



Saltwater Intrusion Mitigations and Technologies for Inland Waterways

Terms of Reference

1. Background

Saltwater intrusion mitigations and technologies can:

- provide continuous measurements of saltwater intrusion from the sea into fresh water areas for warning and awareness of needed actions for the potability of water for human consumption, for its industrial and agricultural uses, and environmental impact.;
- provide methods to counter saltwater intrusion from the sea that result from channel deepening, relative sea level rise (RSLR), as well water diversions and droughts that limit flushing capabilities, etc.;
- provide tools, such as numerical, desktop, and physical models of infrastructures, channels, harbors, watersheds, etc., for gaining insight into, as well as developing strategies to combat, saltwater intrusion from the sea.

2. Objectives

The main goal of saltwater intrusion mitigations and technologies is to provide guidance and insight into the monitoring, moderating, and development of methods for addressing the issue of saltwater intrusion, as well as to promulgate both new and established insights and methods of mitigation.

The objective of this working group is to compare current practices of:

- Identify the state-of-the-art methodologies to quantify saltwater intrusion induced, for instance, by lock operation. Including salt propagation (speed, distance and concentration) in the upper reach.
- Remotely and otherwise monitoring waterway salinity intrusion using sensors and direct measurement to quantify freshwater reliability and prognosis as well as to provide early warning indicators of impending catastrophic conditions of loss of potable, or other suitably fresh, water, including the monitoring of watershed resources for flushing and the treatment of the saltwater intrusion issue as a system wide issue
- Mitigating saltwater intrusion in channels using physical, channel design, and flushing techniques
- Constructing, applying and interpreting numerical, desktop and physical modeling and simulation tools to develop and assess methods of saltwater intrusion mitigation, including determining the criteria for a validated modeling tool for saltwater intrusion.

And to make recommendations for common practices, where these would be helpful.

This working group seeks to gather input from a wide variety of waterway managers, consultants and organizations.

3. Earlier Reports and Concurrent Working Group Activities

PIANC InCom, MarCom, EnviCom, and RecCom Commissions, as well as other entities, have several Working Groups and Task Groups related to the subject. The following past and present related subjects and Working Groups are:

InCom

- PIANC Lock report - section 12 , pp 365-375 PIANC 1986
- Innovations in Navigation Lock Design – Appendix pp 197-201 PIANC WG 106
- Design Guidelines for Inland Waterways PIANC WG 141
- Ship Behaviour in Locks and Lock Approaches PIANC WG 155

EnviCom

- A Practical Guide to Environmental Risk Management for Navigation Infrastructure Projects PIANC WG 175
- A Guide for Applying Working with Nature to Navigation Infrastructure Projects PIANC WG 176
- Working Group on Climate Change Adaptation for Maritime and Inland Port and Navigation Infrastructure PIANC WG 178
- An Introduction to applying Ecosystem Services for Waterborne Transport Infrastructure Projects PIANC WG 195

Joint Task Group

- Sustainability Reporting for Ports Joint IAPH-PIANC WG 174

Permanent Task Group

- PIANC (Permanent Task Group on Climate Change)

Also of interests is the U.S. Army Corp of Engineers Engineering Manual: Tidal Hydraulics EM1110-2-1607.

IARH and other Journals (www.iahr.org)

4. Scope

Matters to be investigated

- Implementation of standardized and ad hoc instrumentation, both short- and long-term, for monitoring of salinity intrusion in waterways and for watershed resources for flushing, including methods of using data from instrumented areas to assess salinity intrusion and freshwater status and trends
- Methods for arresting salinity intrusion, including advanced lock concepts, submerged berms, bubble curtains, channel design, gates and structures, structure operation, flushing, etc.
- Physics based multi-dimensional modeling (2D, 3D), desktop methods, and physical modeling for insight and solution discovery for salinity intrusion issues, including model realization criteria of acceptability
- Interaction between temperature, salinity and suspended solid
- Interaction of Salt Mining with water quality in inland waterways (e.g. Weser River in Germany), which may induce salt water in the upstream reaches,
- Interaction with sedimentation as salt intrusion promotes sedimentation by flocculation process in the border between the salt wedge at the bottom, and the upper water flow layers. That happens in some river estuaries and the salt intrusion is the main cause for dredging requirements.
- Effect of ship passages going in/out of locks (see WG155),
- Project reviews: presenting examples of operational decisions made based, in part, on sensor and model data and on existing practice

Method of Approach

Evaluation of actual saltwater intrusion monitoring, mitigation, and modeling systems and approaches used for operational, engineering, financial and policy decision-making. This will include listing of sensors, methods of sensor deployment and of data analysis, methods of mitigation, and numerical, desktop and physical models, as well as analytical models, which are used address saltwater intrusion issues and to produce decision support information and their effectiveness.

5. Suggested Final Products

All results will be described in a published PIANC report and an associated with PIANC Project Reviews (saved on the PIANC web site). If practical and appropriate, participants will develop and distribute a technical brief containing main outcomes.

6. Recommended Members

Organizations representing Inland Waterway systems especially artificial waterways/canals that connect with the sea, such as river mouths, bays, estuarine and other locations where fresh water conduits to the sea are used as navigation channels. (e.g., waterway management organizations, governmental administrations, consultants, Labs, R&D institutions and universities, etc.).

Support from members having direct interests in the MARCOM and ENVICOM issues are welcome to share knowledges as salt water intrusion is at the edge with Maritime activities and has large impact on environment

7. Relevance for Countries in Transition

Results may help inform CiT and should be considered in design of new inland waterway systems and components, especially as they connect to the sea via estuaries or other openings. Saltwater intrusion mitigations and technologies have the potential to aid in daily operation of new and existing infrastructure for saltwater intrusion prevention, as a risk reduction method for securing freshwater supplies, to provide valuable, accurate, quantitative data to formulate freshwater resource policy. Modeling will enable the testing of existing technologies in new places and will allow the discovery of new and cheaper solutions to saltwater intrusion abatement methods.

World Bank has expressed his interest on this issue.

8. Climate Change

Sea level Rise will affect freshwater outlets to the sea by enabling more saltwater to intrude more often. This additional intrusion will have numerous environmental impacts, the most egregious of which is placing the freshwater supply of coastal areas at risk. Changing climate may additionally affect the water resources in a navigation channels watershed, thus impacting the amount of water available for flushing saltwater out of fresh or brackish channels.

8. Associate Organisation

PIANC will contact AIRH (www.iahr.org) to eventually join the WG