Environmental Control of Dredging Projects

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Changing World

• Environmental Awareness growing within dredging world
• Boskalis: ± 500 dredging tenders / year
• with environmental restrictions
  – 2000: ± 15%
  – 2008: > 50%, of which ± 25% stringent
Observations from the dredging industry

• Each dredging project creates an impact to the environment
• The impact of the project is to be defined by the developer
• The impact of the execution (process) of the works is to be minimised by the dredging contractor

• Environmental restrictions have become common
• Environmental limit values are getting more tight
• Tendency to relate limits to biological, chemical and/or physical processes
• Notification of background levels & exposure times is crucial
• Not all clients / consultants aware (or accept) that imposing restrictions will increase costs
For every new project, questions to be addressed:

- Monitoring to be made?
- How standards have been set?
- How standards shall be adhered to?
- How compliance to standards can be monitored?
- What is cost/benefit ratio for ecology and for economy?

Discussed along project experiences
Objectives of Monitoring

- Based on Environmental Management Plan
- Surveillance monitoring or BACI monitoring
  - Verifying project conditions
- Feedback / adaptive monitoring
  - Verifying predictions / models
- Compliance Monitoring
  - Ensuring compliance with restrictions
- Research monitoring
  - Increasing know-how

Monitoring logic

- Surveillance Monitoring
- Develop EMP and Performance Standards
- Develop Dredging and Disposal methods
- Does method meet criteria?
  - Yes
    - Dredging and Disposal operations
    - Performance Criteria adequate
    - Meet trigger / threshold levels
    - Verify recovery
  - No
    - Mitigate
- Feedback Monitoring
- Project Evaluation / Research Monitoring
Monitoring of environmental parameters

- What is relevant?
- How to measure?
  Where? How often?
  At which depth?
- How to process data?
  How to interpret results?
- What are consequences if criteria are not met?
Øresund Fixed Link Project (1996)

- Peninsula for tunnel approach in Denmark
- Submerged tunnel, 3510 mtr. length
- Artificial Island, 4055 mtr. length
- Bridges, total length 7845 mtr.

Environmental standards

- Precious environment - high demand for control - high level of care - willing to pay for it
- Standards based on bio-assay - translated into physical parameters by Client: spill budget
- Contractor responsible for compliance and monitoring
Øresund Fixed Link Project
Summary

• Contractor was able to meet standards - against loss of production - with very high effort in monitoring
• Client confirmed criteria were met - follow-up evaluation did not show any impact
• Question: could the same have been achieved with less strict control?

Øresund Fixed Link Project
Lessons Learned

• Successful in environmental and economical respect
  but
• not to be used as standard for the future
  as
• each project different in all aspects
  so
• why copy / paste of environmental requirements?
Mejillones (Chile, 2002)

- Dredging for 3 terminals & turning basin
- Bay of Mejillones important for local fishery → environmentally sensitive area
- Environmental standards adopted from projects in Middle-East
- Restrictions on size of sediment plumes at dredging and disposal sites

Mejillones Monitoring Strategy

- First set-up:
  - limits set realistic, protecting aquaculture
  - monitoring extensive but no enforcement
  - negotiations for lowest price
- Second set-up:
  - confusion about scope / responsibilities
  - monitoring requirements exceed compliance level
Mejillones Performance & Lessons

- Monitoring at fixed locations and around dredging / disposal
  - up to 100 m depth
  - up to 11 km distance
- Measurements values only fraction of threshold
- No flexibility to review monitoring procedures
- Monitoring should be integral part of project planning to avoid unforeseen delays / costs

Safer Fairways to Port of Gothenburg (Sweden, 2003)

- Dredging for channel widening and deepening
- Sensitive habitats (eelgrass, mussels) and recreational demands
- Well engineered realistic monitoring & control requirements
Gothenburg Summary and Lessons

• Limited overflow adopted
• Good working relationship between Client and Contractor from start to end
• Outcome of monitoring
  – confirmed minimal impacts
  – enabled reduction of monitoring effort (24/7 → 12/7)
  – gave input for public hearings
• Stakeholder involvement & communication crucial for project success

Channel Deepening Project Melbourne (Australia, 2005)

• Dredging for channel deepening
• Alliance contract between Port of Melbourne Corporation and Boskalis
• Major concerns on environmental impact
• Trial dredging (2005), project cont. in 2008
• Variety of monitoring, focus here on turbidity
Melbourne Dashboard

Site: Port of Melbourne

Summary & Lessons

- Alliance contract with PoMC worked out well
- Turbidity limits soundly based on impacts sensitive receivers
- Ecological processes respond to prolonged impacts \(\rightarrow\) justifies 6-hour avg
- Time-averaging also needed for manageability of operational responses
- Concerns more realistically perceived
Khalifa Port and Industrial Zone (UAE, 2008)

- Dredging for construction of Khalifa Port
- Port located between world-class coral reef and power plant water intake
- Strong constraints on turbidity levels and other impacts - not well-founded
- Limits / Thresholds copied from US (29 NTU)
- Major operational demands (monitoring 24/7, 1-hour response time)

Khalifa Port
Sensitive receivers

Turbidity Measurements
• Environmental standards were met so-far
• Rigid implementation & execution of environmental monitoring procedures
• Research monitoring provides data for validation of plume model
• Project benefits from open communication with Client
Turbidity in a wider context

- Dredging-induced turbidity vs. other drivers

Nature

Jiangsu, Yangtze River (China)

After: Van Houtam and Pauly (2007)

Mississippi River (USA)

After: Vanderploeg (2007)

Lake Michigan (USA)

After: Walker (1997)

Shipping

Fishing

Hierarchy of Responses

- In reaction to adverse monitoring results
  - Continue.
  - Modify, reducing effect on sensitive parameter.
  - Modify, increasing efficiency while still acceptable effects.
  - Cease, waiting for checking.
  - Cease, waiting until recovery.
  - Cease, implementing active recovery.

- In reaction to monitoring data
  - adjust monitoring programme:
    - reduce, as no effect was observed;
    - continue, for further clarification of response;
    - expand, increasing frequency or extending scope
Observations from the dredging industry

• Dredging and environment are often seen as ‘threats’ to each other, rather than as ‘opportunity’:
  ‘Building with Nature’, not ‘Fighting against Nature’
• Dredging industry performs a long year, systematic research into this subject
• Results are being made available to anyone

Conclusions

• Each project is unique
• Lessons from one project to be used for next, with great care (*lessons*, not *limits*)
• Dredging industry capable to work against physical limits
• Dredging contractors care for the environment
• Formulation of limits needs better justification
• Environmental monitoring should be integral part of project planning
• Communication & stakeholder involvement prerequisite for successful project
• Dredging industry disseminating research & project information
Mejillones Contractor responsibility?

“Dredging should not disturb sea lions”