

THE EVOLUTION OF DREDGE PIPELINE SAFETY IN AN ACTIVE RECREATIONAL AND FISHING COMMUNITY

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ABSTRACT

The California Delta is a network of over seven hundred miles of waterways surrounding dozens of islands located in Northern California fifty miles inland from San Francisco Bay. The tidally influenced Delta is created by the confluence of the Sacramento and San Joaquin rivers. Two major ship channels traverse the Delta, the Sacramento Deep Water Ship Channel and the Stockton Deep Water Ship Channel, serving the Ports of West Sacramento and Stockton respectively.

Due to The Delta's labyrinth of waterways, abundance of fish, and location near major population centers, it is home to very large recreational boater and fishing communities. Performing maintenance dredging on the DWSC's requires working in close proximity to thousands of public boaters, most of whom have no formal boater training and are oblivious of the dredging operation and dredge pipeline.

Over the course of nearly two decades of dredging in this environment Ross Island has constantly worked to mitigate safety risk towards the general public while reducing liability to the Company. This work has resulted in an evolution of our safety program from a passive role of issuing Local Notice to Mariners and Anchor Waivers and the use of sign barges near the work area, towards a more active role of having a sheriff enforced speed zone and skiffs patrolling the work zone. Recent efforts to directly reach public boaters include distributing fliers at boat ramps and marinas, contacting fishing tournament organizers, and using a patrol boat equipped with flashing light bars capable of intercepting high speed fishing boats. Although these additional steps and techniques have increased dredging costs, they have significantly mitigated risks to the boating public and therefore paid for themselves many times over.

Keywords: Dredging, California Delta, public boaters, risk mitigation, public awareness.

INTRODUCTION

Pipeline dredging on public waterways can pose significant safety risks to public boaters. Dredge pipelines must be floated from time to time to allow work on the pipe. A floating dredge pipeline can be difficult to see since only the very top of the pipe is above the water. Public boaters are generally unaware that a pipe may be just below the surface as they travel the waterways. Collisions with dredge pipelines, especially at high speed can result in significant injuries to the boat occupants and extensive damage to the vessel. It is the responsibility of the dredging contractor to limit the public's exposure to risk as much as possible. Waterways with significant public boater traffic require the contractor to implement unique and extensive methods of informing the public of the potential danger and prevent collisions with the dredge pipeline. The California Delta is home to a large and active community of public boaters. With its complex network of waterways, the Delta presents a unique challenge to ensuring public safety when performing pipeline dredging. Ross Island Sand & Gravel Co. has developed many different methods and means of informing the public about the dredging and preventing collisions with the dredge pipeline.

DREDGING IN THE CALIFORNIA DELTA

The Delta

The Sacramento – San Joaquin River Delta, also known as the California Delta, is an inland river delta located in Northern California, approximately eighty kilometers (fifty miles) inland from San Francisco Bay. The Delta has a total area of 2,990 square kilometers (1,153 sq. mi), stretching eastward from the confluence of the Sacramento and San Joaquin rivers (Cal DWR 2017). Composed of 57 islands, the Delta contains over 1,100 km (700 mi) of waterways and sloughs (Figure 1). The California Delta is home to over five hundred species of wildlife and serves as a vital migration path for several anadromous species including Salmon, Steelhead, Striped Bass, American Shad, and Sturgeon (Cal DWR 2017).

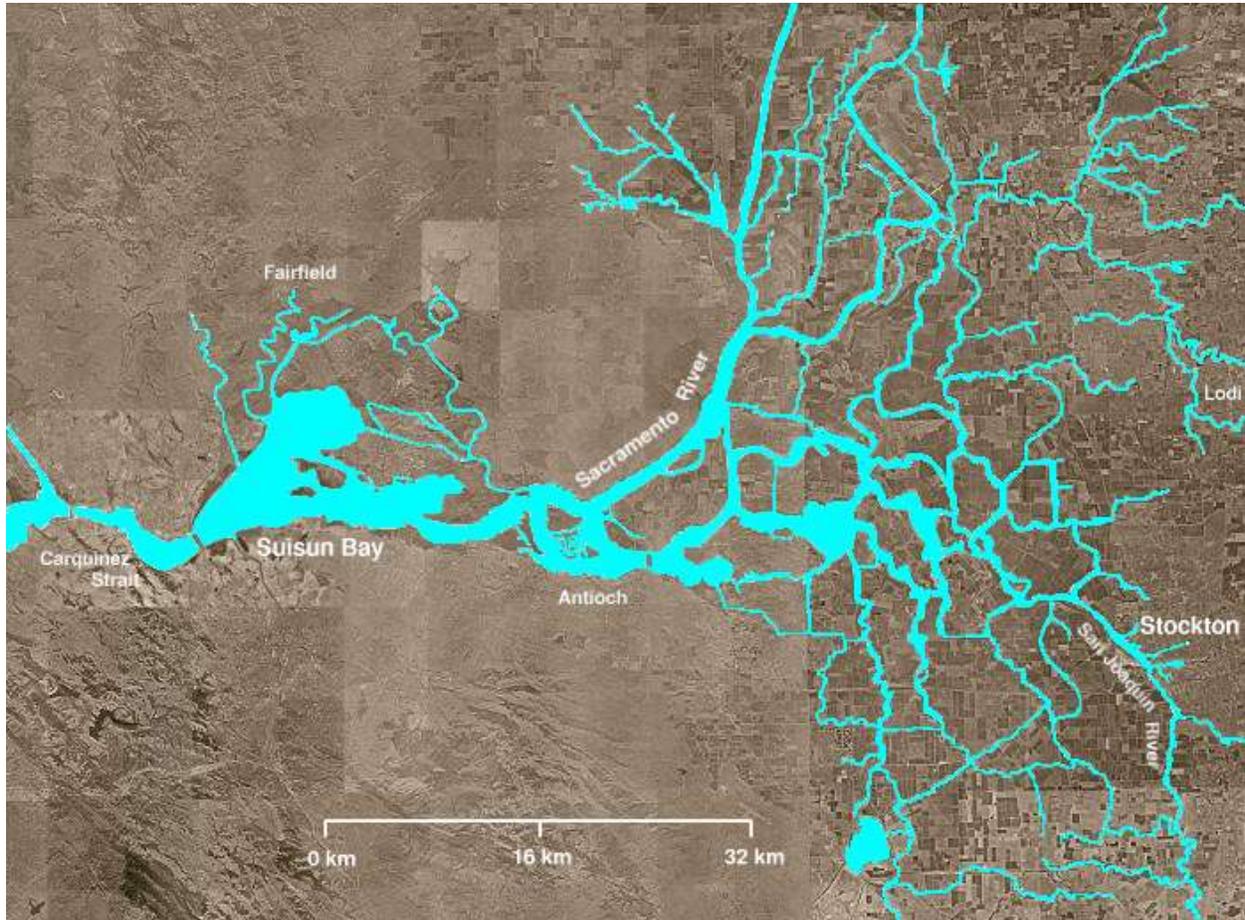


Figure 1 - The Sacramento - San Joaquin River Delta (Trump 2004)

Several major cities and many smaller communities are located in or around the Delta. Major cities with areas lying within the Delta include Sacramento, Stockton, and West Sacramento. Other cities bordering the Delta are Antioch, Pittsburg, Lodi, Oakley, Tracy, and Brentwood. Smaller communities located within the Delta include Rio Vista, Discovery Bay, and Isleton. Overall, more than 1.3 million people live in or near the Delta. Two shipping ports lie within the Delta, the Port of Stockton and the Port of West Sacramento. These inland ports are reached via two Deep Water Ship Channels (DWSC) which cut through the Delta, the Stockton DWSC and the Sacramento DWSC.

With its close proximity to major population centers, its intricate maze of waterways, and abundant fishing opportunities the Delta is home to very large recreational boater and sport fishing communities. The presence of these communities presents significant challenges to performing pipeline dredging within the narrow ship channels. Pipelines are often stretched from one side of the river to the other and must cross side channel entrances to reach the upland placement sites. While the pipe remains sunk on the bottom during dredging operations, it must be

floated to perform certain functions such as adding additional pipe sections. This creates a safety hazard to the general public as they traverse the area, often at high speed. Over the last twenty years Ross Island has constantly updated and evolved its safety practices to ensure the safety of the public boaters.

Initial Safety Practices

Ross Island has been performing maintenance dredging on the Sacramento and Stockton Deep Water Ship Channels for the better part of two decades. Initial safety practices to inform the public of the dredging operation were passive in nature. Local Notice to Mariners are issued prior to setup of the dredge operation in any given location. These notices are issued by the U.S. Coast Guard to notify waterway users of any navigational hazards they may encounter. The dredge is also equipped with the required day shapes and lights used to inform other boaters of an anchored vessel performing dredging operations.

Unfortunately, most of the recreational and fishing boaters in the Delta do not observe Local Notice to Mariners nor understand day shapes/lights. California does not require recreational boaters to receive any formal boater training or for boaters to get a boating license. Without formal boater education the general public is unaware of local notices to mariners and completely oblivious to the meaning of day shapes and hazards around a dredging operation.

In the late 1990's there were several incidents of boaters hitting the dredge pipeline which prompted Ross Island to take action. In order to keep the public safe near the dredge Ross Island contacted the sheriff's departments of the counties in which dredging operations occur. We asked for and were granted by each sheriff's department an enforceable five mile per hour speed zone within the vicinity of the dredge and dredge pipeline. Ross Island created several barges (Figure 2) with large signs with reflective markings to be more visible at night, used to inform the public boaters of the speed zone.



Figure 2 - Sign Barge

These sign barges are placed both upstream and downstream of the dredge as well as near the upland placement site pipeline landing and any slough or side channel entrances (Figure 3). This slows down boaters as they traverse the work zone, allowing them to safely pass by the dredge and have ample time to avoid a potential collision with the pipeline. In addition to informing the public of the enforceable speed zone, the sign barges can be used to guide boaters safely through the work area or be used to block the public from entering an unsafe section of water.

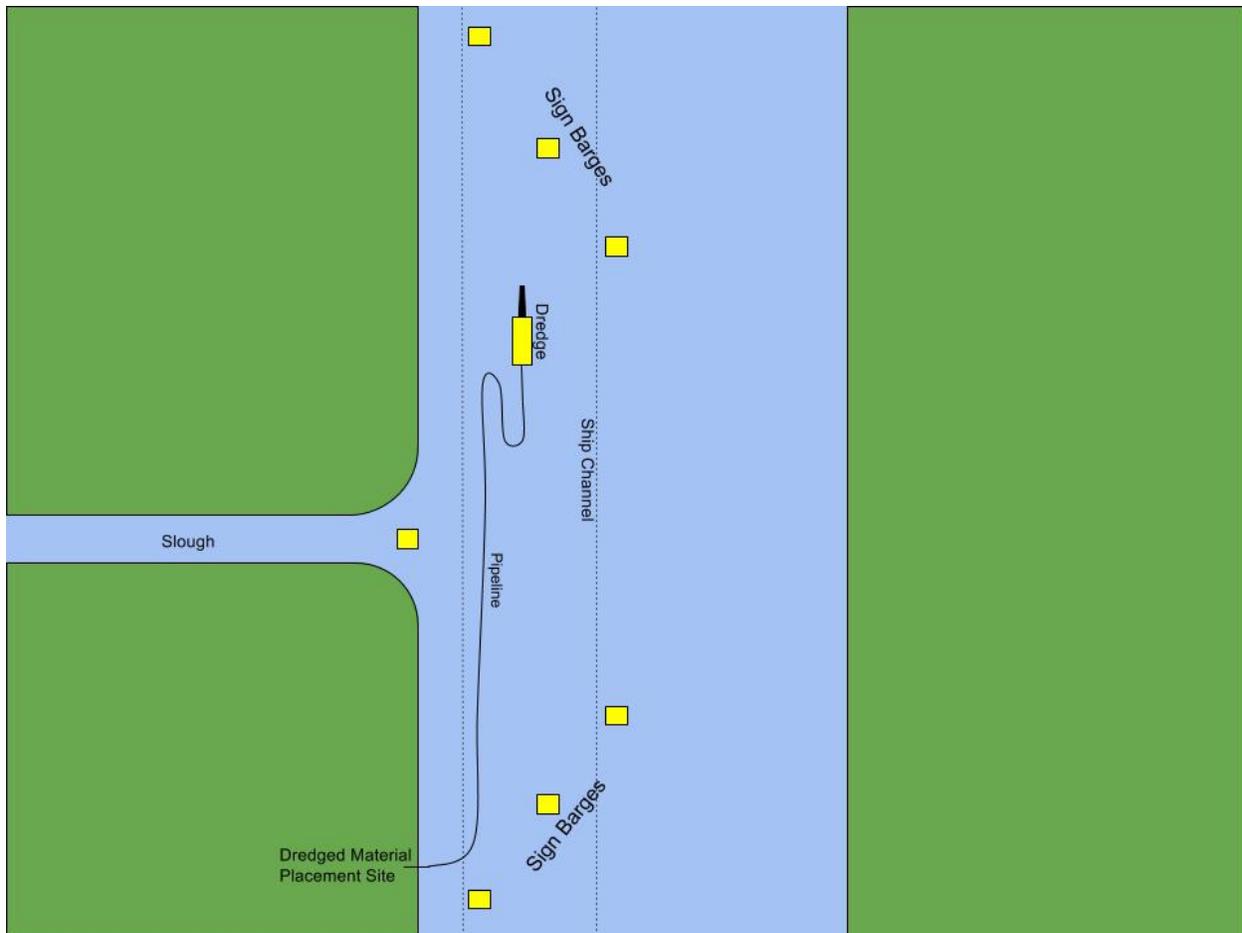


Figure 3 - Sign Barge Layout (not to scale)

Strategic use of pipeline anchors also decreases the probability of a pipeline collision. Using additional anchors in high traffic areas will keep the pipeline secured to the river bottom at all times. These high traffic areas include marina and harbor entrances as well as slough crossings where boats may enter the main river suddenly at high speeds.

Move Towards Active Safety Measures

In a continuous effort to improve public boater safety near the dredge and pipeline, a move towards more active safety measures was warranted. Although the previous safety measures have been quite successful in reducing the likelihood of a boat/pipeline incident and are still being used today, they are not foolproof.

As stated before, the public does not observe Local Notice to Mariners nor know what day shapes/lights mean. Sign barges are effective at slowing most boaters down, but some boaters either ignore them or somehow do not see them. Pipeline anchors are very effective at keeping the pipeline on the bottom of the river, but the entire pipeline cannot be anchored down since it must be floated from time to time to adjust or add pipe.

In order to keep boaters who ignore the sign barges and passing signs from colliding with the pipe, skiffs are used to patrol the work area (Figure 4). The skiffs are equipped with high visibility flags, an air horn, and an amber flashing beacon. These devices are used to get the attention of boaters as they enter the work area. Skiffs patrol several hundred meters upstream and downstream of the dredge, mostly on the side of the river that the pipeline crosses, and are used to intercept boaters to prevent them from entering an area where there may be floating pipe. Once a skiff has intercepted and slowed a public boater down, the skiff operator instructs the boater which side of the dredge is safe to pass on and/or guides the boater safely through the work area.



Figure 4 - Ross Island work skiff

While the skiffs are very useful at intercepting the majority of boaters who ignore the speed zone signs and head into the work area, some recreational boats are simply too fast for the skiffs to intercept. The Delta is a very popular fishing location, with the most popular style of fishing boat being the “Bass Boat”. These bass boats are capable of cruising at speeds in excess of 80 mph. Fisherman will often ignore the sign barges in an effort to get to their favorite fishing spot, or will come out of side channels at full speed into the work area.

In 2011, an incident occurred in which a “Bass Boat” entered the work area from a side channel at high speed. The patrol skiff in the area was unable to intercept and slow the “Bass Boat” down before it hit the dredge pipeline. The boat hit the pipe with enough speed to cause the outboard to flip up and into the seating area of the boat, resulting in very serious injuries to the operator and passenger.

As a result of this incident, it became clear that the standard patrol skiffs are incapable of effectively intercepting the high speed bass boats and something else had to be done. Ross Island created the “Chase Boat” (Figure 5). This vessel is outfitted with an overhead amber light bar, similar to ones used on a law enforcement vessel. The Chase Boat is equipped with a high-horsepower outboard, allowing it to effectively intercept the bass boats of the Delta. This boat is probably the most effective method of ensuring public boater safety in the dredge work area. The light bar is very noticeable and distinguishes the Chase Boat from just another vessel. Once a boater notices the flashing lights, they immediately know that something is happening up ahead and they need to slow down.



Figure 5 - Chase Boat with flashing light bar

In addition to actively patrolling the work zone, Ross Island has recently taken a proactive approach to informing public boaters of the dredging operation before they even put their boat in the water. Information boards are posted at boat launches and marinas throughout the area informing the public of the dredging operation including where the dredge is operating and which radio channels are monitored. Ross Island personnel also hand out fliers at boat launches and marinas on busy weekends (Labor Day, Rio Vista Bass Festival) informing boaters of the dredging operation.

One more safety measure Ross Island takes is to contact the organizers of fishing tournaments that will be taking place in the vicinity of the dredge. We ask the organizers to inform the tournament participants of the location of the dredge, the dangers of a floating pipeline, and the enforced speed zone in the dredge work zone. Tournament organizers have been more than happy to help us inform other boaters about the dredge project since keeping everyone safe is also their priority.

RESULTS

Quantifying results of these safety measures is difficult since it is impossible to know how many accidents are prevented. The only statistic available is how many incidents still occur. Since the introduction of the Chase Boat to the safety program in 2015 only one incident has occurred where a public boater has hit the pipe. This single incident involved a boat pulling water skiers entering the work zone at high speed. The ski boat ignored all sign barges warning of the speed zone and continued towards the pipe at speed. The Chase Boat intercepted the ski boat in an attempt to slow it down, pulling alongside the ski boat with lights flashing and the operator waving his arms in an attempt to get the boaters attention. The ski boat refused to slow down so the chase boat positioned itself in front of the ski boat, hoping to block its path, forcing it to slow down. The ski boat swerved around the Chase Boat at the

last second and subsequently collided with the dredge pipeline. Luckily, no one was injured and the dredge crew successfully towed the damaged boat to shore and pulled the skiers from the water.

The take away from this singular incident is not all accidents are preventable. The Chase Boat successfully performed its task of intercepting the public boater before they were in danger. In this case, the public boater purposefully ignored the warnings and actively evaded the Chase Boat resulting in a collision with the pipe.

A second result of the safety program has been the reduction in the company's liability when accidents do occur. Ross Island has gone above and beyond to ensure the safety of the public and by doing so has lowered its liability in a potential lawsuit. In the above incident the boat owner took full responsibility for the accident and admitted to seeing and ignoring the danger warnings.

CONCLUSION

While the above safety measures are effective, it is impossible to prevent all accidents. Sometimes the general public will purposefully ignore all the warning signs of the potential danger ahead, including actively evading the Chase Boat equipped with a flashing light bar, in an effort to go where they want to. Overall, these safety measures are effective at keeping the public out of harm's way, but you cannot stop an individual that ignores all signs and warnings to get where they want to go. It is the contractor's responsibility to take every reasonable action to eliminate risk towards the public; the above measures accomplish that goal.

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CITATION

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