

Tidal Inlet Protection Strategies (TIPS) Field Guide

API TECHNICAL REPORT 1153-2
JANUARY 2016



AMERICAN PETROLEUM INSTITUTE

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Field Guide for Tidal Inlet Protection Strategies (TIPS)

Introduction

Tidal inlets occur along most barrier coasts and therefore these dynamic systems must be considered separately when designing an overall strategy for oil coming towards the coast. Inlets are the gateways that can allow oil to enter extensive, sensitive marsh, mangrove and sheltered tidal flats environments that dominate backbarrier lagoons, bays, and estuaries. Reversing tidal flow, wave-current interaction, and periodic exposure of tidal sand bodies make advance planning a necessity if oil is to be contained. Important attributes of tidal inlets and how these relate to the development of response strategies are provided below.



- Tidal currents dominate areas adjacent to the inlet throat and inside the inlet, whereas the shoals seaward of the inlet are dominated by waves and wave-generated currents.
- Currents at tidal inlets can reach high speeds where the entire tidal prism must flow through the narrow channel.
- Flooding tides can transport oil into bays and lagoons and surrounding sensitive tidal flat, marsh, and mangrove habitats.
- Response operations at tidal inlets face numerous challenges, the most important of which are the constantly changing water depths and reversing current directions. At large inlets, wind-generated currents also can affect oil transport.
- Recognition of the morphological features of an inlet system enables planners and responders to understand how water depth and current pattern change through the tidal cycle.
- Determination of morphological features and current patterns provide the basis for selecting realistic and practical response strategies for minimizing oil transport through an inlet during flooding tides.
- With a basic understanding of the hydrology and morphology of a tidal inlet and dedication of resources, it is possible to implement a number of protective actions which can mitigate risk and reduce oil spill impacts.

How to Use This Guide

This field guide is intended to be used by strategic planners and responders with the purposes of:

- explaining the physical dynamics and characterization of a tidal inlet,
- identifying oil transport and operational constraints and opportunities for tidal inlet protection,
- identifying potential strategies for protection,
- providing considerations and checklists for tidal inlet protection.

This Field Guide is divided into the following four parts.

PART 1: Physical Character of Tidal Deltas

PART 2: Planning

PART 3: Strategy and Tactics Selection

PART 4: Checklists

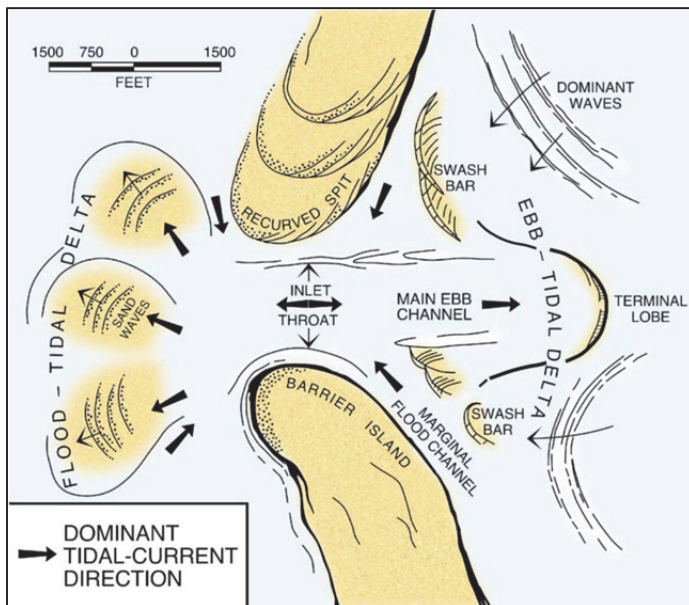
First-time users should turn to the checklists on pages 25 and 26 which run through the steps required to select options for a response operation with reference to the relevant sections of this Field Guide.

PART 1: Physical Character of Tidal Deltas

Tidal Deltas and Their Importance and Challenges for Protection

Tidal inlets are found on shorelines worldwide and form a connection between the open ocean and environmentally sensitive sheltered bays, lagoons, marshes and tidal creeks. Tidal inlets are complex and dynamic systems that include ebb and flood tidal deltas on either side of an inlet throat. These systems provide pathways for oil to enter sheltered back-bay tidal flats, marshes and mangroves (bay-lagoon complex) and are critical control points for protection of these sensitive and vulnerable environments. Currents generated by the tidal exchange between the ocean and bay or lagoon maintain the main channel of a tidal inlet. The currents slow as the main channel (the "inlet throat") widens on either side of the inlet and deposit sediment to form shoals or underwater deltas.

The character of a tidal inlet results from a combination of geologic and oceanographic factors that include wave action, tidal range, the tidal prism in the bay or lagoon, freshwater input to the bay or lagoon, sediment availability, and alongshore sediment transport. The tidal prism is defined as the open-water area of the bay, lagoon or marsh and tidal creek system multiplied by the tidal range.



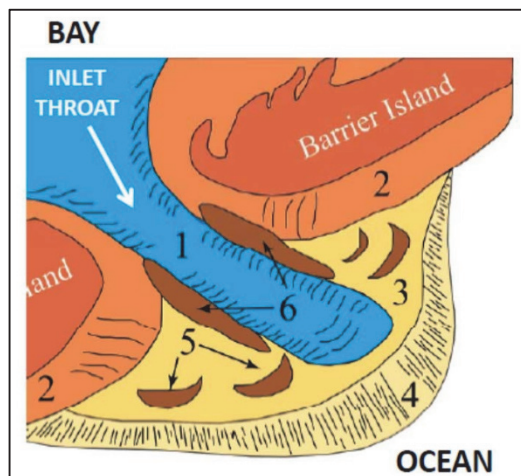
The key challenges that planners and responders face include:

- high current velocities in channels and wave-induced currents across ocean-side shoals;
- constantly changing patterns of shoals and channels that are controlled by the balance between wave and tidal forces and bay geometry;
- intertidal areas that are often wide and alternately exposed and submerged during each tidal cycle; and
- current reversals approximately every 6 or 12 hours, depending on the type of tide.

How to Recognize the Components of a Tidal Inlet: Ebb Delta

The Ebb Delta

- Is a shoal built seaward by sand deposition as ebbing tidal waters slow and expand after passing through the constricted inlet throat.
- Can be intertidal or subtidal.
- May limit boat or boom deployment operations due to waves breaking across shoals.
- At tide-dominated inlets, tends to be elongated with a main ebb channel and channel margin linear bars that extend far offshore.
- At wave-dominated inlets (such as that shown in the adjacent photograph), tends to be comparatively small with sediment shoals driven onshore, close to the inlet mouth, by the dominant wave processes. Often subtidal or have several major and minor tidal channels.
- At mixed-energy inlets, typically have a well-formed main ebb channel bordered by a broad swash platform and sand bodies that widely overlap the adjacent inlet shoreline.



Ebb Delta Components

1. **Main Ebb Channel** is a narrow and relatively deep channel formed between two sand barriers adjacent to the inlet throat.
2. **Marginal Flood Channels** flank the main ebb channel close to the shoreline, and are the first tidal waters to enter the inlet even as flow continues to ebb in the main channel.
3. **Swash Platform** is a broad, shallow platform located on both sides of the main ebb channel.
4. **Terminal Lobe** is formed by reworked sediment deposited at the terminus of the main ebb channel.
5. **Swash Bars** are formed by sediment migrating landward by wave action.
6. **Channel Marginal Linear Bars** border the main ebb channel and sit above the swash platform.

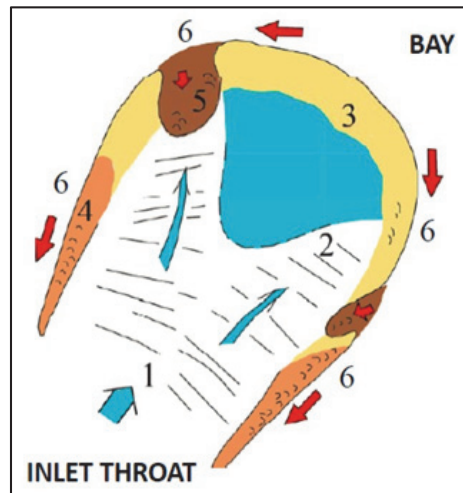
How to Recognize the Components of a Tidal Inlet: Flood Delta

The Flood Delta

- Forms in sheltered waters as sediment is deposited by the flooding tides due to slowing of the current as the channel widens and flow expands after passing through the narrow inlet throat.
- Contains exposed shoals at low tide, but is largely or completely submerged in the late-flood stage.
- When backed by a system of tidal channels, tidal flats, and salt marsh, is usually a single horseshoe-shaped delta.
- When backed by large shallow bays, may contain multiple flood-tidal deltas.
- Commonly increases in size as the tidal prism increases and as the amount of open water area in the back barrier increases.
- Have, in some regions, become colonized and altered by marsh growth and are no longer recognizable as former flood-tidal deltas.



Flood Delta Components



1. **Flood Ramp** is formed by sheet-like lobes of deposited sand with landward sloping ramps on their seaward sides covered by landward migrating waves of sand
2. **Flood Channels** allow water flow only during the late-flood stage (blue arrows) and at high tide
3. **Ebb Shield** deflects ebb flow to marginal channels after high tide (red arrows)
4. **Ebb Spits** are created by sediments being carried seaward by ebb currents
5. **Spillover Lobes** are formed by deposited sand where ebb currents have breached the ebb shield or ebb spits
6. **Marginal Channels** allow water to enter the bay or lagoon between late ebbing and early to flooding stages