Title:

S-104: Set new and appropriate water turbidity standards and support the efforts to improve turbidity monitoring methods for marine construction to limit damage from coastal constructions to reefs and associated habitats.

Background:

- This recommended management action relates to coral reefs and seagrasses in the entire state of Florida.
- This recommended management action is being put forth because of the damage to corals caused by high turbidity and silt deposits during construction work. The current turbidity standard may not be effectively minimizing resource impacts caused by sedimentation and high turbidity in the water column resulting from coastal construction projects. The current standard of 29 Nephelometric Turbidity Units (NTU) above background is too high. Even the special standard of 15 NTU above background that's been used near sensitive coral reefs in the southeast Florida area (see Maritime Industry and Coastal Construction Impact Local Action Strategy 4 Phase 2 report) seems excessive for some species of corals.

Objective:

- The intended outcome of this action is to set a new Florida limit of 10 NTU for construction in or adjacent to submerged resources of ecological significance that are sensitive to turbidity and/or sedimentation. This water quality standard should be based on scientific literature and monitoring data and observations from past coastal construction projects to provide assurance that resources will not be impacted by turbidity and siltation generated by coastal construction projects. Also, a better monitoring methodology, such as in situ /real time, and more frequent monitoring should be required.
- Any expansion of mixing zones should be justified by monitoring data or modeling. If a larger mixing zone variance request is approved, even if there is a lower NTU, it may negate the protection provided by the lower NTU standard. (Note: If a mixing zone extension is approved, the Florida Department of Environmental Protection (FDEP) considers the ecological value of the resources in the expanded zone and considers the area to be a direct impact in compensatory mitigation determinations.)

Intended Benefits and/or Potential Adverse Effects:

- A benefit of implementation of this recommended management action includes a new science-based turbidity standard that will minimize damage to benthic organisms caused by elevated (relative to background) turbidity and sedimentation/siltation during construction. This recommended management action proposes to minimize the possibility of more environmental disasters similar to the one caused by the Port of Miami expansion in 2014.
- A science-based turbidity standard will provide regulatory agencies with reasonable assurances that impacts to resources will be minimized to the maximum extent practicable. Minimization of impacts to coastal resources from project-related turbidity and sedimentation/siltation will aid in maintaining the ecological functions and economic benefits provided by those resources. This will result in better protection of these resources, improved recreational attraction to tourists, and maintenance of functional larval and juvenile habitats, which support the fishing industry.

- Some anticipated negative impacts associated with this recommended management action include mixing zones for projects would likely need to be expanded and may extend over coral reef and seagrass resources if the turbidity limit (NTUs) is reduced. As a result, additional mitigation for significant adverse impacts and sedimentation monitoring would likely be required, which would increase the cost of construction projects. A dredge may also need to slow its production rate or move a greater distance away from the resource to allow turbidity levels to drop below the NTU standard, both of which could increase the duration of construction and project costs.
- The duration of the benefit of this recommended management action is a discrete one-time rule change with long-lasting benefits. While project-related turbidity from many projects is often temporary, turbidity can be elevated for a prolonged period of time. Furthermore, areas subject to multiple/repeat projects may experience cumulative effects of elevated turbidity. Higher water quality standards (lower NTU limits) may better protect resources from effects caused by prolonged or chronic exposure to elevated turbidity.
- If this recommended management action is not implemented damage to coral reefs will occur each time a coastal construction project is conducted.

Agencies/ Organizations

- The lead agency for implementation of this recommended management action would be the FDEP.
- Other potential agencies or organizations who could be involved include the United States Environmental Protection Agency.
- The key stakeholders for this recommended management action would be any stakeholders involved in coastal construction activities (including permittees and regulatory agencies).
- The legislative considerations to take into account include the current rule stating that turbidity must be less than or equal to 29 NTUs above background. This recommended management action may require a rule change to implement a higher standard (lower NTUs) or alternative turbidity standard (total suspended solids) on a project-by-project basis depending upon the resources within the project area and their relative tolerance (resistance and resilience) to turbidity and sedimentation.

Permitting/ Enforcement Requirements of MA:

- There are no permitting requirements for this recommended management action.
- Enforcement requirements for this recommended management action include compliance efforts that are consistent with current procedures.
- A measurable way to show success with this recommended management action is enactment into law of 10 NTU limit. The effectiveness of this recommendation could be measured by reviewing the results of biological monitoring reports submitted in compliance with coastal construction permits. A reduction in turbidity-related stress and lower sedimentation on benthic organisms would be a measureable outcome indicating the success of this recommended management action.

Cost:

- There is no estimated direct cost of implementing this recommended management action because rule changes do not require funding.

Time Frame & Extent:

- The anticipated timeframe for implementation of this recommended management action is 2 - 5 years.

Miscellaneous Info:

- This recommended management action is linked to S-106.
- Some uncertainties or gaps can be addressed by additional research establishing the turbidity thresholds because it is not certain that a limit of 10 NTUs will be low enough. It would be helpful to know the relative resilience and resistance of various marine communities to turbidity and sedimentation. Multiple factors need to be considered including the magnitude (NTUs) and duration (persistence) of turbidity. Alternative parameters such as suspended solids or sediment deposition might better reflect the direct aspects of stress to corals. An absolute ceiling level of turbidity should also be incorporated into the standard (in addition to an 'above baseline' threshold). Moreover, a comprehensive literature review of turbidity related impacts on benthic marine communities will likely be required to justify a change in the current water quality standard. Alternative measurements of water quality (e.g., total suspended solids) should potentially be considered in addition to assessing the appropriate turbidity standard (NTUs).
- Supporting and relevant data includes the following:
    - Erftemeijer, P. L., Riegl, B., Hoeksema, B. W., & Todd, P. A. (2012). Environmental impacts of dredging and other sediment disturbances on corals: a review. *Marine Pollution Bulletin*, 64(9), 1737-1765.
    - Erftemeijer, P. L., & Lewis, R. R. R. (2006). Environmental impacts of dredging on seagrasses: a review. *Marine Pollution Bulletin*, 52(12), 1553-1572.
    - Pollock, F. J., Lamb, J. B., Field, S. N., Heron, S. F., Schaffelke, B., Shedrawi, G., Bourne, D. G., Willis, B. L. (2014). Sediment and turbidity associated with offshore dredging increase coral disease prevalence on nearby reefs. PLOS ONE, 9(7).
    - Flores, F., Hoogenboom, M. O., Smith, L. D., Cooper, T. F., Abrego, D., Negri, A. P. (2012). Chronic exposure of corals to fine sediments: lethal and sub-lethal impacts. *PloS one*, 7(5).
    - Rogers, C. S. (1990). Responses of coral reefs and reef organisms to sedimentation. *Marine ecology progress series. Oldendorf*, 62(1), 185-202.
    - Sheridan, C., Grosjean, P., Leblud, J., Palmer, C. V., Kushmaro, A., & Eeckhaut, I. (2014). Sedimentation rapidly induces an immune response and depletes energy stores in a hard coral. *Coral Reefs*, 33(4), 1067-1076.
    - http://link.springer.com/article/10.1007/s00338-014-1202-x.
    - There seems to be only one paper describing the effects of high turbidity in laboratory conditions, namely:
        - Telesnicki, G. J., & Goldberg, W. M. (1996). Effects of turbidity on the photosynthesis and respiration of two south Florida reef coral species. Oceanographic Literature Review, 2(43), 199.
        - Researchers in this study observed no effects with turbidity levels of 7-9 NTU and measurable effects with levels of 14-16 and 28-30 NTU.
    - Dr. Bob Richmond (Hawaii) has a manuscript coming out that synthesizes all of the known sediment/turbidity thresholds for corals. It will be a stop light style matrix that includes 3 types of data: 1) Sedimentation Rate, 2) Turbidity/Suspended

Sediment Concentration, and 3) Sediment Accumulation as Depth.
    - United Nations Environment Programme and PIANC report "Dredging and port construction around coral reefs" http://www.unep-wcmc.org/system/dataset_file_fields/files/000/000/099/original/2010_PIANC_Dredging_and_port_construction_around_coral_reefs_Report_108-2010_FINAL_VERSION_LowRes.pdf?1398441422
    - Hawai'i has turbidity standards that may be of interest:
        - http://health.hawaii.gov/cwb/files/2013/04/Clean_Water_Branch_HAR_11-54_20141115.pdf.
- Currently differences between project type, equipment, and resources all impact the scenario, so we support a case-by-case approach based on the coral reef resources present. Increasingly, FDEP is already doing this in permit conditions and requiring lower turbidity standards to trigger additional sedimentation monitoring and specific conditions which require the dredge to stop dredging and move to a greater distance from the reef resources until accumulated sediment levels return to background conditions. This should be pursued by the regulatory agencies in the interim while a more stringer water quality standard is developed. Currently, there is a turbidity monitoring working group that should be contacted in regards to this recommendation.

Goals/ Objectives to be achieved:

Refer to the SEFCRI Coral Reef Management Goals and Objectives Reference Guide

- FL Priorities Goal C1 Obj. 1.
- FDEP CRCP Coral Reef Ecosystem Conservation Goal C.
- SEFCRI LAS MICCI Issue 1 Goal, Obj. 1 / SEFCRI LAS MICCI Issue 1 Goal, Obj. 2.