The 1900 Galveston Hurricane

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Introduction

The 1900 hurricane that struck Galveston, Texas – then known as Oleander City – remains the deadliest natural disaster in United States history. It is also one of the three most catastrophic events in Texas, along with the 1937 New London School Explosion and the 1947 Texas City Disaster. Between 6,000 to 12,000 lives were lost, with most sources estimating around 8,000 deaths – 6,000 in Galveston and 2,000 in the surrounding coastal areas.

The storm made landfall at approximately 8:00 PM on September 8, 1900, as a Category 4 hurricane on the modern Saffir-Simpson scale. It brought 130-140 mph winds and a devastating 15-foot storm surge. Galveston's highest point at the time, Broadway Avenue, was only 8.7 feet above sea level. The resulting inundation destroyed much of the city.

Much of the loss of life stemmed from human error, overconfidence, and failure to implement engineering measures that were already feasible at the time—many of which are used today to protect Galveston.

Galveston Island Before the Storm

Galveston Island, a barrier island on the Texas Gulf Coast, stretches about 28 miles in length and varies in width from one-half to three miles. By the late 19th century, Galveston had become the largest city in Texas and one of the busiest ports in the country, with a population nearly 40,000. Its commercial center, known as The Strand, earned the nickname "Wall Street of the Southwest." Figure 1 shows the layout of Galveston in 1900, before the storm.

Although hurricanes had previously damaged Indianola, Texas, proposals to build a seawall and raise Galveston's elevation were rejected after the 1886 storms. The idea had even been introduced as early as 1874 by General Braxton Bragg. Making matters worse, protective sand dunes—12 to 15 feet tall—were leveled to allow easier access to the beach, eliminating a natural storm buffer.

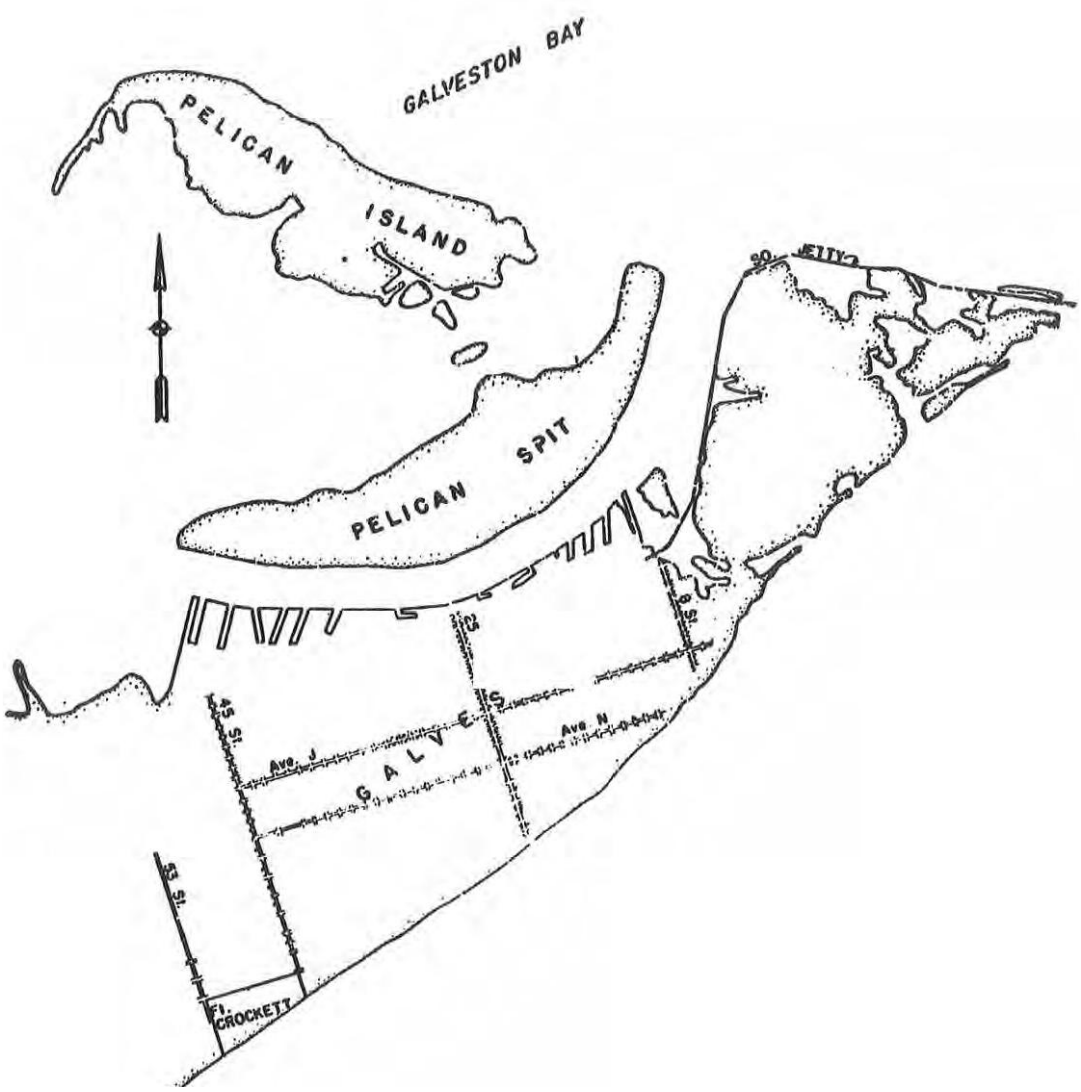

Figure 1. The City of Galveston in 1900. (US Army Corps of Engineers)

Path of the Storm

The hurricane was first detected over the tropical Atlantic on August 20, 1900. It was reported by a ship east of the Windward Islands on August 27. The storm gradually intensified as it moved into the Caribbean and then into the Gulf of Mexico. By September 6, it rapidly strengthened over the Gulf's warm waters and turned toward the Texas coast.

At the time of the storm, the population of Galveston was 40,000 and it was the largest port city in Texas. The storm made a northward turn towards Galveston between noon and 8:30 PM on September 8. The storm struck Galveston on the evening of September 8, 1900. From Galveston, the storm moved north through Houston the next day. It made a gradual turn eastward as it went towards the Great Lakes by September 11. It entered the Atlantic on September 13 and dissipated near Iceland on September 15. Figure 2 shows the path of the 1900 Storm.

Figure 2. Path of the 1900 Storm. (NOAA)

Forecasting

Weather forecasting in 1900 was not advanced like today, where we have many indirect observation methods. In fact, it would be considered very primitive by today's standards. Forecasting and tracking storms were done from reports from ships (direct observation). The disturbance passed over Antigua on August 30th with 2.6 inches of rain on the island. On September 4, the Weather Bureau's (forerunner of the National Weather Service) Galveston office received warnings from Washington DC that a tropical disturbance had moved over Cuba.

The term "hurricane" comes from the Spanish and Caribbean Indian terms for evil spirits and big winds. At the time of the 1900 storm, the use of the term "hurricane" was discouraged. This was to prevent panicking residents in the event of a storm. To make things worse, the Weather Bureau director Willis Luther Moore had implemented a block on telegraph reports from Cuban meteorologists from the meteorological observatory in Havana. This ensured that there was no way of knowing the storm's trajectory, as the Cubans were good at tracking storms. Moore had also changed the protocol to mandate that the local Weather Bureau offices seek approval from the central office before issuing a storm warning.

On September 2 the storm was moving westward. The next day it made a northward turn. By 8:00 AM on September 4 the storm was located just south of Cuba.

The first advisory of the approaching storm was issued on September 4, 1900. Isaac Cline received a telegraph at approximately 4:00 PM from the Weather Bureau central office in Washington, DC. The message simply stated, "Tropical storm disturbance moving northward

over Cuba." No other details were provided, and they were likely not available. Cline was not aware that the threat of the storm was apparent on August 30, when it passed over Antigua traveling west at 15 miles per hour.

On September 5, 1900, the storm was traveling north, toward Florida. An advisory was received from Washington, DC to warn shipping traffic near Florida and Cuba.

The Weather Bureau forecasters in Washington DC were under the belief that the storm had taken a northward turn into Florida. They believed that it would turn northeast and emerge into the Atlantic Ocean. On September 5th, they issued a storm warning in Florida from Cedar Key to Miami. A hurricane warning was issued the following day along the East Coast from Cedar Key to Savannah, Georgia. The telegraph wires were down just south of Jacksonville then wires between Pensacola and Jacksonville went down. Cuban forecasters correctly stated that the hurricane would continue west, as the storm made a westward turn on September 6.

At midnight on September 7, there was no obvious sign of a storm. There was a light wind, but Cline noticed long swells breaking on the beach with an ominous roaring sound and an above normal tide. On September 7, 1900, at approximately 9:00 AM, the storm warnings were extended to Galveston, Texas. Isaac Cline hoisted the warning flags atop the Levy Building by 10:30 AM. The central office had predicted that the center of the storm would strike the coast to the east of Galveston. Cline thus assumed that the city would be somewhat safe.

The attitude at the local level was that it could not happen that a major storm could strike the island. Isaac M. Cline, director of the Weather Bureau's Galveston Office, wrote an article in 1891 stating that it would be impossible for a major hurricane to strike Galveston Island. His article was printed in the Galveston Daily News. He also argued that a seawall was not needed.

On the evening of September 7, at approximately 6:30 PM, Cline was looking for the "brick-dust" sky as he stood on top of the Levy Building in downtown Galveston. Moisture intensifies the red hue caused by smoke and dust, and this frequently signals the approach of a tropical hurricane. Cline did not observe a "brick-dust" sky. The waves were high and kicked up ugly brown sand in the surf. The beaches were mostly deserted that evening.

The morning of September 8th had partly cloudy skies, but there were swells on the surf. The rain clouds started moving in by midmorning. The population was not concerned about these storm clouds.

The Weather Bureau had suggested that residents and visitors should move to higher ground. Isaac Cline's memoirs state that he traveled by horse along the beach to warn people of the impending storm. This account is challenged, based on Cline's earlier insistence that a seawall was unnecessary and that a major storm could not strike Galveston. Cline is, however, known to have issued a hurricane warning without permission from the Weather Bureau's central office in Washington DC.

Joseph Cline (Isaac Cline's brother) and John Blagden, a meteorologist on temporary duty from Memphis office, spent the afternoon advising callers to the office to get to higher ground. At that point, many telephones that did exist were not working. Mr. Blagden remained in the Weather Bureau office all night during the storm.

Landfall

The storm made landfall in Galveston on the evening of September 8, 1900. The sustained winds were estimated to be 140 mph, making it a category 4 storm on the modern day Saffir-Simpson Scale (which did not yet exist). The storm surge that came with the hurricane was 15 feet between 8 PM and 9 PM, so it washed over the entire island. The storm surge began flooding the city early on September 8. From 3 PM until 7:30 PM, there was a steady rise in the water level. There were reports that after that, there was a four-foot rise in the water level in only four seconds. The storm dropped 9 inches of rain on the city.

The wind was measured at 100 mph at about 6 PM on September 8. It was just after that the wind speed indicator (anemometer) blew off the building. Estimates place the maximum wind speed at 120 mph. Survivors reported information that helped show the power of the storm. They reported seeing bricks timbers, slates, and other heavy objects becoming airborne. This indicated that the winds were stronger. It was later figures that placed the storm at a Category 4 on the Saffir-Simpson scale. The lowest pressure recorded was 28.48 inches of mercury.

At 6 PM on September 8, the Angelus rang out from the bell at Saint Mary's Cathedral. Father James Kirwin described it as sounding a warning of death and destruction. Just after that, the cathedral towers swayed violently, and the bell went crashing to the ground.

There were more than fifty people that took refuge inside the Bolivar lighthouse. Some sources put the number at 125. They were moving up the stairs as the water level rose. The water filled the eight-foot-high doorway to the 130-foot-high lighthouse.

Isaac Cline lost his house in the storm. His wife was lost, but his three children were saved.

The damage was extensive. Every street had water damage with most of the damage from the storm surge. Most streets also had wind damage. The connections to the mainland were destroyed, including bridges and 15 miles of railroad track.

The storm surge and strong winds also tore down electrical, telephone, and telegraph wires throughout the city. The storm surge moved buildings off their foundations and destroyed them. Buildings were destroyed after being pushed into other structures by the waves. Even buildings that were constructed to withstand hurricanes were destroyed.

The toll on Galveston was devastating. 3,636 homes were destroyed, 2,600 of them along the Gulf front. There were 10,000 left homeless out of approximately 40,000 in the city. Notable places that suffered damage were the Tremont Hotel, where many tried to get away from the storm. Galveston city hall lost its roof. The 1894 Grand Opera House was severely damaged. It was quickly rebuilt after the storm. Figure 3 shows the Grand 1894 Opera House that was damaged by the storm. Up to 300 feet of beachfront land was lost due to erosion of the shore by the storm.

Figure 3. The Grand 1894 Opera House damaged by the storm. (Library of Congress)

There were three schools, as well as St. Mary's University that received severe damage. Twenty-five churches were destroyed, while the remaining 14 were damaged.

There was also an orphanage (St. Mary's Orphans Asylum, not to be confused with the Galveston Orphans' Home that was heavily damaged by the storm) that was owned by the Sisters of Charity of the Incarnate World that had 93 children and 10 nuns that collapsed. As the tides moved in, the nuns moved all the children into the girl's dormitory. It was sturdier than the other dormitories. One of the sisters had just returned with provisions, despite being urged by Mother Gabriel to stay at the hospital (St. Mary's Infirmary) until the storm passed. The nuns had the children sing "Queen of the Waves" as an attempt to calm them. When it was apparent that the building was going to collapse, the nuns used a clothesline to tie themselves to six to eight children each. This was unsuccessful since after the building collapsed, all the nuns and all but three of the children perished. Rescue workers found the bodies of one nun with nine children still tied to her. They also found the bodies of two nuns in Texas City, across Galveston Bay. They were buried where they were found, with the children still attached to them. The three survivors were boys that drifted on a tree for three days. William Murney, Frank Madera, and Albert Campbell were eventually able to make their way into town. They then told the sisters what happened during the storm at the orphanage. On September 8, 1994, a Texas State Historical Marker was placed at the site of the former orphanage, at 69th Street and Seawall Boulevard. Figure 4 shows the aforementioned Galveston Orphans' Home.

Figure 4. The Galveston Orphans' Home. (Library of Congress)

The main tidal surge hit the south shore at approximately 7:30 PM. The houses along the beach front were lifted from their foundations and hit other houses, destroying them.

Only a few buildings survived. Some were houses along The Strand and in the East End Historic District and a few mansions along Broadway Street. The early property damage estimates were around 25 million dollars ($939,300,595 today). Itemized damage estimates came in 1901 based on damage assessments conducted by the Galveston Daily News, the Galveston Chamber of Commerce, multiple insurance companies, and a relief committee. These assessments put the damage at 17 million dollars. The breakdown included $8.44 million damage to residential properties, $500,000 damage to churches, $656,000 to wharves and properties used for shipping, $580,000 to manufacturing facilities, just to name a few categories.

The city had an arc-shaped area of destruction of approximately 1,900 acres, where nothing remained standing. There was complete destruction in the west, south, and eastern parts of the city. There was a 3-mile-long 30-foot-high wall of debris in the middle of the island. The storm essentially constructed a breakwater of wreckage from the east end to 45th Street, and parallel to the Gulf of Mexico about six blocks from the beach. Everything outside of this was destroyed. The wall of debris had parts of houses, furniture, kitchen utensils, dogs, cats, and people (both dead and dying).

St. Mary's Infirmary had the injured as well as those with no place to go. The main hospital building survived the storm, but the adjacent buildings were destroyed by the storm. There was no food or water.

On September 9, the Pherabe set sail and arrived on the western side of Galveston Bay, in Texas City. The Pherabe was one of the few ships at Galveston wharfs to survive the storm. Figure 5 shows the damage to the wharfs. The Pherabe took a group of five messengers from the island. They reached the telegraph office in Houston early on September 10. A short message was sent to governor Sayers and President McKinley informing them that the city of Galveston was in ruins. The messengers reported that there were an estimated 500 dead as advised by Father Kirwin while leaving Galveston, but this was initially thought to be an exaggeration. Help from Houston came quickly. Rescuers arrived in Galveston to find the city in ruins.

Figure 5. The Galveston wharfs showing damage and death. (Library of Congress)

In early 1901, a survey was conducted that indicated a population loss of 8,124. It was believed that approximately 2,000 people left after the storm, never to return. It was on this basis that they determined that the death toll was at least 6,000 for Galveston itself. It is believed that 8,000 were killed by the storm. This represented 20 percent of the population of the island.

Most of the deaths were either from drowning or being crushed by the storm debris being pounded by the waves. There were also a significant number of fatalities from the winds turning objects and debris into missiles. There were also those that survived the storm, but died being trapped in the debris before rescuers could reach them. Rescuers could hear screams of the survivors when they walked on debris in the attempt to rescue those they could.

Before the storm, there were sixteen ships in the harbor. After the storm, they were aground in various places. The British ship Taunton was stranded twenty-two miles away, in Trinity Bay.

The British steamer Roma was blown down the channel sideways. It destroyed three bridges in the process. The lightship was moored between the jetties before the storm. After the storm, it had been pushed four miles across Galveston Bay.

The Aftermath

The storm wiped out Galveston. The survivors of the storm had to wait for relief since the railroads to the mainland were destroyed. Destruction of the railroads is shown in Figure 6. The Central Relief Committee for Galveston Storm Sufferers (CRC) was established on September 9, 1900. The Chairman was the mayor; Walter Jones had called an emergency city council meeting at 10 AM and the committee was created. The CRC had subcommittees that concentrated on a specific aspect of the relief effort. For example, disposal of the dead, correspondence, food and water distribution, finances, hospitalization/rehabilitation, and public safety.

Figure 6. Damage to the railroads caused by the storm. (Library of Congress)

John Blagden went out the next day and wrote that everything was swept away in the quarter of the city where he was staying. He could not find the house where he was staying and the family he was staying with were all lost. He wrote back home that their bodies had all been recovered. He wrote that he got sick of what he saw (bodies and destruction) and he returned to the office to attempt to put things in order. He slept in the office.

The day after the storm, the morning began with bells sounding from the Ursuline Academy. This was the call to worship by the nuns in the convent. During the storm, there was nearly 1,000 people at the convent, which was located ten blocks from the beach. The convent had a ten-foot wall around it that collapsed and washed people, animals, and debris against the building. The blacks began singing after the north wall collapsed. The mother superior rang the

chapel bell to attempt to quiet them and announced that a convent was no place for that. She told them they may pray quietly and offered baptism to all who desired it. The Ursuline Academy after the storm is shown in Figure 7.

Figure 7. The Ursuline Academy after the storm. (Library of Congress)

As soon as the sun rose, people were out looking for their families. These people were bruised and cut up and many almost naked. Many of the dead were also without clothes. The sharp objects thrown into the air had torn off clothing, as well as mutilating the bodies of victims. A lot of Galveston was coated with a foul-smelling slime that was about an inch deep and had the consistency of axle grease.

The Lucas Terrace Apartments were destroyed. There were 64 rooms in the complex and only 1 room survived. This complex only had two survivors and 50 dead. One of these survivors was Daisy Thorne, who occupied the surviving room in the complex. Figure 8 shows the Lucas Terrace Apartments after the storm.

Figure 8. The Lucas Terrace Apartments in Galveston. (Library of Congress)

The Galveston Daily News published a reduced-sized paper. Advice to temporarily relocate to Houston was given by the sister paper, Dallas Morning News. This advice was ignored and a single sheet was published on September 9th and 10th listing the names of the dead on one side and reporting the devastation caused by the storm on the other.

The number of bodies was overwhelming. There were four morgues that were set up, but this idea proved to be inadequate. They could not all be buried, as they attempted digging, and the holes filled with water. The next idea was to take them out to sea and dump them. This idea was proposed by two city aldermen. Bodies were collected by groups known as "dead gangs". They were taken to 12th Street wharf. They were then given to 50 black men that were volunteered at gunpoint to load them onto a barge. Approximately 700 bodies were taken out to sea on three barges, weighted, and dumped. The currents in the Gulf of Mexico washed many of the bodies onto the beach. They then set up funeral pyres on the beach wherever bodies were found and burned them. Bodies were burned 24 hours a day for several weeks. The authorities did give out free whiskey to the men that volunteered to collect and burn the bodies. There was only a minimal attempt at identification. Figure 9 shows the burning of bodies after the storm.

Figure 9. Burning of bodies after the storm. (Library of Congress)

There were rumors of looting. Mr. Blagden wrote of this in his letter back home. He wrote that the city was under military rule, and the streets were patrolled by armed guards expected to immediately shoot any looters. He wrote that he heard that four men were shot that day (September 10) for robbing the dead. The number of looters caught, or shot is somewhat in dispute. The Monday and Tuesday following the storm armed Galvestonians were out with permission to shoot looters on sight. Stories were exploited by the media. One story stated that seventy-five "ghouls" were shot. Clarence Ousley doubted the figure and stated that there were no more than six killed. The Galveston Daily News reported on September 11 that eight black looters killed but could only verify seven later. Police records for the month of September listed one arrest for robbing a body and five for looting. In another story, a man was caught cutting off fingers from bodies to get rings. He was caught by soldiers, who put a sugar sack over his head and shot him. Figure 10 shows a deaf looter stealing off of a body, being shot at.

Figure 10. A deaf looter is shot at. He didn't miss the second time. (Library of Congress)

By September 13, there were two thousand law enforcement officers and soldiers in Galveston. The mayor requested that the Texas Militia take over law enforcement duties and declared martial law. He also established a curfew and closed all bars.

The Red Cross responded to the disaster, but it was somewhat late. They arrived on September 17, 1900. This was the last disaster that Clara Barton, the founder, would respond to. After they heard about the disaster, they set up temporary headquarters in a warehouse in the commercial district of Galveston (25th Street and The Strand). They shared the building with the New York World newspaper. Barton's appeals resulted in a large amount of donations. Cash donations to the Red Cross amounted to $17,341. Donations of goods included 258 barrels, 1,552 pillow cases, and 13 casks of bedding, clothing crockery, disinfectants, groceries, medical supplies, hardware, and shoes. These were all received at the warehouse, and the total of money and supplies was approximately $120,000. The Red Cross left Galveston on November 14, 1900.

The survivors of the storm used surplus US Army tents set up along the shore as temporary shelters. Within the first two weeks after the storm there were about 17,000 people in these tents, vacant storerooms, or public buildings. There were so many of these white tents that observers referred to Galveston as the "white city on the beach". Figure 11 depicts the tents set up on the beach. Others used the salvageable material from the debris (storm lumber) to build a shelter. The building committee gave money to build and repair homes. They gave enough to build a cottage having three 12' X 12' rooms. There had been 1,073 cottages built, and 1,109 homes repaired by March 1901.

Figure 11. The "white city on the beach" made of surplus US Army tents. (Library of Congress)

Charitable donations began to come in to assist survivors. The first reporter to file reports from Galveston was Winifred Bonfils, who worked for William Randolph Hearst. Hearst sent relief supplies by train to Galveston.

On September 12, 1900, the wholesale grocers Pabst and Leinbach reopened. Goods sold quickly, even the canned goods that had lost their labels. Galveston also received the first mail since the storm on September 12, although the residents had to pick it up at the post office. Basic water service was re-established, and Western Union began minimal telegraph service by September 13. Also on September 13, the Galveston Daily News printed a full-sized paper, instead of the abbreviated versions that were printed just after the storm. On September 14, the banks reopened. A railroad bridge across Galveston Bay was rebuilt by September 21, with the first train arriving in Galveston the same morning. Cotton was shipped out of the Port of Galveston within three weeks. Schools did not open until October 22.

Monetary donations towards the rebuilding of Galveston were made by cities, organizations, businesses, and individuals. Monetary contributions totaled $1.5 million within a week of the storm. Donations came in from New York City ($134,000) and five other major cities donated $15,000 each by September 15. Donations from New York state were the largest of any state at $228,000. They also came in from overseas. The largest personal donation was from Andrew Carnegie, the steel tycoon.

The relief groups from Houston went home after three weeks. Galveston started to have a little bit of normal operations. The bar reopened and the electric trolleys began operating. Freight began moving through the Port of Galveston.

Before the storm, Galveston was known as the "Ellis Island of the West" and "Wall Street of the Southwest". After the storm there was a gradual shift towards Houston for production and shipping. The Houston Ship Channel opened in 1914, and Houston became a major commercial center.

There was a significant decline in population after the storm, according to a Morrison and Fourmy Company survey. The Galveston Movement was a project that was designed to combat population loss. It was designed to draw Jewish immigrants away from the East Coast towards cities like Galveston. Of the 10,000 Jewish immigrants that arrived during the period, only about a quarter of them remained in Texas. Figure 12 shows a historical photograph of the damage caused by the storm. Bishop's Palace is shown in the background.

Figure 12. Historical photograph showing the aftermath of the 1900 Storm. (US Army Corps of Engineers)

Engineering Response: Seawall and City Elevation

The storm finally convinced Galveston to build a seawall. Galveston's recovery included two major civil engineering feats: construction of a seawall and elevation of the island. They also made other improvements to help the island survive a storm. The city hired a team of three engineers to design protective structures. The engineers were Alfred Noble, Henry Martyn Robert, and H.C. Ripley. They designed a three-mile solid wall, to be 17 feet above mean low water. The proposed wall was concrete, paved on top and ran from the south jetty (across the eastern edge of the city) and down the beach. There was a 27-foot-wide layer of rip-rap extending from the toe of the sea face of the wall (with large stones on the surface). A bond referendum was approved by the voters in 1902 to fund the building of the seawall, which had an

estimated cost of $3,505,040. The location of the seawall as proposed by the Robert Board is shown in Figure 13. The proposed embankment as designed by the Robert Board is shown in Figure 14.

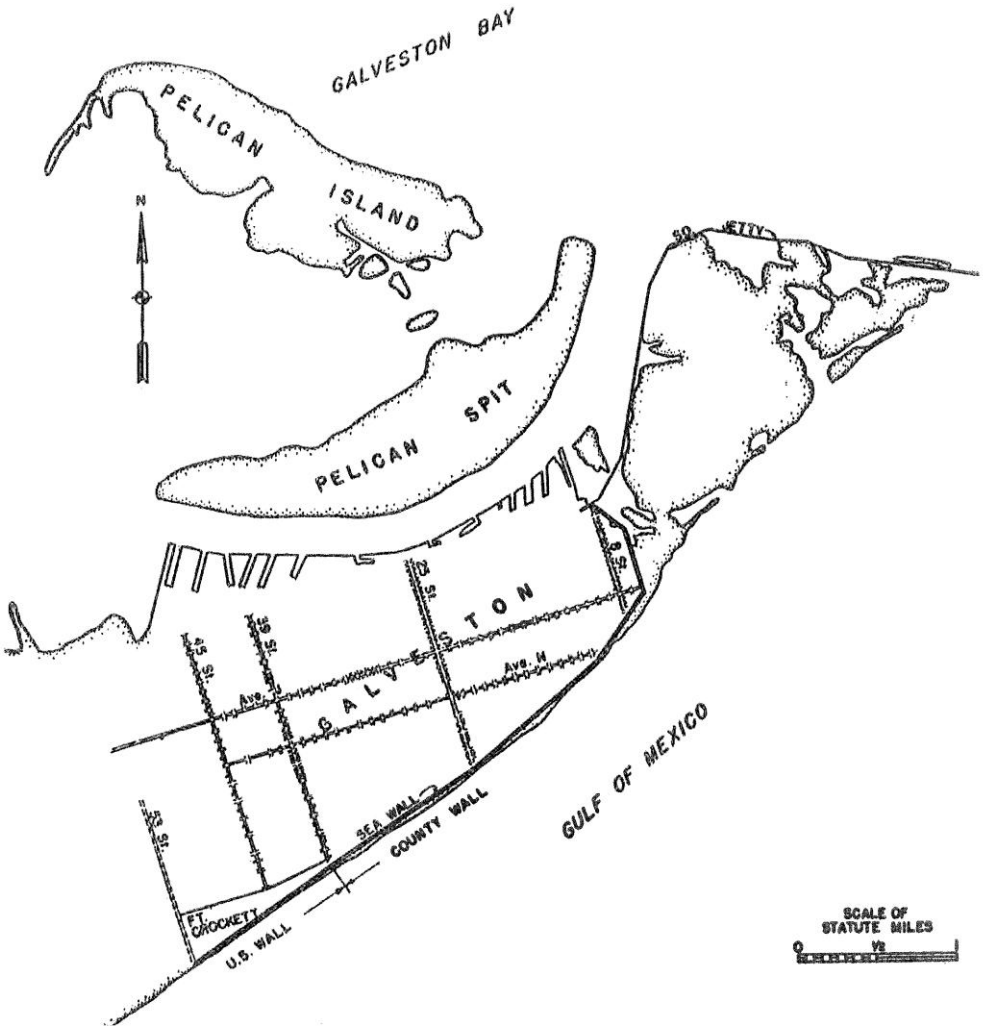

Figure 13. The location of the seawall as recommended by the Robert Board. (US Army Corps of Engineers)

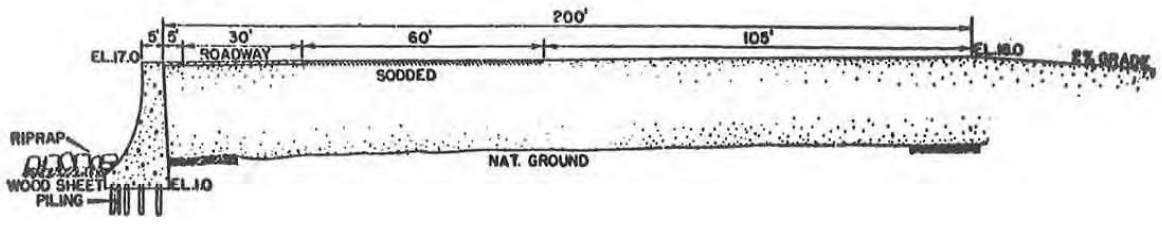

Figure 14. The embankment as proposed by the Robert Board. (US Army Corps of Engineers)

Galveston County contracted with J.M. O'Rourke and Company of Denver, Colorado for construction of the seawall. The first three miles were 17 feet high as the engineers had recommended. Construction was started in 1902 and was directed by Robert. The wall was built in sixty-foot sections by pouring concrete into molds. It then took seven days for the cement to set.

The first segment of the wall was completed in 1904. Construction continued for decades, and the seawall was ten miles long upon completion. The wall had a base that was 15 feet thick, and it was 5 feet thick at the top and was 17 feet tall. The wall had a concave wall that faced the ocean, so the force of the waves would be driven upward. The seawall was built generally to the plans of Robert, except the embankment behind the concrete section was built only 100 feet wide to a maximum elevation of 16.6 feet. Figure 15 shows the seawall as originally constructed.

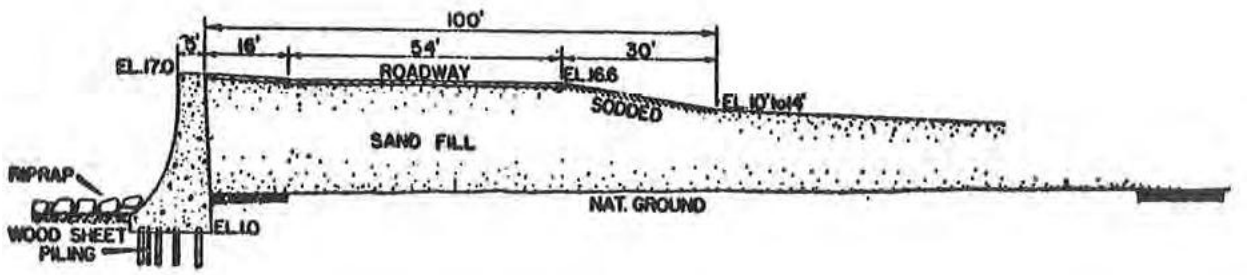

Figure 15. The seawall as originally constructed, and completed in 1904. (US Army Corps of Engineers)

There were a few imperfections in the seawall. The engineers that designed the seawall were marine engineers. They were used to measuring from mean low tide. The seawall was therefore only 15.6 feet above sea level, when it was supposed to be 17 feet. The difference between sea level and mean low tide meant that the seawall came out being a little shorter than it was supposed to be.

You cannot stand in the historical parts of Galveston and have the same perspective as they did in 1900. The city was raised building by building. The same engineers that constructed the seawall were contracted to raise the city. The city was raised using sand dredged from the Galveston Ship Channel. Some sections were raised by 17 feet and was sloped downward by one foot for every 1,500 feet to Galveston Bay. This is the height of the seawall, and it can be seen today where the street level is on top of the seawall.

Over 2,100 buildings were raised by pumping sand underneath during the grade raising. This required pumping in sand dredged from the Galveston Ship Channel and pumping it in as a liquid slurry. Even the graves in the city's old cemeteries along Broadway were raised. Some of them are only 3 feet deep because of the raising of the city. The city paid for moving the utilities for the grade raising, but each homeowner had to pay to have his or her house raised. By 1911 there had been 500 city blocks raised by varying degrees.

A storm like the 1900 hurricane hit Galveston Island on August 16, 1915. The storm surge was 12 feet. The seawall did its job as the loss of life was only 12 in Galveston, so it was greatly

reduced. The integrity of the seawall was tested by the 1915 category 3 storm as well as subsequent storms. None of these could compare to "The Storm" which Galvestonians refer to the 1900 storm of September 8, 1900. Some of these storms were Hurricane Carla in 1961, Hurricane Alicia in 1983, and Hurricane Ike in 2008. The US Army Corps of Engineers estimated that the seawall prevented approximately $100 million in damage after Hurricane Alicia. Hurricane Ike caused a lot of damage, even with the seawall, with an estimate of $2 billion.

Even after the reconstruction of Galveston, it was bypassed by Houston as the major port after the Houston Ship Channel opened in 1914.

The US Army established Fort Crockett along the beach front in 1897. They also planned a protective wall for the fort. There was a six-block gap between the county portion of the seawall and the fort. The county purchased the land and gave it to the US Army. This effectively expanded the base by twenty-five acres. The Army agreed to fill in the gap and extend the seawall from 39th Street to 53rd Street. Congress authorized the funds for construction of a seawall of similar design to the county seawall. The Fort Crockett portion of the seawall is 4,935 feet long and was completed in October 1905.

The completed seawall connected to the south jetty at 8th Street and Avenue A, it angled toward 6th and Market, followed 6th to Broadway (main drag from I-45), angled from Broadway to the beach, took the beach to 53rd.

A report was prepared in 1913 that considered the question of extending the seawall to Fort San Jacinto. This proposal brought it up to the Jetty near present day East Beach. Storm erosion was a major concern. This design was the same as the seawall already constructed, except an embankment behind the wall.

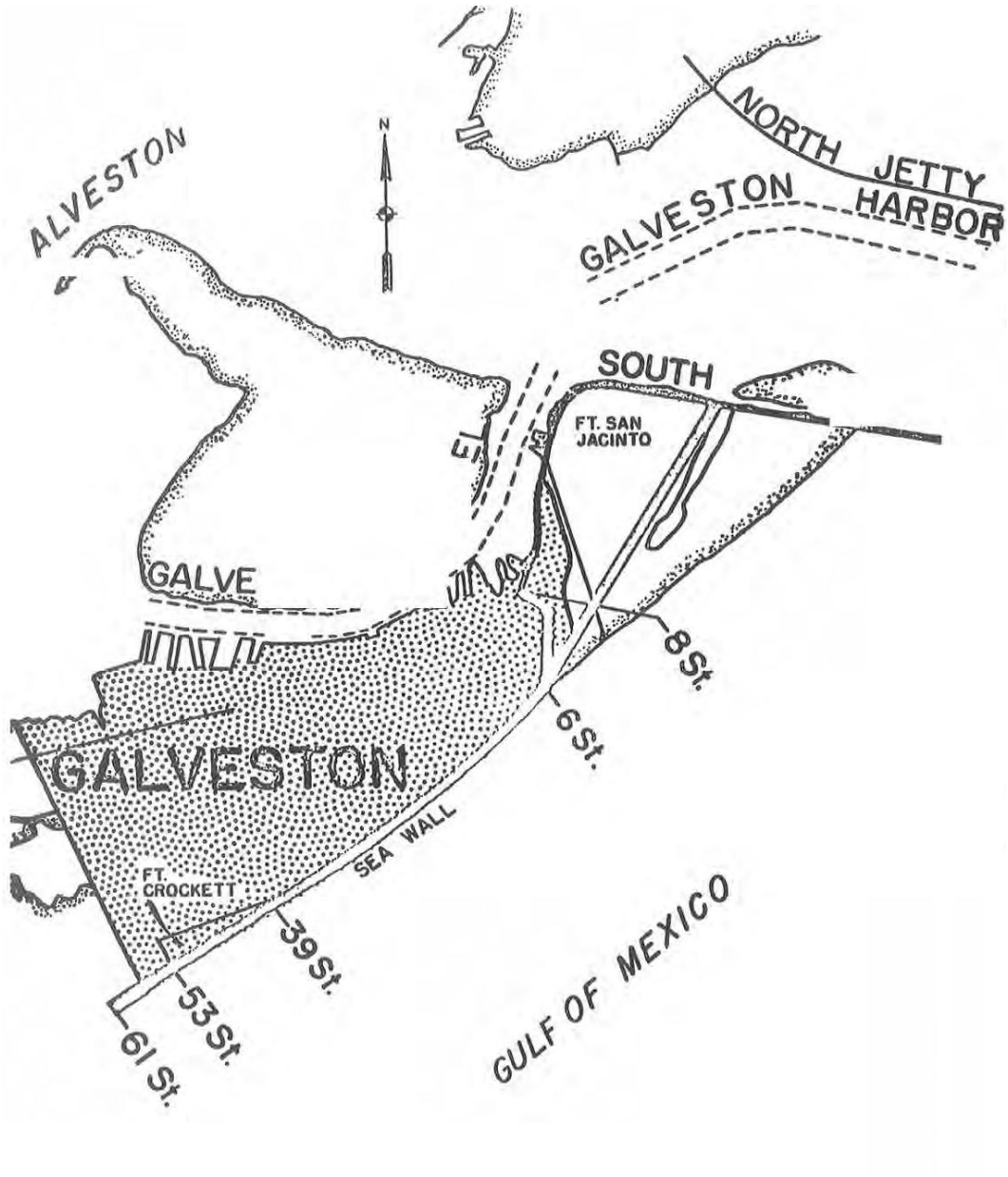

Figure 16. The proposed extension of the seawall to Fort San Jacinto. (US Army Corps of Engineers)

When the extension to Fort San Jacinto was built in 1921 there was the east end flats that were forward the wall as can be seen on Figure 16. Presently there are several condo complexes and a housing development in this area. The seawall looks very different in this area and I never even knew it was part of the seawall, as it does not look like any other part of it. It is a different design. I first encountered this part when my ex-wife was pulled over by Galveston PD in this area. I remember the grade going up from the roadway, but you don't think that it is part of the seawall because of the sandy flat area and the condos forward the wall. This part of the seawall has an embankment behind the wall with a 10-foot walk and a 50-foot roadway on a 2 percent slope. The embankment then rises on a 20 percent slope for 40 feet. The crest is 8 feet wide and

26 feet above mean low water. Figure 17 shows the layout of the seawall extension to Fort San Jacinto.

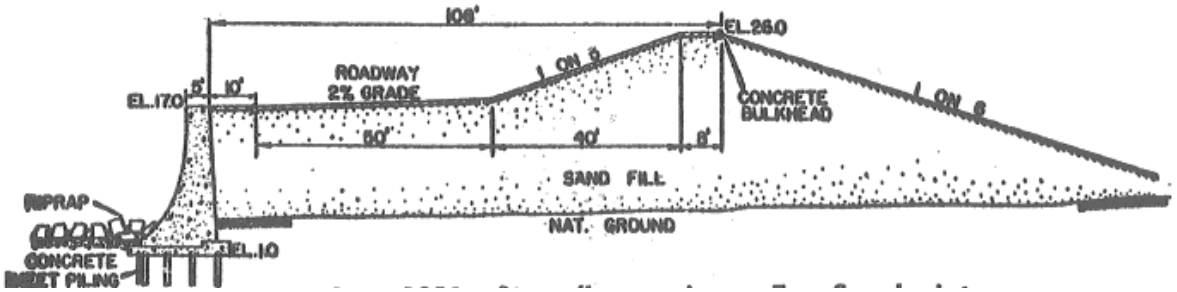

Figure 17. The seawall extension to Fort San Jacinto. (US Army Corps of Engineers)

The seawall was eventually extended over several decades and is ten miles long presently. The seawall and the raising of Galveston Island was named as a National Historical Civil Engineering Landmark by the American Society of Civil Engineers (ASCE) on October 11, 2001. The wall presently runs from Boddeker Drive, near East Beach (and South Jetty) to just past Cove View Boulevard, before West Beach. It is a tourist attraction on top of protecting the city.

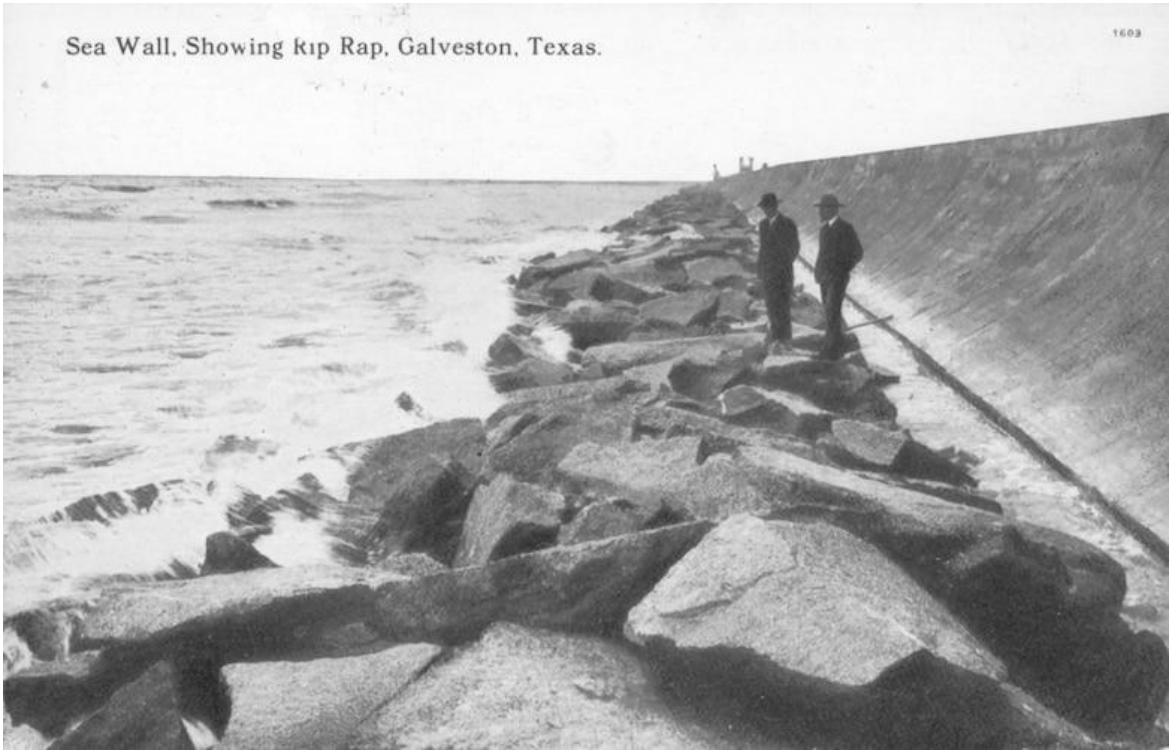

Figure 18. Vintage Postcard showing men standing in front of the completed wall among the rip-rap. (US Army Corps of Engineers)

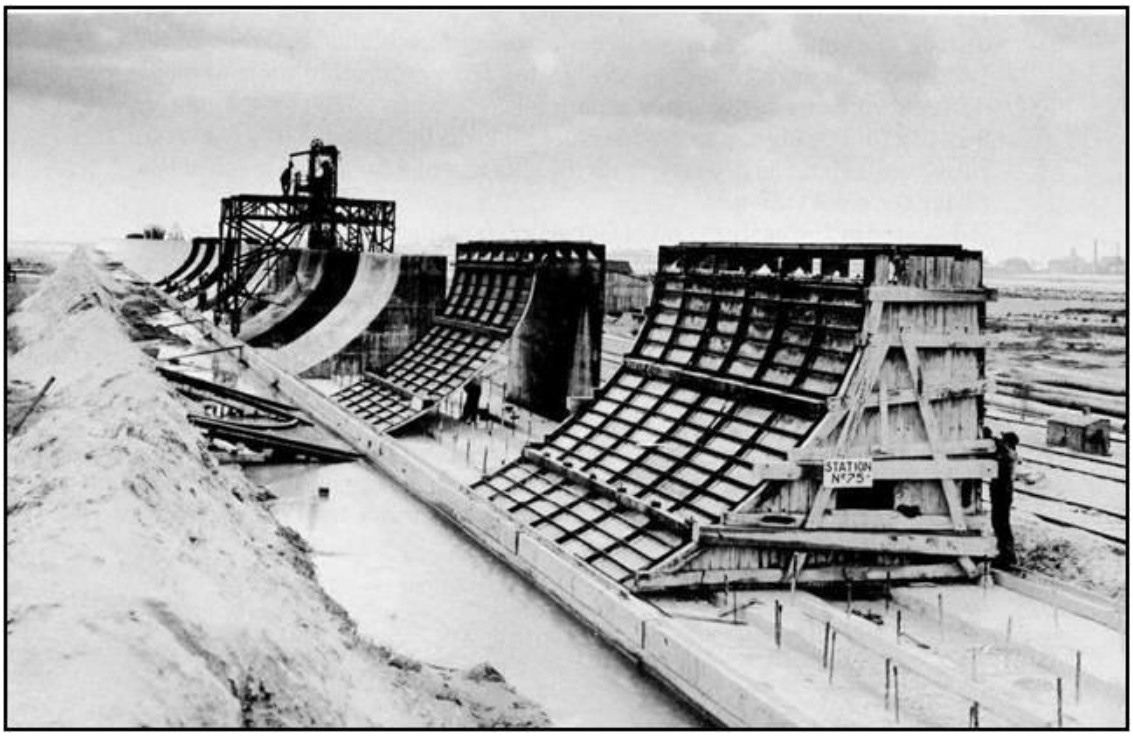

Figure 19. The seawall under construction. (US Army Corps of Engineers)

Discussion

Hurricanes are unpredictable, even in our time. When hurricane Beryl hit Houston, it was predicted to go ashore in Corpus Christi and then hit Houston instead. Hurricane Harvey went in towards Victoria, went back out to the Gulf and then entered the Houston/Galveston area. Hurricane Harvey then basically parked over the Houston area. The 1900 Storm took a similar path to Hurricane Ike once it entered the Gulf of Mexico. Ike did not have the Florida turn so there was little doubt that it was entering the Gulf.

In 1900, the Weather Bureau was still a new agency. One issue that cannot be ignored is the arrogance of Isaac Cline and Willis Luther Moore. Politics may have played a part since the 1900 storm occurred after the Spanish-American War. Moore put a block on information coming out of Cuba, even though they had an expertise in tropical weather.

Long before hurricane Ike my ex-wife and I went to a restaurant that was over the water, just off the seawall over the ocean. I went back to the area after hurricane Ike and it had been destroyed by Hurricane Ike, which was of similar strength as the 1900 storm. On the Bolivar Peninsula it was worse. Stilts could be seen where beach houses had been. Bolivar did not have the protection of the seawall.

The poor communications policies of the US Weather Bureau contributed to the number of deaths. The combination of the block on information from Cuba and making it more difficult for local forecasters to report hurricanes proved to be deadly in the 1900 storm. The Spanish-American War had occurred in 1898 and led to an attitude by some Americans towards Cubans.

In 1900, the seawall did not exist, although it had been proposed. It was Isaac Cline's article in the Galveston Daily News that partially led to the idea of a seawall and elevating being rejected. The 1900 Storm brought a 15-foot storm surge. Water came in from the Galveston Bay side as well in 1900. The breakwater created by the storm debris probably prevented further damage to property behind it.

When Isaac Cline went to look at the evening sky, he was looking for signs. The "brick-dust" sky in the evening would have indicated a lack of a storm due to a high-pressure system. He was following the adage "Red sky in morning, sailors take warning; Red sky at night, sailors delight". He referred to the morning after the storm as "a most beautiful day" in his memoirs.

The warning time was adequate as warning flags were flying all over. Many chose to ignore the warnings as they had gotten used to the storms. It may be difficult to understand unless you live along the Gulf Coast. I am guilty of this myself, but not with every storm.

The ships in the harbor ended up scattered everywhere. There were only sixteen ships there when the 1900 hurricane came . After hurricane Ike, there were various watercraft of all sizes aground on I-45, near the causeway to Galveston.

The death toll could not be accurately made in 1900, since they made only a small effort at identification. They started burning the bodies where they found them. Some were found a significant distance from where they died.

Legacy and Reflection

The 1900 Galveston Hurricane, also known as the deadliest natural disaster in U.S. history, struck Galveston, Texas, on September 8, 1900. The hurricane made landfall as a Category 4 storm with winds reaching 130-140 mph and a devastating 15-foot storm surge. At the time, Galveston was a thriving port city with a population of almost 40,000 and was the largest city in Texas. However, with the city's highest elevation, only 8.7 feet above sea level (on Broadway), the storm surge completely inundated the island.

The hurricane caused catastrophic damage, with estimates of the death toll ranging between 6,000 to 12,000 people, most cited at 8,000. The storm destroyed 3,636 homes and left 10,000 people homeless. Significant landmarks, including churches, schools, and the St. Mary's Orphans Asylum, were destroyed, resulting in tragic losses, including the deaths of 93 children and 10 nuns.

In the aftermath, relief efforts were hampered by destroyed infrastructure, including bridges and telegraph lines. The Central Relief Committee for Galveston Storm Sufferers was established to coordinate recovery, focusing on food, shelter, and the disposal of bodies. The latter became particularly grim, as bodies were initially taken to sea but later had to be burned on pyres when they washed ashore.

The storm also reshaped Galveston's future. A seawall was constructed beginning in 1902 to protect the city from future storms. The elevation of the island was raised using sand pumped from the Galveston Ship Channel. These measures proved effective when another hurricane

struck in 1915, with significantly fewer casualties. However, the storm contributed to Galveston's decline as a major port, with Houston eventually becoming the primary commercial hub in the region following the opening of the Houston Ship Channel in 1914.

Conclusion

The 1900 Galveston Hurricane was a pivotal event in American history, not only because of its human toll but also due to the long-lasting changes it prompted in disaster preparedness and urban planning. The construction of the Galveston seawall and the elevation of the island are the lasting legacies of the storm, showcasing human resilience and ingenuity. However, the disaster also highlighted the limitations of early 20th-century weather forecasting and communication, contributing to advancements in meteorological science. While Galveston never fully regained its pre-storm prominence, the city’s recovery efforts set a precedent for modern disaster response and urban engineering practices.

Timeline of the 1900 Storm

Event	Date
Isaac Cline writes an article stating it would be impossible for major hurricane to strike Galveston	1891
Fort Crocket is established along the beach front	1897
Spanish-American War	1898
Storm first detected in the tropical Atlantic	08/20/1900
Captain of a cargo ship east of Windward Islands reports as the first tropical storm of the season	08/27/1900
The disturbance passes over Antigua	08/30/1900
Storm enters the northeastern Caribbean	08/30/1900
Storm hits the Dominican Republic as a weak tropical storm	09/02/1900
Hits Puerto Rico and Cuba as a tropical storm	09/03/1900
The first advisory of the storm is received by Isaac Cline from Weather Bureau central office in Washington, DC	09/04/1900 4:00 PM
Storm warning issued for Florida from Cedar Key to Miami	09/05/1900
Storm moves from Cuba in west-northwest direction	09/06/1900
Storm warnings are extended to Galveston, Texas	09/07/1900 9:00 AM
Isaac Cline hoists warning flags on top of the Levy Building	09/07/1900 10:30 AM
Isaac Cline is looking for “brick-dust” sky which he does not see	09/07/1900 Evening
Storm clouds start moving in	09/08/1900 Midmorning
Storm makes a northward turn	09/08/1900 Noon-8:30 PM
The wind speed was measured at 100 mph just before the indicator blew off the building	09/08/1900 6:00 PM
Main tidal surge hits the south shore	09/08/1900 7:30 PM
Storm surge measures 15 feet	09/08/1900

	8:00 PM
The Pherabe takes a group of messengers from the island to Texas City	09/09/1900
The Central Relief Committee is established	09/09/1900
The messengers from the Pherabe arrive at the Houston telegraph office	09/10/1900 Morning
The Galveston Daily News reports that eight black looters were killed	09/11/1900
Wholesale grocers Pabst and Leinbach reopens	09/12/1900
Galveston receives first mail since the storm	09/12/1900
Western Union begins minimal telegraph service	09/13/1900
The Galveston Daily News prints full size paper instead of abbreviated version	09/13/1900
Banks reopen	09/14/1900
The Red Cross arrives in Galveston	09/17/1900
A railroad bridge across Galveston Bay is rebuilt and first train arrives	09/21/1900
Schools reopen	10/22/1900
The Red Cross leaves Galveston	11/14/1900
Survey is conducted indicating a population loss of 8,124	1901 Early
Voters approve a referendum to fund a seawall	1902
First segment of the seawall is completed	1904
Report prepared to consider extending the seawall to Fort San Jacinto	1913
Houston Ship Channel opens	1914
Comparable storm to the 1900 storm strikes Galveston (Category 3)	08/16/1915
The extension to Fort San Jacinto is built	1921
The Saffir-Simpson scale is developed	1971
The seawall is named as a National Historical Civil Engineering Landmark by the ASCE	10/11/2001

Hurricane Ike strikes Galveston as a Category 2 09/13/2008

References

Encyclopaedia Britannica (2025 January 9). *Galveston hurricane of 1900*. Encyclopaedia Britannica, Inc. Retrieved February 2, 2025 from https://www.britannica.com/print/article/1491132.

(no date) Galveston Daily News. *The 1900 Storm*. Galveston Newspapers, Inc. Retrieved March 13, 2025 from https://1900storm.com/.

History.com Editors (2019 June 10). *1900 Galveston Hurricane*. A & E Television Networks. Retrieved February 2, 2025 from https://www.history.com/topics/natural-disasters-and-environment/1900-galveston-hurricane.

Little, Becky (2023 August 25). *How the Galveston Hurricane of 1900 Became the Deadliest US Natural Disaster*. A&E Television Networks. Retrieved March 24, 2025 from https://www.history.com/articles/how-the-galveston-hurricane-of-1900-became-the-deadliest-u-s-natural-disaster.

Longley, Robert (2020 June 29). *1900 Galveston Hurricane: History, Damage, Impact*. ThoughtCo. Retrieved February 2, 2025, from https://www.thoughtco.com/1900-galveston-hurricane-5070052.

McComb, David G. Galveston: A History. The University of Texas Press. Seventh Printing, 2008.

NOAA (2020 September 8). *120 Years Ago Today*. Department of Commerce. Retrieved February 4, 2025 from https://www.nesdis.noaa.gov/news/120-years-ago-today-the-great-galveston-hurricane-made-landfall.

NOAA (May 1999). *Hurricane Basics*. Department of Commerce. Washington DC.

Gomez, Carlos (2024 February 27). *Galveston District Celebrates 144 Years*. US Army Corps of Engineers. Retrieved April 4, 2025 from https://www.swg.usace.army.mil/Media/News-Stories/Article/3688450/galveston-district-celebrates-144-years/.

(no date) Wikipedia. *1900 Galveston Hurricane*. Wikipedia: The Free Encyclopedia. Retrieved February 9, 2025 from https://en.wikipedia.org/wiki/1900_Galveston_hurricane

US Army Corps of Engineers (1981 October). *Galveston's Bulwark Against the Sea: History of the Galveston Seawall*. US Army Corps of Engineers, Galveston, Texas.

Weems, John Edward. A Weekend in September. Holt Publishing. New York. Tenth Printing, (2005).