# Navigating the Water Treatment Design and Permitting Process for Environmental Dredging Projects

***Prepared for:***

WEDA Western Dredging Association *Educational Commission*

***Prepared by:***


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INFRASTRUCTURE ALTERNATIVES, INC. CLEAN WATER SOLUTIONS

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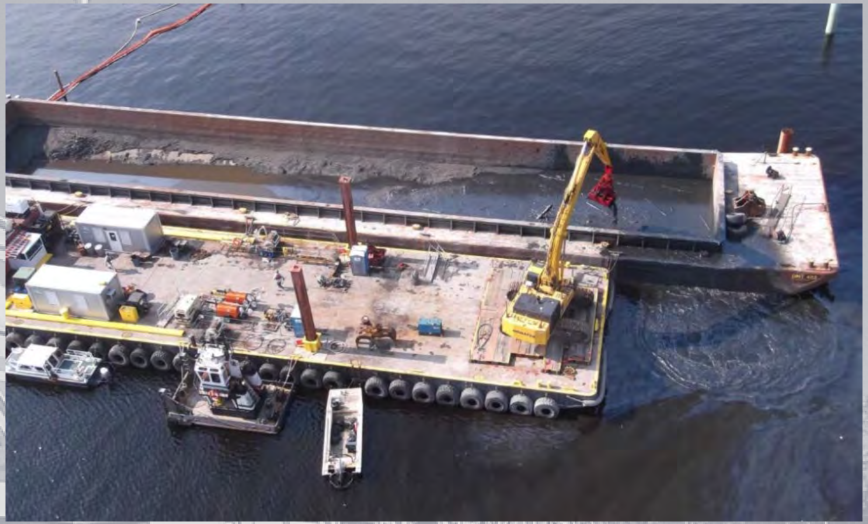
# Key Topics

- Water Treatment Basics
- Treatability Testing
- Design Considerations Relative to Water Treatment
- Discharge Permitting
- Uncertainty and Risk: Drivers, Reduction, and Sharing
- Lessons Learned



# Sources of Water Requiring Treatment

- Gravity Dewatering
- Barge Effluent/ Decant Water
- Sediment Processing (geotextile tubes, filter presses)
- Wick Drains
- Stormwater
- Groundwater Intrusion

# Typical Water Treatment Processes for Dredging Projects

**To remove…**

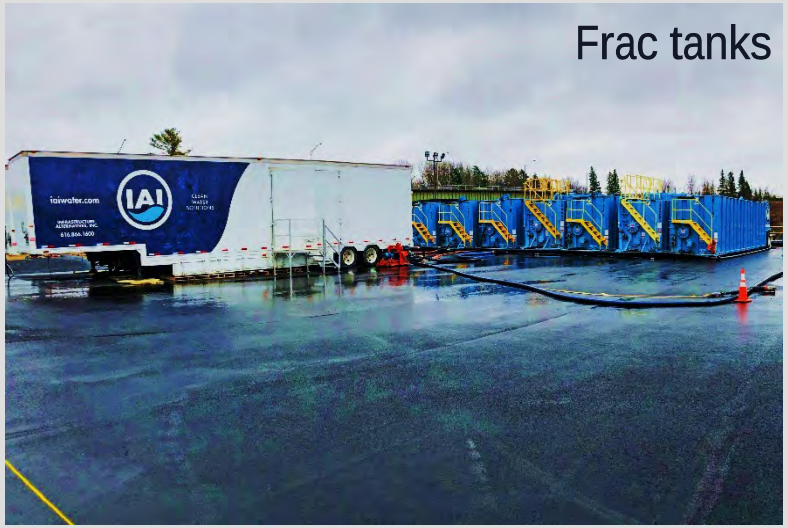
| To remove | Treatment processes |
|---|---|
| Solids | • Clarification (with or without coagulation)<br>• Filtration |
| Dissolved inorganics (metals) | • Chemical precipitation (pH adjustment) |
| Dissolved organics | • Activated carbon adsorption<br>• Ion exchange |

# Typical Treatment System Components

| Influent storage | Processes to remove solids | Processes to remove dissolved contaminants | Effluent storage | Discharge | Ancillary equipment |
| --- | --- | --- | --- | --- | --- |
| Retention basin | Coagulant addition | pH adjustment | Retention basin | Pipeline | Pumps |
| | Clarifier or basin | Activated carbon | | | Flow meters |
| | Filter(s) | Ion exchange | | | Sample taps |
| Tank(s) | Residual solids | Spent media | Tank(s) | Diffuser | Valves |
| | | | | | Secondary containment |
| | | | | | Safety shower, eye wash |

# Examples of Water Treatment Equipment/Processes

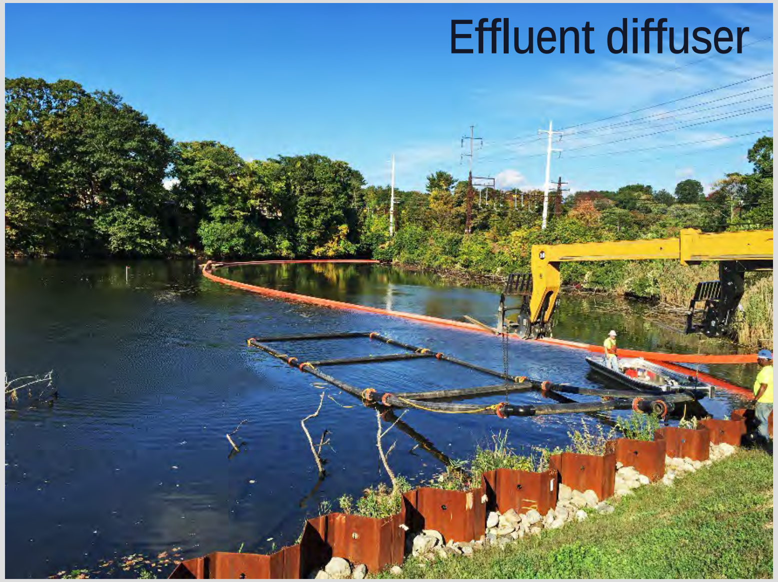

Retention basin


Frac tanks


Clarifier and filters


Clarifier


Carbon vessels, clarifier and diffuser


Effluent diffuser

# Treatability Studies

- Range from simple or complex, e.g.:
  - Jar testing to select a coagulant, dial in target dosage, for improved clarification
  - Bench-scale testing to estimate treatment efficacy (removal)
  - Pilot testing to evaluate system design
- May be used to refine treatment schemes (less expensive than mobilizing equipment that may not ultimately be needed)
- Chemical additives require regulatory approval prior to use; treatability testing can provide necessary data
- Both sediment and water treatability studies can be performed during pre-design

# Project Design Considerations Relative to Water Treatment

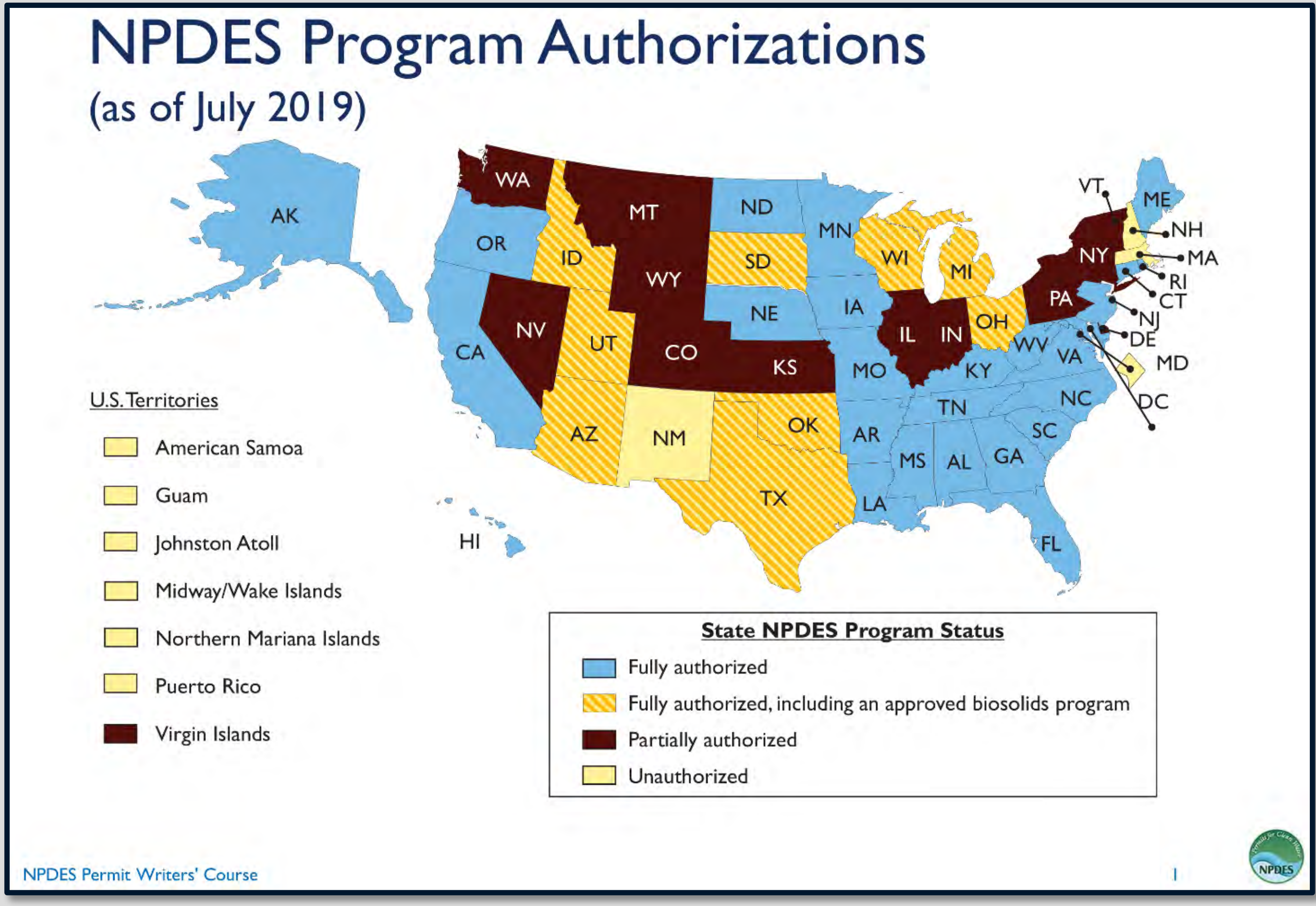
- Contaminants of Concern (COCs)?
- Dredging method and production?
- Site conditions, layout?
- Receiving stream, discharge location?
- Proximity to existing treatment systems?
- Potential storm water contribution?
- Water storage volume?

# Sustainable Practices: Waste and Energy Reduction, Recycling, Re-Use

- Water treatment infrastructure creates additional end waste materials; minimize end waste from pad construction and secondary containment; find ways to manage and re-use materials onsite or offsite
- Recycling/recirculation of flows – Re-use of treated water for chemical make down, backwashing, and performance testing. Re-use of treated water for slurry offload/transport of material mechanically dredged.
- Power – Running or tying into an existing line rather than use of generators results in less emissions and on-site fuel storage.
- Site restoration – Restore WWTP area to be compatible with post-remediation land use(s).

# Discharge Permitting

- Discharge permitting regulated under Clean Water Act, Section 402: National Pollutant Discharge Elimination System (NPDES) Program (includes the National Pretreatment Program)
- EPA has delegated the administration of the NPDES program to States (with exception of several states/territories).
- Each state has its own process and requirements.



# Discharge Permit Types

- 3 basic discharge options/permit types:

Sanitary Sewer /
Publicly Owned Treatment Works (POTW)

Surface Water Under
General NPDES Permit

Surface Water Under
Individual NPDES Permit

# Comparison of Discharge Permits

| Discharge Permit Type | Industrial Pretreatment Program (IPP) | General NPDES | Individual NPDES |
|---|---|---|---|
| *Discharge to* | POTW (sanitary sewer) | Surface water | |
| *Permitting Authority* | Sewer owner becomes regulatory authority and determines discharge requirements. EPA or state agency may oversee pretreatment program. | State environmental agency, or EPA in MA, NH, NM, District of Columbia, US Territories, Federal and Tribal Lands | |
| *Effluent Quality Standards* | Based on available treatment capacity of downstream treatment; typically, less restrictive than other permit types. Standards for pretreatment apply. | No consideration or provision made for unique project conditions or level of treatment; solids, oil and grease, pH, and sediment COC discharge limits are known in advance. | Dependent upon Water Quality Standards for receiving waters but considers treatment processes and technology; mixing zone allowances; site-specific conditions. Discharge limits can be less restrictive. |
| *Flow Limitation* | Based on sewer and treatment flow capacity; usually per gallon surcharge; typically, most restrictive. | Typically, not restrictive | Possibly least restrictive – depends on site specific and project-specific conditions |
| *Monitoring and Reporting* | Varies, but generally monthly or quarterly. | Monthly or Quarterly Discharge Monitoring Reports | Monthly Discharge Monitoring Reports; Operator of Record required to certify |

# Comparison of Permit Application Requirements

| Discharge Permit Type | Industrial Pretreatment Program (IPP) | General NPDES | Individual NPDES |
|---|---|---|---|
| *Discharge to* | POTW (sanitary sewer) | Surface water | Surface water |
| *Application Process* | Varies by municipality/sewer owner; typically requires application form. Application form may be quite extensive and may require Public Notice. | Application forms vary by state; Notice of Intent to the permitting authority – identification of outfall, designated use of receiving water, other information may be required. | Application form(s) vary by state; formal Public Notice and Comment Period required. |
| *Supporting Documentation* | Site layout and pretreatment system process flow diagram; Safety Data Sheets (SDS) for all chemicals in use; anticipated flow volume and variability | COC data; chemicals to be used; anticipated flow volume | More COC analytical data; approval required for additive chemicals to be used; loading and hydraulic calculations; anticipated flow volume; expected exposure concentrations; other supporting data or studies |
| *Lead Time* | Typically, shorter than other permit types | Relatively short in comparison to Individual NPDES permit; can be as short as 7 days. | Typically, longest of all permit types (6-8 months+); possibly longer for supporting studies (i.e., mixing zone) and response to public comments |
| *Fee* | Fee per gallon and/or per pound of pollutant (i.e., TSS, BOD, etc.) | Permit application fee – some states have annual fees | Permit application fee only |

# Which Permit Type/Option is Best for Your Project?

### Sanitary Sewer - POTW

- POTW tie-in in close proximity
- Low flow volume
- No production impact related to flow volume/disruption
- Short-duration project or short lead-time
- Coordinate early with POTW; don't assume that POTW will accept the water - may decline for multiple reasons

### General NPDES

- Most widely-used permit type
- Low or high flow volume
- Effluent limits are pre-established
- Single or several COCs
- Short-duration project or short lead-time
- May be favored by regulatory agencies based on effort required for issuance

### Individual NPDES

- Most complex/complicated application process; significant supporting data requirements; public notice and comments
- Multiple COCs or complex COCs
- High flow volumes
- Effluent limits not known in advance, but can be less restrictive
- Long-duration project with longer lead time
- Significant review and issuance effort for regulatory authority

- Consider project location, timeline, COCs, and expected flow volume
- Coordinate early with regulatory agencies
- Hybrid permit options are possible; phased projects may use more than one permit type

# Water Treatment Cost Drivers

- Complexity of treatment required
- Number of unit processes
- Influent data (quantity and quality) available at the time of bid
- Discharge location
- Flow limitations
- Discharge permit status at the time of bid
- Responsibility for permit compliance
- Staffing requirements/ hours of operation

# Uncertainty and Risk

**Uncertainty = unpredictable; indefinite**

- Time/duration that a WWTP will be required on a project site; many factors influence time
- Concentrations of contaminants in influent
- Changeouts that may be required
- Weather events and dredging operations – how they impact volume
- Settling times for solids

**Risk = chance of injury or loss**

- Time (schedule)
- Money $$$$
- Other (non-quantifiable, such as public and worker safety or public relations)

# Risk Drivers and Risk Reduction

## Increased Risk

- More COCs; more effluent limits
- Presence of emerging contaminants (e.g., PFAS)
- Lack of, or low quality, influent characteristics data
- Discharge permit not in place at time of bid (outfall location, limits unknown)
- More restrictive effluent standards
- Higher flow rate
- Temporary systems = less time for adaptive management
- Less cooperation among project team, lack of trust or communication

## Decreased Risk

- Fewer COCs
- Treatability and/or pilot testing
- Discharge permit in place at time of bid
- Vetting discharge permit options as a project team, to select the option that provides the least restrictive requirements and allows the most cost-effective treatment
- Fewer effluent quality limits
- Less restrictive effluent standards
- Lower flow rate
- Flexibility to change processes or approaches when challenges arise
- Permanent systems = more time for adaptive management
- Strong cooperation, trust and communication among project team

# Balancing and Sharing Risk

- Try to find a cost structure that is fair to both owners and operators
- What is the owner's responsibility for time and what is the contractor's/operator's responsibility for time?
- Uncertainties and placement of risk will drive unit costs and fixed price costs
- Owner passes time-related risk to contractor/operator = increased cost to owner, but more overall cost certainty
- Owner pays for media change-outs = decreased risk to contractor/operator
- Use appropriate unit price structure to share risk (i.e., per month rather than per gallon)
- Think through risks thoroughly (flow, influent concentrations, duration, compliance, monitoring, etc.) and assign risk responsibilities in appropriate documentation
- Consider development of joint sampling plan with owner and contractor/operator

# Lessons Learned: Operations and Treatment

- Collaboration produces better systems; allow contractors to give input/propose alternates in bid process
- Conduct treatability studies to determine influent characteristics with greater accuracy
- Include contingency for media changeout; consult with product manufacturers to get more accurate estimated media life, select best products
- Account for potential fouling of the system (iron bacteria), excess organics, or other factors that require a significant degree of maintenance
- Be flexible in approaches, to resolve problems
- Examples:

**Unexpected media changeouts = down time (added cost)**

**Unexpected influent contaminants or concentrations = additional media, chemicals and/or treatment units (added cost)**

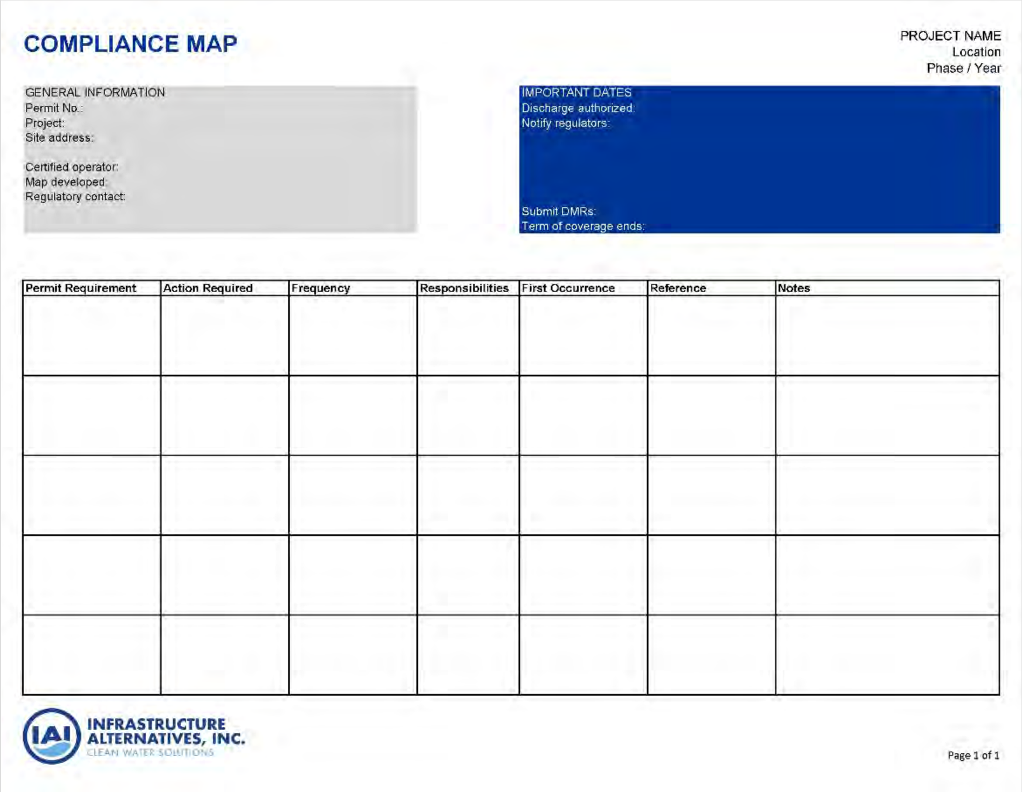
# Lessons Learned: Permit Requirements

- Know what your permit says: the whole document, as well as any attachments
- Make a plan to achieve and maintain compliance, with schedules and checklists
- Communicate early and often with regulators about any concerns; work out an approach that suits everyone and prevents non-compliance
- Examples:

**Concentration limit < Loading limit**

**Outfall location designated by permit, even when land-based operations moved**

**Potential non-compliance avoided by upfront communication of concerns with regulators**



COMPLIANCE MAP

PROJECT NAME
Location
Phase / Year

GENERAL INFORMATION
Permit No.:
Project:
Site address:

Certified operator:
Map developed:
Regulatory contact:

IMPORTANT DATES
Discharge authorized:
Notify regulators:

Submit DMRs:
Term of coverage ends:

| Permit Requirement | Action Required | Frequency | Responsibilities | First Occurrence | Reference | Notes |
|---|---|---|---|---|---|---|
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# Lessons Learned: Bid Packages

- Separate fixed (lump sum) and variable (unit) costs
- Break down unit costs carefully and provide unit rate options (ie, half-day operations, full-day operations, etc.)
- Include assumptions for maximum quantities for unit costs (gallons to be treated, days per month for operations, hours per day for operations)
- Include mobilization and demobilization as separate line items
- Include cost items for chemicals and media change-outs, process control sampling, and compliance monitoring
- Provide discharge permit status (or copy of permit); responsibility for compliance, reporting, sampling, and lab coordination and data management
- Specify need for Operator of Record and Operator qualifications
- Examples:

Few Bid Items or One Lump Bid Item Requested

Process Control Sampling and Media Change-Outs Not Included as Bid Items

Mobilization/Demobilization Cost not Requested = Cost Included in Higher Unit Cost for Other Bid Items

# Lessons Learned: Unexpected Conditions

- Include modularity and conditions in the design for conditions that are worse than expected
- Add contingency budget for the unexpected
- There is always a chance that something unexpected could occur; prepare contingency plans – what could happen and how would you approach resolution of the problem?
- Examples:

Colloidal Clays Would not Settle

Higher Concentrations of COCs than Expected in the Influent

Effluent Requirements More Stringent than Ambient Background Concentrations

# *Questions?*

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