

Minutes of the 110th Meeting

11 - 13 September 2001

Executive Summary

The U.S. Army Corps of Engineers Committee on Tidal Hydraulics (CTH) met in Galveston, Texas on 11 - 13 September 2001 at the invitation of Mr. Harry G. Kohler, Chief of the Engineering and Construction Division, Galveston District Corps of Engineers.

The CTH was asked to review the Mouth of the Colorado River project and offer suggestions on improvements to navigation for multi-barge tows traveling on the GIWW where it intersects with the Bypass channel and the Colorado River. The Committee was also asked to review and recommend approaches to reduce or control shoaling at the Colorado jetty channel inlet. Information was presented on the navigation and diversion features of the Mouth of the Colorado River project and the navigation, environmental, and safety concerns of the commercial and recreational users of the waterway. A site visit to the Colorado River East Lock, the GIWW Bypass channel, the Colorado River and the entrance jetties was conducted. Barge traffic, river currents, wave strength and direction were observed. The Committee was also briefed on the Corps' research initiatives in sediment management, navigation and marine transportation.

In Executive Session, the CTH considered the questions presented by the District and established a sub-committee to prepare a response.

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1. The 110th meeting of the Committee on Tidal Hydraulics (CTH) was held 11 - 13 September 2001 at the Galveston District Corps of Engineers at the invitation of Mr. Harry G. Kohler, Chief of the Engineering and Construction Division.
2. On 11 September and the morning of 13 September, Technical Sessions on the Mouth of the Colorado and GIWW Intersections and the Mouth of the Colorado Jetty Channel were held. Sessions were also held on the USACE Research and Development programs in navigation, flood and storm damage reduction, coastal inlets, and dredging operations. The Executive Session was held on the afternoon of 13th. On 12 September the Committee visited the Colorado River Locks, the GIWW intersection, and the Colorado River jetties. The meeting commenced in the Galveston District building but was soon recessed and moved to a hotel as a result of terrorists' attacks at the World Trade Center in New York City and the Pentagon in Washington D.C. The Technical and Executive sessions continued in the San Luis Resort and Conference Center.
3. Attendees were:

Committee on Tidal Hydraulics

William H. McAnally, Chairman	Coastal and Hydraulics Lab
Virginia R. Pankow, Executive Secretary (1)	Institute for Water Resources
David B. Wingerd, Liaison	Headquarters, USACE
A. Jay Combe	New Orleans District
Eric E. Nelson	Seattle District
Edward A. Reindl, Jr.	Galveston District
Ronald G. Vann	Norfolk District
Todd L. Walton	Coastal and Hydraulics Lab
Charles L. Wener (1)	New England District
Frank A. Herrmann, Jr.	Consultant, Vicksburg, MS
Ashish J. Mehta	Professor, University of Florida

Presenters and Guests (1)

Bill Hopkins	Galveston District
Bob Bass	RJB Services
Carolyn Murphy	Galveston District
Cynthia Burke	Galveston District
Dan Heilman	Shiner, Moseley & Associates
Dianna Laird	Galveston District
Donna Richey	Coastal and Hydraulics Lab
Gary Brown	Coastal and Hydraulics Lab
Jeff Waters	Galveston District
Ken Silverthorne	Port of Bay City
Les Sutton	Kirby Corp
Lynn Hales	Coastal and Hydraulics Lab
Lynn Robinson	Galveston District
Michael Walther	Coastal Tech
Mike Bragg	Galveston District
Mike Griffith	Port of Bay City
Nicholas C. Kraus	Coastal and Hydraulics Lab
Nicolle Dailey	Galveston District
Pete Ravella	Coastal Tech
R. Butler	GICA
Randy McCollum	Coastal and Hydraulics Lab
Rob McAdory	Coastal and Hydraulics Lab
Ron Meyers	Galveston District
Ronnie Barcak	Galveston District
Ronny Beesley	Galveston District
S. Sullivan	Texas DOT
Glen Dvorak	Texas DOT
Sandra Knight	Coastal and Hydraulics Lab
Simon Desoto	Galveston District
Soraya Sarruff	Coastal and Hydraulics Lab

(1) Technical sessions only

4. The minutes are divided into discussions of presentations made at the Technical Session and actions taken in the Executive Session. The order of the minutes is not necessarily the chronological order in which these matters were considered at the meeting.

TECHNICAL SESSIONS

5. Dr. William H. McAnally, Chairman CTH, opened the 110th meeting of the Committee on Tidal Hydraulics at 0830, 11 September 2001.

6. Major Spears, Deputy District Engineer, Galveston District (SWG), welcomed the Committee, presenters and guests and wished everyone a productive meeting and an enjoyable stay in Galveston.

7. Dr. McAnally welcomed the participants and briefly summarized the purpose and role of the Committee on Tidal Hydraulics. The CTH is one of four Corps of Engineers technical committees that are available to offer technical advice, formulate, and review engineering

guidance. The Committee meets once a year and is nationally recognized for the expertise of the members. The last time it met in Galveston was in 1968, where the issues discussed involved the Colorado River. The members of the Committee and guests introduced themselves and the Technical Session agenda was reviewed.

8. Mr. Ed Reindl, SWG, CTH member, and host for the meeting, requested advice from the CTH on the ongoing and proposed studies that will be presented in the technical sessions. Are the studies going in the right direction, are they on track and are they environmentally sound?

Mouth of the Colorado and GIWW Intersection

9. Mr. Mike Bragg, SWG, presented an overview of the Mouth of the Colorado River project. Originally authorized in the River and Harbor Act of 1968, it took years of compromise and negotiation over the diversion channel feature before work would begin. The Water Resources Development Act of 1986 allowed the diversion feature to be constructed at 100 percent Federal expense.

10. The project consists of navigation and diversion features. They are:

a. Navigation Features

- Jetties and Entrance Channel - Consists of a 3500' east jetty and a 2900' west jetty along the 15' x 200' entrance channel from the Gulf of Mexico. The east jetty contains a 1000' weir jetty and impoundment basin to trap westerly moving sediment. This feature was completed in April 1990.
- Jetty Park is a public use area with parking and picnic tables near the east jetty. It was completed in December 1990.
- Harbor and Turning Basin - Consists of a 12' x 350' x 1450' harbor and turning basin on the north side of the GIWW east of Matagorda. This was completed in May 1989.
- Navigation Channel - Consists of a 12' x 100' channel along the alignment of the existing Colorado River from the Gulf of Mexico to the GIWW. This was completed in April 1990.

b. Diversion Features

- Diversion Channel - Originally dredged 3.1 miles long by 20' x 250' wide, this feature diverts water from the Colorado River into Matagorda Bay. This is intended to enhance water quality and fish life in the bay by increasing the amount of fresh water and nutrients while also supplying sediment to create marshland areas. This was completed in May 1990.
- Diversion Dam - This hydraulically placed dam in the existing channel of the Colorado River just south of the GIWW, diverts 100% of the river flows into the diversion channel. It was completed in July 1992.
- Parker's Cut Dam - Constructed across Parker's Cut, near the mouth of the Colorado River, to prevent Gulf saltwater from entering Matagorda Bay. It was completed in May 1991.
- Bypass Channel - Provides a navigable connection from the GIWW to the Gulf of Mexico. It ties the GIWW east of the East Lock to the navigation channel just south of the diversion dam. This was completed in June 1992.
- Oyster Clutch - Provided for the construction of areas to raise and harvest oysters. It was completed in March 1995.

11. With the completion of the project features, concerns were raised by waterway users. Currents in the GIWW at the Bypass channel and at the Colorado River crossing changed and presented different (and perceived as dangerous) conditions for navigating the GIWW. It appeared that the changed current patterns at the river crossing resulted in the erosion of the southwest point of the intersection near the west lock. The point was used by the barge industry as a pivot point for tows heading into the west lock. Recently tows have more severely damaged the west lock guidewalls. The closure of Parker's Cut increased a boater's distance from 4 or 6.2 miles to 10 miles to reach the closest reliable access to Matagorda Bay. It also required the boater to travel through the west lock. The increased use of the lock by recreational boaters presents safety concerns for both commercial and recreational boaters. Other concerns are the occurrence of fish kills in the old river channel and the effects of increased sedimentation in the old river and the diversion channels. Navigation in the old river channel is hampered by reduced depth and access to Matagorda Bay is limited because former cuts are silting in. The impoundment basin along the east jetty has been filling up faster than anticipated resulting in navigation channel shoaling and the need to dredge more frequently than planned.

12. Mr. Bragg briefly discussed previous modeling and simulation studies performed to address these problems in the bypass and diversion channels. The studies were conducted by ERDC - CHL and Texas Department of Transportation (DOT) and looked at the effect of various changes on navigation and the environment.

13. Mr. Glen Dvorak, Texas DOT, spoke of the plan to replace the swing bridge, that is east of the east lock on the GIWW, with a fixed bridge near the existing bridge. The new bridge will have piers on dry land, span the GIWW, and have a vertical clearance of 73 feet. The swing bridge and all the fender systems will be removed leaving the waterway unobstructed and improving the navigation approach to the east lock. The environmental study is just beginning and it is estimated that the bidding process will begin in 2005. He indicated that, if the Corps is planning changes to the bypass channel, it would be too late to incorporate the changes into the current plan. A dialogue would have to be started if channel changes were planned.

14. The comment was made that the Committee has been hearing about several projects that all seem to affect each other. There is a need to coordinate and integrate all these projects.

15. Discussion focused on the locks. Initially they served as flood gates to reduce GIWW flooding when there was flooding on the Colorado River and to keep river sediment out of the GIWW. They later became locks. It was mentioned that the new bridge is expected to promote development along the river with a corresponding increase of recreational boating and traffic.

16. The meeting was interrupted at this point as news of the New York World Trade Center and Pentagon attacks was announced. The Galveston District building was evacuated.

17. At 1300, the meeting convened in a conference room at the San Luis Conference Center, Galveston. After discussion of the developing events, travel concerns, and the pros and cons of continuing, the members elected to continue the session. It was assumed that the sessions could not return to the district building so a conference room was secured at the San Luis.

18. Mr. Ed Reindl, SWG discussed the engineering considerations of the Mouth of the Colorado and GIWW intersections. The diversion dam and diversion channel were designed to provide fresh water and sediment into Matagorda Bay. The resulting delta growth in the bay was a desired feature of the plan. Commercial barge traffic travels east/west along the GIWW while fishing vessels use the bypass channel and the navigation channel (old Colorado River).

19. There have been numerous studies (about 67) conducted on the project to evaluate the effects on currents and velocities in the GIWW at the bypass and the Colorado River. One study indicated that opening Parker's Cut might reduce the velocities at the bypass. However, the cut was closed to assure 100% river diversion into Matagorda Bay. The Texas agencies are very sensitive to the salinity gradients in the bay and want to decrease the salinity to improve the oyster beds. Models have been used to address the effects of salinity, sediment, SW cut and Parker's cut. There is also a physical model of GIWW intersection. River currents are the problem at the diversion channel intersection and tidal currents are the problem at the bypass intersection.

20. The tidal effect is felt 21 miles upstream. Information from a velocity meter in the bypass channel is provided to the tows in an effort to aid them in navigating the GIWW intersections. The tows are affected by tide almost 50% of the time. Tow delays have increased from 3.5 minutes to 3.5 hours since the completion of the diversion channel. Before the construction of the diversion dam, and with the diversion and bypass open, there were less traffic problems than after the completion of the dam. Navigation issues are the primary concerns the CTH is being asked to address.

21. Soraya Sarruff and Gary Brown, ERDC-CHL, presented information on a numerical model navigation improvement study of the intersection of the GIWW and the bypass channel. The focus is on the impact of salinity in Matagorda Bay and sediment in the old Colorado River channel and river delta. The study will develop a numerical model of existing conditions, calibrate and verify it to field data collected for the study, and then model various plan conditions to evaluate the effect of the change. A finite element, depth averaged numerical model will be used to compute hydrodynamics, salinity and sediment transport. The code will consider forcing due to tides, freshwater inflows, wind, Coriolis, precipitation, evaporation, and salinity and temperature density gradients. The model grid will include all of East and West Matagorda Bay. The plan conditions will include: different size opening of Parker's Cut; diversion dam bypass; weir or culvert through the diversion dam; a Southwest Cut, alone, in combination with an open Parker's cut, and in combination with a diversion dam bypass; and a two different Parker's Cut openings in combination with a diversion dam bypass.

22. When asked why not consider the closing of the mouth of the Colorado River as it seems this is the source of the problem, the response was that this channel was used extensively by recreation boaters and shrimpers to get to the Gulf of Mexico. There was some discussion on opening Southwest cut into East Matagorda Bay and then closing the old Colorado River. It was also recognized that wind and seiching must be investigated, as there may be water level changes due to the wind that are shorter than tidal frequencies. The dominant frequency should be isolated.

23. Randy McCollum, ERDC-CHL discussed some results of a barge and ship simulation study. The study was designed to address the navigation concerns of the towing industry relating to cross currents in the GIWW/Colorado River diversion channel and tidal currents at the GIWW/Bypass channel. A site visit was conducted to get visual information that was used in the preparation of the simulator database. Pilots familiar with the GIWW operated the simulator and adjustments were made until the pilots were satisfied that the model realistically represented conditions on the waterway. The pilots then used the simulator with various plans to identify the most promising ones for full testing and evaluation. The testing procedure involved model runs of existing and proposed plan conditions and included the maximum credible worst-case scenario. They were also conducted in random order to avoid a bias in the results. Data recorded included

vessel position, heading, rudder angle, engine speed, ship speed, yaw angle, rate of turn, tug/thruster usage, port and starboard clearances, and wave induced vertical motion. The results were analyzed using information from the base vs. plan comparisons, vessel track plots, navigation parameter plots of rudder and engine speed, and the evaluation of the pilot. The simulations evaluated plans that included one or more of the following conditions: addition of a structure such as a dike; dredging the intersection; restoration of the southwest corner; removal of the southern corners; and the relocation of a lock. Each scenario resulted in plots of the tow path and of velocity and current direction with the identification of the location and size of eddies. The tow simulation results indicated that navigation between the locks was not adversely impacted by the diversion of flow into Matagorda Bay. However, at the GIWW/Bypass channel the tidal flows did impact navigation. Tripping was required at 3.0 fps and shutdown of navigation at 4.5 fps. The report indicated that the removal of the east gates of the West Lock produced the most improvement for navigation. However, it recognized that this was probably the most expensive solution. It also recommended the use of numerical hydrodynamic and sediment models to evaluate: the changes due to the enhancement of the southwest corner; the placement of a dike to control shoaling; and the use of the physical model to further test the condition with the most favorable results.

Mouth of the Colorado Jetty Channel

24 Dr. Nick Kraus, ERDC-CHL gave a project overview and presented information on the jetty channel sedimentation studies. The entrance channel from the Gulf of Mexico is flanked by east and west jetties. It has been dredged several times the amount dredged is about two to three times greater than anticipated in the original design, and is increasing. The east jetty contains a 1,000-ft weir and an impoundment basin to trap westerly moving sand in an attempt to keep the channel open. The channel is used extensively by shrimpers. There is an accumulation of about 600,000 cubic yards a year of beach quality sand in the deposition basin. The sand enters over the weir close to the shore forming a spit, which encroaches on the channel. One action to consider is that of closing the weir.

25. From a regional perspective, this is a six-inlet system containing several projects. Five projects in the West Bay, three projects in the Colorado River navigational channel, and two projects in the East Bay. In the Gulf, the prevalent winds and waves are out of the southeast with the net transport from east to west. Winds dominate this Texas shallow water estuary with southeast winds in the summer (June-October) and north fronts in the winter. The annual water level lows are usually in August and December. The tide is diurnal with a 1.5-ft range at Galveston.

26. Dr. Kraus presented results of simulations with a regional model encompassing the six inlets to represent the hydrodynamics of the system. He stated that the model was operated with default values of bottom friction and mixing coefficients owing to the excellent bathymetry data available. The model includes only the hydrodynamics and does not include salinity transport. If Parker's Cut were opened, the model indicates the flood phase would increase and produce a phase difference between the Gulf and Matagorda Bay. If SW Cut were opened, due to wind influences, the cut would have a net ebb discharge and the opening may introduce more salinity into East Matagorda Bay through Mitchell's Cut. Recommendations include the following actions be taken, implementing incrementally at perhaps one a year with continual monitoring:

- a. Construct a 500-ft long basin training structure.
- b. Close the outer half of the weir.
- c. Move the disposition basin, as necessary, away from the shore.
- d. Extend the west jetty.
- e. Construct a new east jetty.
- f. Move the sand bypass further west.
- g. Over dredge the channel as necessary.

Navigation Research and Development

27. Dr. Sandra Knight, ERDC-CHL, discussed some of the unique problems and special solutions of the Mouth of the Colorado River project. Some suggested options to the current problems were: lock relocation; dredging; helper boats; or structures such as dikes or current deflectors. A current deflector wall is used to break up eddies that hamper traffic, however care must be taken to prevent the wall itself from becoming a hindrance to traffic. There is a need to understand all the morphological changes taking place. It is important to know how the river bottom responds to river flows. Look for lessons learned from other projects such as Brazos River and the Wax Lake floodway.

28. With the conclusion of these presentations, Dr. McAnally explained that the Committee would have a report that addresses each of the questions presented to the CTH, to the District in 4-6 weeks.

29. A site visit to the Colorado River East Lock and other parts of the project was conducted on Wednesday 12 Sep 2002. The group visited the East Lock and observed the movement of barge traffic on the GIWW and the effect of the river currents on the set of the tow. The lock gates are open for traffic and closed when there is no traffic to keep the Colorado River sediment out of the GIWW. A tow must proceed through both the East and West locks and not stop in the GIWW/Colorado River intersection. No mooring is allowed in the intersection. Also observed was the operation of the swing bridge and the damage to wooden fendering on both the East and West locks. A boat ride was provided into the bypass channel, through the East Lock into the GIWW/Colorado River intersection, past the diversion dam, and the SW corner. The tour then proceeded to the Colorado River jetties, the trip paralleling the river past the location of the closed Parker's Cut. At the jetties, the weir jetty and wave strength and direction were observed and discussed. The day also included a briefing by the Lockmaster on the history and construction of the Colorado River Locks and by a Port Authority representative on his organizations suggestions for modifications to the Mouth of the Colorado River project.

30. The technical presentations continued on Thursday with Bob Bass, RJB Services and SWG (ret), discussing some of the environmental considerations of the project. He provided a brief history of Matagorda Bay. Prior to 1929 the Colorado River flowed freely into Matagorda Bay with very little delta growth. Oysters serve as an indicator organism and at that time the Bay was a large oyster producer. The river contained many logjams that were removed in 1929 after two major floods. The resulting large sediment load into Matagorda Bay produced rapid delta formation. As the delta grew, it pushed against the barrier island and the people of Matagorda cut through to the Gulf. Now fresh water from the river flowed directly into the Gulf and the Bay salinity started to increase. This in turn increased the occurrence of oyster predators and the decline of the oyster harvest. Healthy oysters need a time of salinities below 15 ppt. Since 1929, the Bay has been effected by; loss of fresh water; loss of oysters due to increased salinity, harvesting of oyster shells, and delta smothering; and loss of wetlands due to shoreline erosion. Parker's Cut was dredged to get easy access to oyster areas to harvest the shells. The purpose of

the diversion channel was to reverse these effects by increasing fresh water into the Bay, promoting delta growth and intertidal areas and revive the oyster population. Parker's Cut was closed, as a result of modeling information, to keep the salt-water influx through the Cut from negating the effects of the newly introduced fresh water. Three years before the diversion the salinity, seven miles from the diversion, was in the upper 20 ppt. Three years after the diversion the salinity was in the upper teens. The project appears to be working environmentally for the long-term health of the Bay. It has taken years of study and the concurrence and cooperation of many agencies. The re-opening of Parker's Cut (as some propose) may jeopardize the benefits that have been realized. Water quality and dissolved oxygen are not problems, the main issue in the Bay is salinity.

31. Dr. McAnally read the District's questions to the Committee to be sure there were no further questions or clarifications needed from the District or the presenters.

Question 1 - Does the Committee have any suggestions or recommendations on how the District can improve multi-barge tow navigation crossing on the GIWW at the Colorado River? Please include comments on the adequacy of on-going or proposed model studies on the project.

Question 2 - Does the Committee have any suggestions or recommendations on how the District can improve multi-barge tow navigation crossing on the GIWW at the Bypass channel intersection? Are on-going studies adequate?

*Question 3 - a) Does the Committee have any suggestions or recommendations for reducing or controlling the heavy shoaling at the Colorado Jetty channel inlet?
b) Should a larger sediment basin be considered/designed?
c) Should changes to the weir jetty be studied?*

32. The discussion involved what and how to present information that involved many individual but interrelated projects. Matrix analysis may be an approach with sensitivity testing of each proposed change addressing the significance and threshold of parameters. Unsure of what the environmental agencies need from the Corps to make their evaluations, it was suggested that salinity plots of before and after conditions with respect to salinity isohalines and duration be used. Baseline data for West Matagorda Bay and water level gage information in the bypass and Colorado River are also desirable.

USACE Sediment Management Initiatives

33. Dr. Lynn Hales, ERDC-CHL, briefly reviewed the activities of the Dredging Operations and Environmental Research Program. The Coastal and Hydraulics (CHL) and Environmental (EL) Laboratories are heavily involved in these research efforts. Issues being addressed are:

- a. Contaminated sediments - even though approximately five percent of dredged material is contaminated it is a costly part of the dredging project.
- b. Environmental windows - when can dredging activity take place without harming migrating or resident species?
- c. Innovative technologies - what current technologies exist that can be used/adapted to benefit the program?
- d. Instrumentation - improve monitoring activities and develop standardized reporting.

- e. Nearshore placement - Identify the most appropriate placement for clean material for shoreline protection.
- f. Risk - try to incorporate the principles of human health aspects of risk into dredging operations.

A July workshop on fine grain sediments highlighted problems and research opportunities and needs.

34. Dr. Sandra Knight, ERDC-CHL discussed the Corps navigation and marine transportation related R&D. An increased emphasis is being placed on strategic issues, involvement of the Divisions to determine program direction, and the integration of new technologies into practice. R&D will be organized to support the Corps business functions with navigation being a major area. She discussed improvements to navigation capabilities by focusing on infrastructure enhancements; integration of navigation system design and management; regional sediment management; and dredging and dredge material management. The challenges as well as benefits were discussed. The Corps is one partner in a multi agency cooperative effort to integrate each agencies work into one program. Other agencies are National Oceanic and Atmospheric Administration, Maritime Administration, Coast Guard, and Environmental Protection Agency.

35. This concluded the Technical Session presentations.