Adaptive Environmental Monitoring and Management: An International Best Practice Narrative on Addressing Site Specific Dredge and Reclamation Turbidity in South Florida

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Dredge & Reclamation Turbidity: Traditional Management Approach

- Fixed location monitoring of turbidity and habitats (shown with red dots)
- Typically close to the work area
- *criteria often worded like:*
  - **Concentration 200m from the dredger shall not exceed 100mg/l**
  - **Reduction in live coral cover / eelgrass biomass shall not exceed 5%**

Proposed FDEP Criteria (1st para):

Turbidity *shall not be increased more than* ***29 NTU*** *above* ***natural background****, nor shall turbidity levels be increased to levels that* ***negatively*** *affect designated uses or result in increased sedimentation or reduced light transmission to the point that the normal growth, function, reproduction, or recruitment of aquatic life is impaired.*

(Prepared by: Florida Department of Environmental Protection, Division of Environmental Assessment and Restoration, Water Quality Standards Program, 2600 Blair Stone Rd., Tallahassee, FL 32399, September 2019)

- How do you sufficiently
  - define ‘natural’ background?
  - measure in multiple variable locations?
- How do you quantify negative impact…?
  - differentiate between tolerances of various receptors?
  - account for time exposure?
- NTU to real TSS?
- How do you communicate obligations to the contractor?

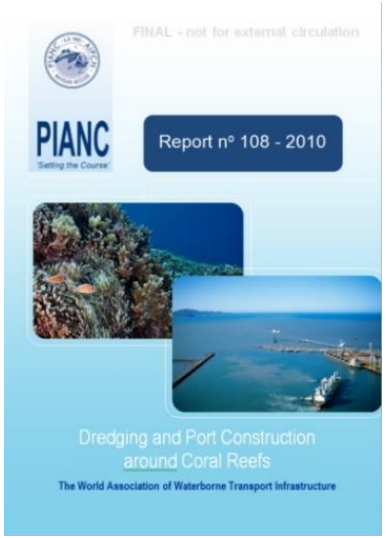
Origins of (Adaptive) Feedback EMMP

Europe / Singapore / Malaysia

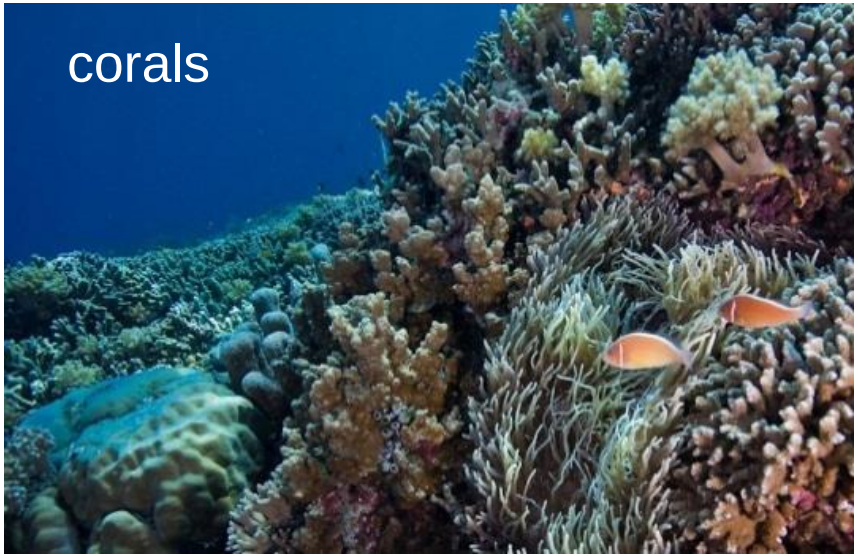
Images
http://www.seanews.com.tr/malaysia-s-port-of-tanjung-pelepas-sets-aside-funds-for-more-cranes-in-2016/157017/
http://ifonlysingaporeans.blogspot.com/2015/06/pasir-panjang-terminals-35b-expansion.html
https://archerrecruitment.com/news/we-are-not-done-building-singapore-yet-lawrence-wong
https://sgx.i3investor.com/blogs/singaporestockmarketnews/16764.jsp

Approach endorsed / recognized by:

- PIANC
- WODCON XVIII (2007) (Best Practice)
- UNEP
- IFC's Environmental, Health, and Safety Guidelines for Ports, Harbors, and Terminals
  www.ifc.org/ehsguidelines



It is applied to…



With Feedback EMMP, you get ALL the pieces of the puzzle

Traditional “Reactive” EMMP

Fixed receptor monitoring stations
Physical and biological parameters

Trigger Limits

Respond when trigger is exceeded

“Proactive” Feedback EMMP

All the features of Traditional EMMP

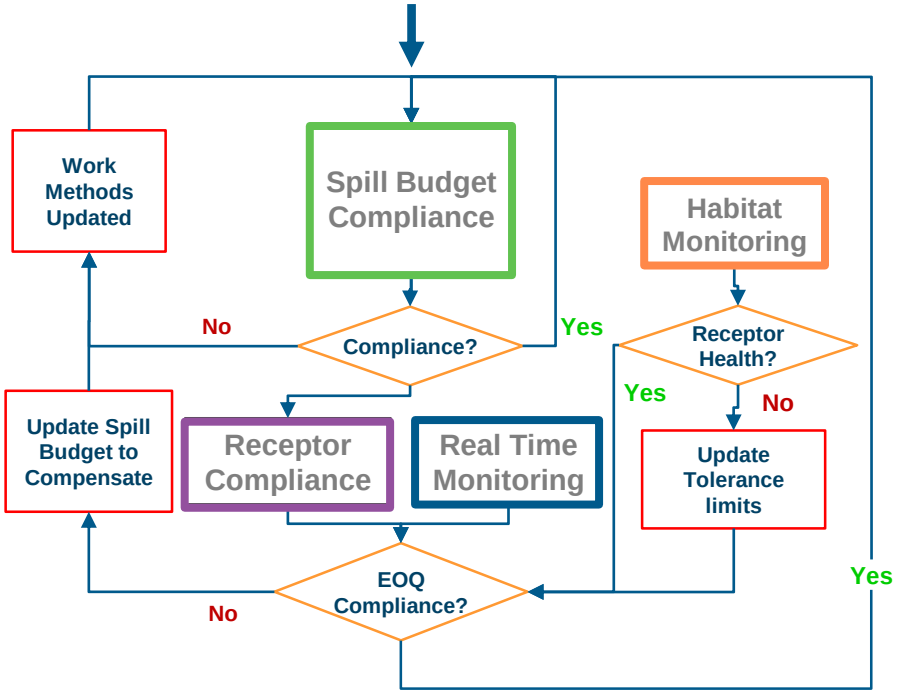
+

Spill Budget

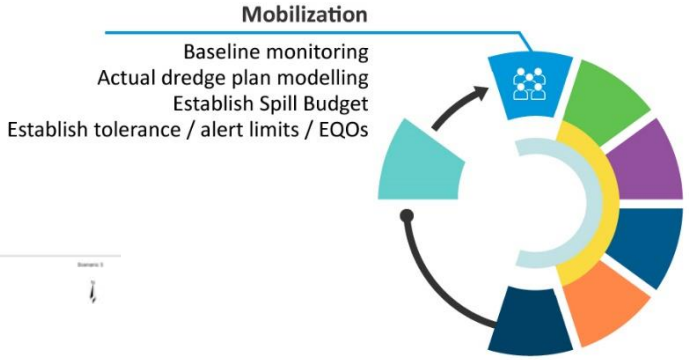
Hindcast Modelling / Dedicated Trigger Limits

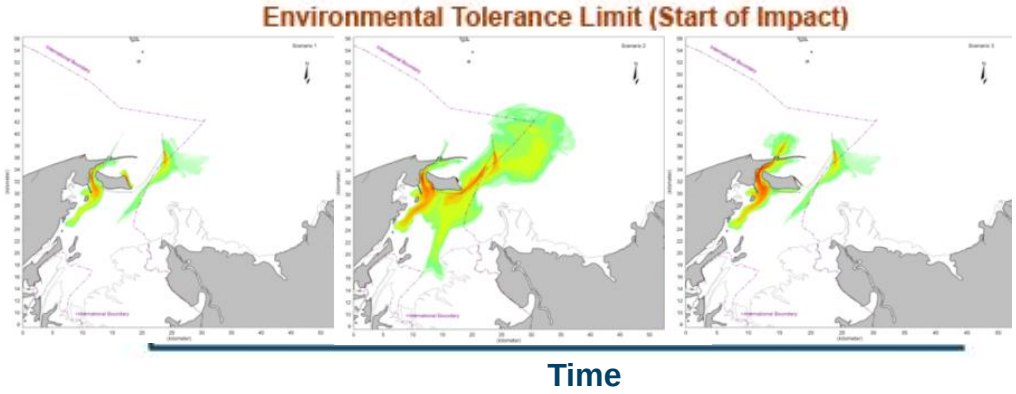
Feedback
Updating of spill control limits based on receptor monitoring

Feedback EMMP: Components & Control Process



Mobilization

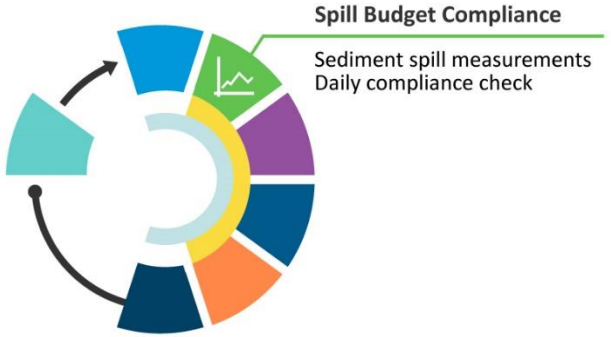




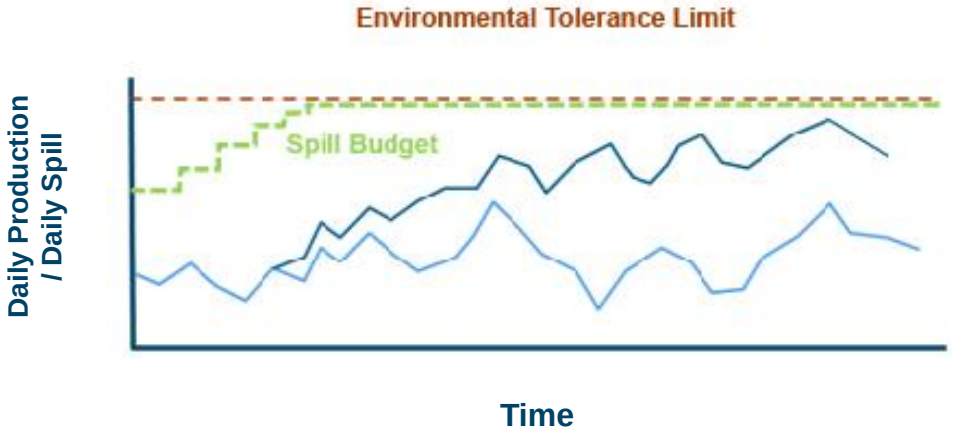
Spill = Portion of (fine) sediments that are released or mobilized at source from dredge or reclamation activities

Spill Budget = Maximum amount of sediment spill (fine sediments) that can be released in the waters but still meet the Environmental Quality Objectives (EQOs) for the project

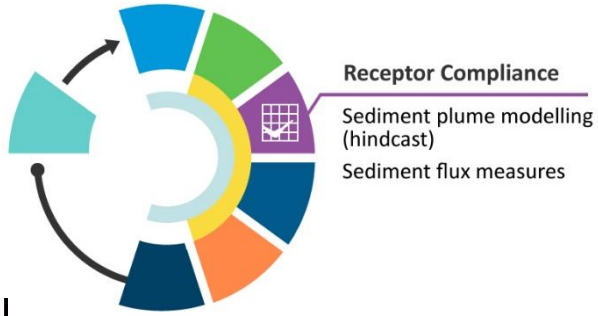
Spill Budget Compliance (Daily)



- Sediment samples and work activity information is collected from the dredge contractor
- This information:
  - undergoes laboratory analyzes
  - is used to calculate actual daily sediment spill
- Results determine Spill per activity and allow for a compliance check

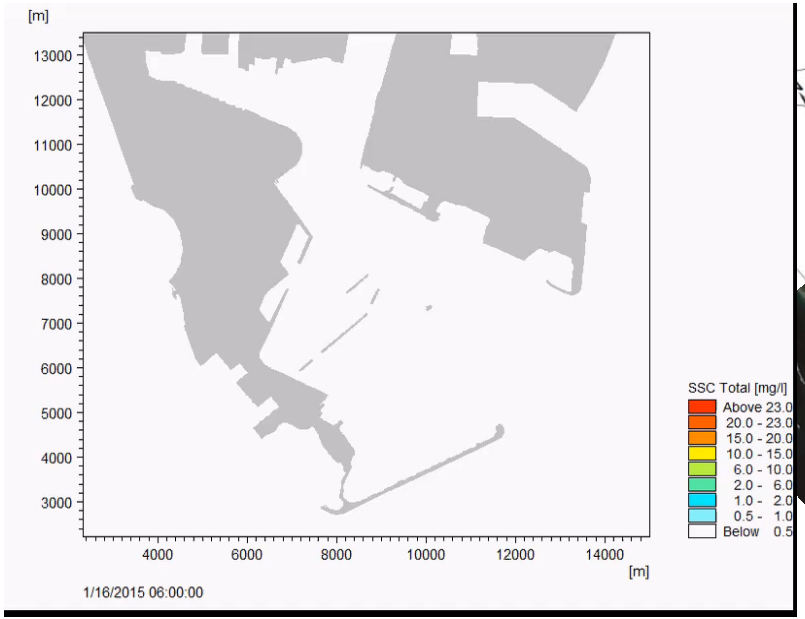


Receptor Compliance (Daily)

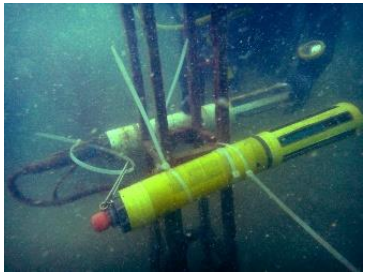


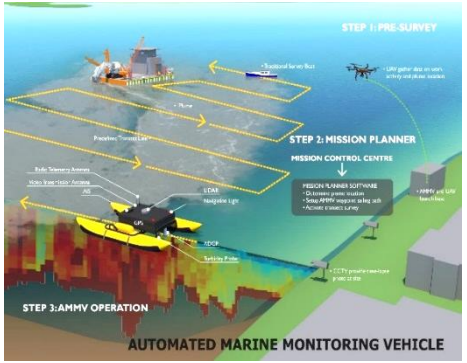
Daily sediment plume modelling is a critical component for the Feedback EMMP:

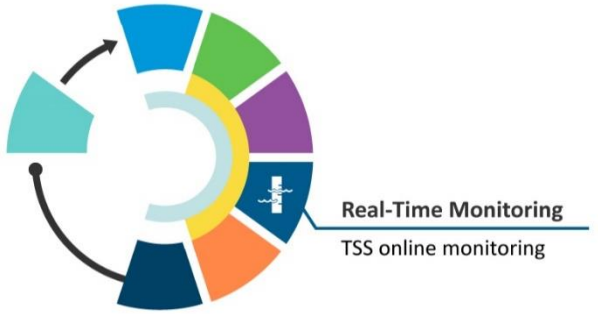
- measured spill is used for numerical modeling
- results are compared against the receptor locations and site specific tolerance limits
- Results determine Receptor Compliance



Real-time Monitoring







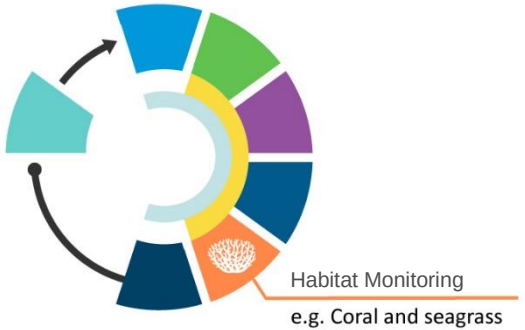
TSS ADCP Status - Windows Internet Explorer

TSS ADCP Mean Values Info@SEA

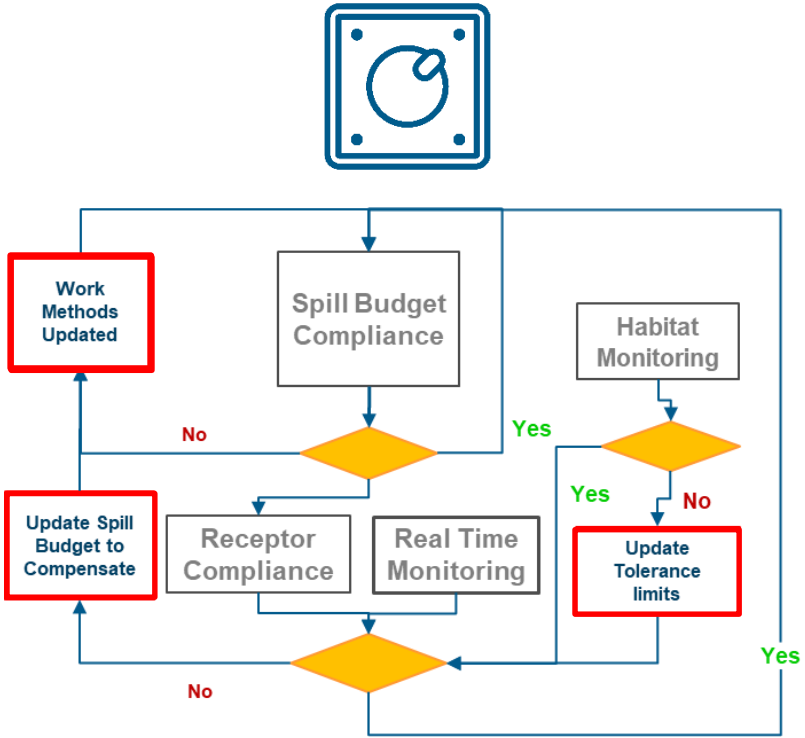
TSS Data	Value (mg/l)	Alert Level (mg/l)	View Graph
Latest value at	(23-10-2009 04:22)		
10-Min Mean	7.6	28.6	View Timeseries
1-Hr Mean	7.9	24.0	View Timeseries
3-Hr Mean	8.1	19.7	View Timeseries
1-Day Mean	8.7	13.0	View Timeseries
3-Day Mean	10.4	12.0	View Timeseries
7-Day Mean	10.5	10.4	View Timeseries
14-Day Mean	9.3	9.5	View Timeseries

- Monitoring of exceedance of sensor threshold (alert limit)
- Similar to traditional approach, but…
- Locations can be more targeted / reduced as there are
  - other levels of control
  - other sources of data to interpret the monitoring results

Habitat Monitoring



Adaptive Loops



Adaptive Responses:

- Slow the dredging operations (reduce spill budget)
- Use of tidal windows, work with currents / tides
- Change in dredge location (if possible)
  - Avoid migratory, spawning / breeding seasons
- Deploy mitigation measures (e.g. silt curtains) quantifiably assessed to address the issue
- Adjust tolerance limits in relation to Habitat Monitoring
- Stop works – only in extreme cases

Feedback EMMP: The Takeaway

- Proactive adaptive management approach
- Favorable to Contractor and Regulators
- Flexible, allows for changes in equipment, timing, duration, etc.
- Segregation of impacts from different components of work and from natural events
- Accountable, reduces developer's liability through improved communication
- Optimisation of spill budget allows consistent work without fear of stoppage
- Tolerance limits can be adjusted based on real habitat response
- Similar in cost to traditional approach
- **It truly protects the environment**

Thank you

For further information, please contact / see:

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Mamta Jain – maja@dhigroup.com

PIANC Report Number 108 – 2010 (recognised by WOCON, UNEP and IFC)

Foster, T.M., van Berkel, J.J., Hoa, V, Tan, C.A, “APPLICATION OF FEEDBACK EMMP APPROACHES TO THE MANAGEMENT OF DREDGING ACTIVITIES IN SENSITIVE TEMPERATE AND TROPICAL COASTAL ENVIRONMENTS”, Proceedings of the Western Dredging Association Dredging Summit & Expo ’18, Norfolk, VA, USA, June 25-28, 2018.