Understanding
- Including socio-economic drivers
- Closer/intenser stakeholder engagement
- More relevant for management & policy decisions