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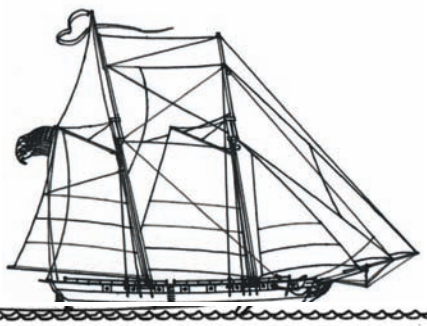

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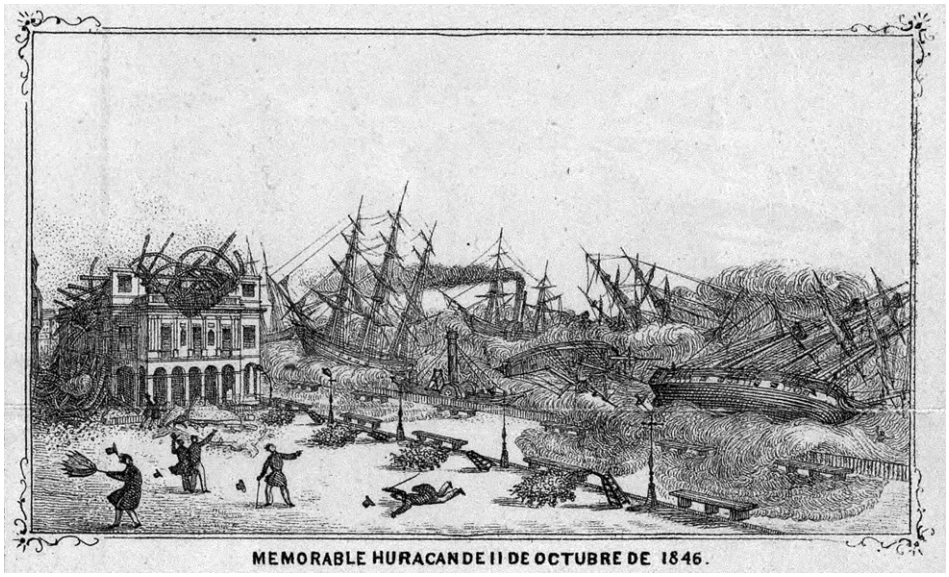
Understanding the Key West Hurricane of 1846

By Corey Malcom

Introduction

Key West is no stranger to hurricanes. Located near the heart of the Atlantic-Caribbean hurricane zone, the small, low-lying speck of land, situated along the northern edge of the Florida Straits, is frequently visited by tropical weather systems. These large cyclonic storms are simply a part of the island's natural weather-pattern.

Hurricanes have been known in the Florida Keys for centuries. Colonial shipping interests were especially vulnerable to them, and tales of maritime disaster account for much of what we know about early storms in the Keys. In 1622, a hurricane that passed just to the west of Key West wreaked havoc on the 1622 *Tierra Firme* fleet, sinking eight of 28 vessels (Lyon, 1989). In 1733, the Spanish fleet from Mexico was destroyed by a hurricane that struck as they passed the middle and upper Florida Keys (Smith, 1997). In more recent years, as weather data collection was systematized, the frequency of these tropical weather systems has been more accurately measured. Between 1852 and 2009, sixty tropical storms



The Memorable [Havana] Hurricane of October 11, 1846. Mapa Historico Pintoresco Moderno de la Isla de Cuba, Hamburg: 1853. Photo credit: Murray Hudson Maps.

or hurricanes have come within 50 nautical miles (57.5 statute miles) of Key West (NOAA, 2010). Based on these figures, Key West has just over a 38% chance of a significant tropical weather system passing quite closely in any given year.

Modern Key West was first settled in 1822, after it became a remote island outpost of the United States, and its earliest days as a fledgling community were not except from the effects of hurricanes. The earliest documented hurricane to strike the island town happened in September of 1827. The storm was strong enough to force the small fleet of military vessels stationed in the port to flee, and it left at least 12 other vessels wrecked along the reef (Anonymous, 1827 a; Anonymous, 1827 b). Eight years later, in 1835, another hurricane moved westward along the islands, striking the Upper Keys on the 15th of September, and then Key West on the 16th, but most of its damage was to shipping interests along the northern part of the island chain (Anonymous, 1835).

On September 5th, 1842, after having first hit Havana the day

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before, another storm struck quite close to Key West (Anonymous, 1842 a). Damage was extensive at Sand Key, on the reef seven miles south of Key West, where the lighthouse keeper's quarters were completely destroyed. Many ships in the area were damaged too, and a wrecking vessel with a crew of thirteen went missing, its crew presumably drowned. But on Key West proper, the storm's impact was apparently more moderate. A writer from the island said, "…the damage on this key is trifling, some old buildings have been destroyed and fences blown over; nothing like it has been felt here for the last 20 years, so say our oldest inhabitants." (Anonymous, 1842 b).

But things got worse two years later. On October 5th of 1844, a hurricane struck the island directly, and it was much stronger than any felt before. This storm also hit Havana first, then wreaked havoc at Sand Key and damaged the lighthouse there, before coming ashore at Key West. Many ships in the harbor were sunk or damaged. The Revenue Cutter **Vigilant** and crew went missing in the storm, never to be seen again. A writer from Key West declared, "The unequal fury of the gale, when at its height, can scarcely be conceived! It swept everything before it – houses, fences, trees, vessels, and almost everything in its course was leveled to the earth or borne off with frightful velocity" (Anonymous, 1844). But as bad as the 1844 hurricane might have been, there was much worse to come: What is thought to be the strongest hurricane known to have struck the island came just two years later, in October of 1846.

The Eyewitnesses

The first-hand accounts of the 1846 storm certainly support the legends of its power. There were a number of witnesses, both on land and at sea, who recorded their observations of the horrifying weather. These eyewitnesses to the storm describe wind, flooding, suffering, and damages that are unparalleled in modern Key West memory, and the following examination of the storm draws heavily from these accounts.

These witnesses saw the events unfold from a variety of perspectives, and they wrote of the storm for different reasons. An anonymous Key West resident submitted a long and especially rich description of the hurricane and its effects to the *New York Herald* (Anonymous, 1846 a). Captain George Dutton of the U.S. Army, in charge of the construction of recently commissioned Fort Taylor, wrote a letter to his superior Colonel J.G. Totten explaining post-hurricane status of the fort-building project (Dutton, 1846). Long-time Key West resident and collector of customs Stephen Mallory wrote to the Secretary of the Treasury Robert J. Walker to notify him of the storm and its effects on the island (Mallory, 1846). Commodore John D. Sloat of the U.S. Navy notified the Secretary of the Navy, John Y. Mason, about his experiences aboard the brig **Perry**, and he also described the devastation suffered at Key West (Sloat, 1846). Another, unnamed member of the **Perry's** crew wrote his recollections of his experience onboard the brig as it was driven back and forth across the Florida Straits between Cuba

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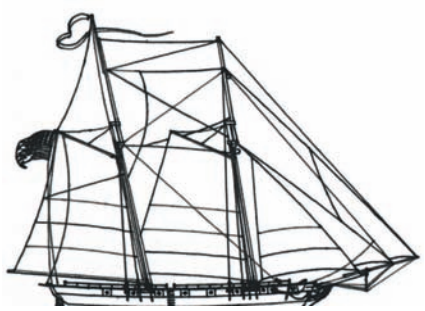
New Member

William and Louis Bienlier, Tawas City, MI; Joan Bollinger, Key West; Jay Johnson and Jill Wolfe, Key West.



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Editor: Tom Hambright

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and the Florida Keys (Anonymous, 1848). Lieutenant William C. Pease, aboard the U.S. Revenue Cutter *Morris*, documented his harrowing experiences onboard ship in the Key West Harbor. (Pease, 1846). Another detailed story of the storm and its effects at Key West was published in the *New Orleans Daily Picayune* (Anonymous, 1846 b).

By compiling information from the various perspectives of these eyewitness accounts and other primary observations, an accurate reconstruction of the storm's fury is possible. All of the eyewitnesses provide a timeline of sorts for how the storm unfolded and progressed. The descriptions of these various eyewitness observers can be looked at for evidence about the effects of the storm and the sorts of damage it caused. Each man had a different vantage point and saw the hurricane unfold slightly differently, but they all describe strikingly similar circumstances both during and after the storm. The words of these witnesses give a good sense of the worst that a hurricane has to offer.

Tract of the 1846 Hurricane. Photo credit: the Author.

The 1846 Storm

On the 5th of October, 1846, the barque **Cora,** at sea in the Caribbean off the Venezuelan coast near Maracaibo, was the first to notice the beginnings of the hurricane (Redfield, 1846). From there, the storm traveled northwestward and strengthened as it progressed. It passed south of Jamaica, where the resulting sea swell caused problems along the eastern end of the island (Schomburgk, 1848). The hurricane maintained its course, and it soon reached the Cayman Islands, where it was quite strong. At those small islands, the hurricane generated a surge of fifteen feet or more, which sent water coursing across the entirety of Grand Cayman at the communities of Savannah and Newlands (Piddington, 1848).

By the 10th of October the hurricane was at Cuba, striking somewhere on the southwestern shore; by evening, Havana was feeling its effects. As the storm raged across the city and through the night, ships were dashed to pieces, buildings fell, and scores of people died. Over 150 vessels were lost in Havana Harbor, destroyed by waves so large they sent water as high as the lanterns of the lighthouse of the Moro Castle. By 11 A.M. on October 11th, the hurricane's fury had passed, but the devastation left in its wake was extreme. "In the city and environs, the injury to the buildings, trees, &c., has been immense and many lives have been lost," wrote a reporter from Havana (Anonymous, 1846 c). Of 104 ocean-going vessels in the Havana Harbor, only 12 were without significant injury. Nearly 50 local coasting vessels were destroyed. "It is not known how many lives were lost, but bodies were seen floating in the harbor, in the different dresses of seamen in the merchant and naval services," said a witness to the next day's aftermath (ibid.).

The Storm Arrives at Key West

Roughly 100 miles to the north, at nearly the same time, the island of Key West was beginning to feel the storm's effects. The anonymous writer for the *New York Herald* was the first to document the indications of the storm's approach. "On the 10th [of October] the barometer gave evidences of change, and by comparing it with the sympiesometer, I was satisfied that there were elements in motion, which would soon be earnestly at work," he wrote. At 3 A.M., the same reporter went to the harborfront and noted that the seas were increasing on a heavy northwest wind. He kept watch of the changes throughout the night and reported that within six hours from his first measure the

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barometer dropped 6/10ths of an inch. Clearly, things were amiss.

The Wind

According to Stephen Mallory, the wind was the earliest indicator of the storm. It first came from the northeast, starting around 10 o'clock in the morning. According to his account, the winds eventually came around to the southwest, reached their peak in the afternoon, and finally abated around midnight. Capt. George Dutton noted similarly that the storm started as a northeast wind around 5 A.M. and increased through the day, when by 3 in the afternoon it "became a tornado." Dutton also said that as the wind increased in strength, it shifted direction to the south, and then the southwest, before abating around 11:00 P.M. By these accounts, the 1846 hurricane could first be felt at Key West on the night of Sunday October 10th and steadily increased through the morning of the 11th. By early afternoon the hurricane reached its full force, and it then blew until close to midnight, when it abated.

Strong wind is perhaps the most distinctive characteristic of a hurricane, and the speed of the wind is the general measure of the storm's strength (Caldwell, 2008). Much of a hurricane's damaging effects result from the forces of strong winds. Key West suffered from them tremendously in 1846. Most of the houses and buildings on the island were built of wood and were not designed to withstand the extreme forces generated by a powerful storm; those built of stone or masonry proved just as vulnerable. These buildings blew apart, and their components hurtled through the air as deadly projectiles, which caused injury to people caught in their path and more destruction as they flew into other structures. Stephen Mallory wrote, "… slates from roofs, boards, and even heavy pieces of timber were driven through the air like straws, one piece of plank, nine feet by fourteen inches wide came from a distance like a Indian arrow and penetrated through the weatherboards and ceiling into one of the Customs House rooms." Capt. George Dutton was also awed by the devastating effect of the wind and wrote, "The houses in town, (stone as well as wood,) were torn piecemeal and scattered away like chaff before the wind…" The writer for the *New York Herald* also said, "… the air was filled with missiles – the slates were driven with deathlike celerity, giving dreadful wounds – rafters, boards and shingles flew with the lightness of feathers, and bricks and stones were falling in all directions." In a virtually identical description, the *New Orleans Daily Picayune's* writer reported, "…the air was full of boards, timber, slate, &c., and buildings falling in every direction. Stone could not withstand the gale…" These eyewitnesses were all in agreement – the storm's wind was fierce, and virtually all of the island's structures could do nothing but disintegrate before it.

The Storm Surge

The wind was only one-half of the terror that was wrought upon the island by the hurricane. The force of the gale also brought with it a flood of seawater that swept across the island and added to the terrible destruction and loss of life. This storm surge appears to have arrived about mid-day or early afternoon on Monday the 11th, driven by the central fury of the storm. As Mallory wrote, "…the citizens began to desert their dwellings and seek the higher ground of the island at about noon when the sea had taken possession of the streets..." He also noted that some people climbed into boats, hoping to stay above the rising tide. The *New York Herald* writer was even more specific about how the flooding unfolded at Key West and said, "It was not until about 3, when the inhabitants of the south western part of the town began to realize their danger. The wind had hauled to the southward and westward, and the waters of the Gulf came rolling in with fearful rapidity, the streets were deepening from the fresh accumulations of each succeeding moment …" He then described how people from along the waterfront areas of the town tried to flee the rising water by wading to the higher ground inland. But at the time, the small town was divided by a large salt pond that ran through the business district from the Bight on the island's north shore, across Duval Street, and ended near the intersection of Caroline and Whitehead streets. The pond was normally passable via a 200 foot-long bridge, but the bridge had failed in the wind. So, the *New York Herald* writer continued, "when the wind veered to the south west, the waters rushed in … sweeping into the pond." This meant that for those along the waterfront to reach higher ground "the only avenue of escape [was] to be effected by swimming through the *debris* of falling houses, the government wharves, &c., &c." In an especially harrowing moment, the *Herald's* writer describes swimming across the pond as the storm raged: "The scene was awful – life's uncertain tenure seemed fast waning to its close – and amid the crash of falling houses, the rolling in of the sea, and the messengers born upon the air, but little hope could be entertained for safety. It was decidedly the tightest place ever I was placed in…"

By all accounts the storm surge was swift and high as it raged across virtually all of Key West. In the inhabited part of the island, Lt. Pease of the Revenue Cutter *Morris* wrote "…the tide was five feet high and running six miles an hour through the center of town, which is rather higher than the rest [of the island]…" The writer for the *New Orleans Daily Picayune* described an almost identical swiftness of the tide, saying, "The current ran six miles an hour through the town of Key West." Similarly, Capt. Dutton, in his letter to Washington, said of the water, "The lower part of the town was inundated to a depth of three feet, with a strong current running across it." Dutton also noted that the area to the south of the town, near Fort Taylor, was even deeper underwater. Stephen Mallory similarly reported that the tide was having a more pronounced effect on the low-lying parts of the island outside of the town. "On the back or North East part of this island the tide covered the land to a depth of seven and a half feet…" he wrote of what were then generally uninhabited areas of Key West. As he tried to evacuate his family from their harborfront home to higher ground inland, he observed, "The sea was then as high as my breast…the entire town at that time (4 o'clock P.M.) being underwater, and its houses falling to pieces or floating off to sea…"

Most of the citizens living along the lower-lying areas north of Eaton Street made their way inland, toward tree-covered, elevated ground (Browne, 1912). There they could find refuge at Solares Hill. This hill is the highest point of Key West at between 15 and 16 feet above sea level (Anonymous, 2005). The *New York Herald* writer documented the confusion that many experienced in getting to this rise: "Women were wading in all directions – children being carried by their friends or parents; and by general sentiment all seemed anxious to attain the higher portions of the town," he wrote. But even once they were there, Lt. Pease wrote, there was little comfort to be found. "The citizens fled to the back part of the town… into the bushes, laid down and held on, expecting every moment the waves would reach them," he wrote.

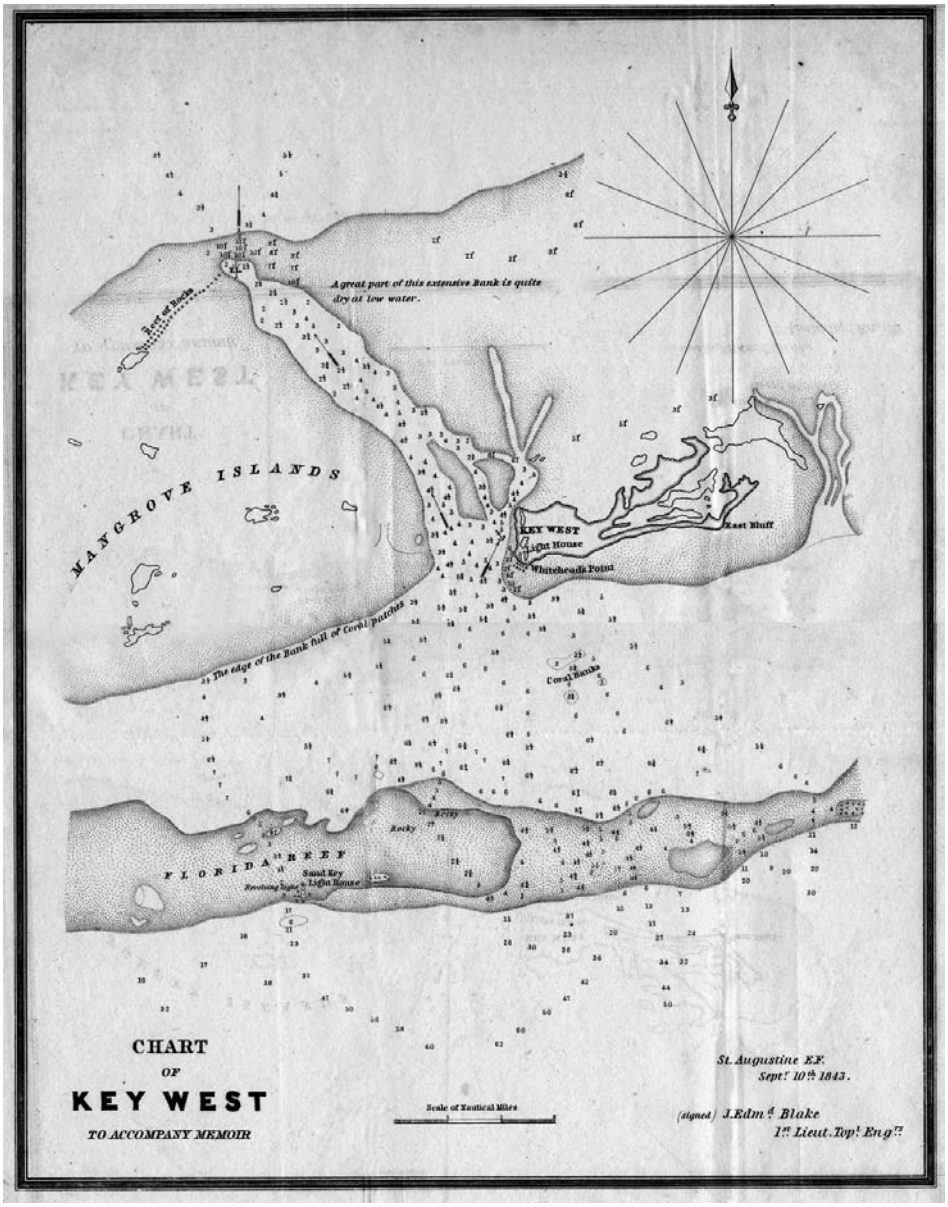

Chart of Key West, 1843, by J. Edmund Blake, US Corps of Topographical Engineers. Photo credit: the Author.

At Sea

Key West was, of course, also a significant seaport that boasted a large maritime community. With dozens wrecking and fishing vessels making their home port there, and others visiting on business, the island's harbor was always filled with ships of varying size and design. The Florida Straits were also generally busy with traffic, as ships exited the Caribbean and Gulf of Mexico via the Gulf Stream current. Because they were all caught relatively unaware of what was unfolding, many mariners were forced to ride out the storm aboard ship. Onboard a vessel at sea was (and still is) nowhere to

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be during a powerful hurricane, and those who rode out the 1846 hurricane onboard ships suffered terribly during the ordeal. Many of the vessels were completely at the mercy of the storm and could not be controlled by their crew in any way. There are three firsthand accounts written by those who rode out the hurricane aboard ships at or near Key West, telling of what it was like to be at sea as the storm raged around them.

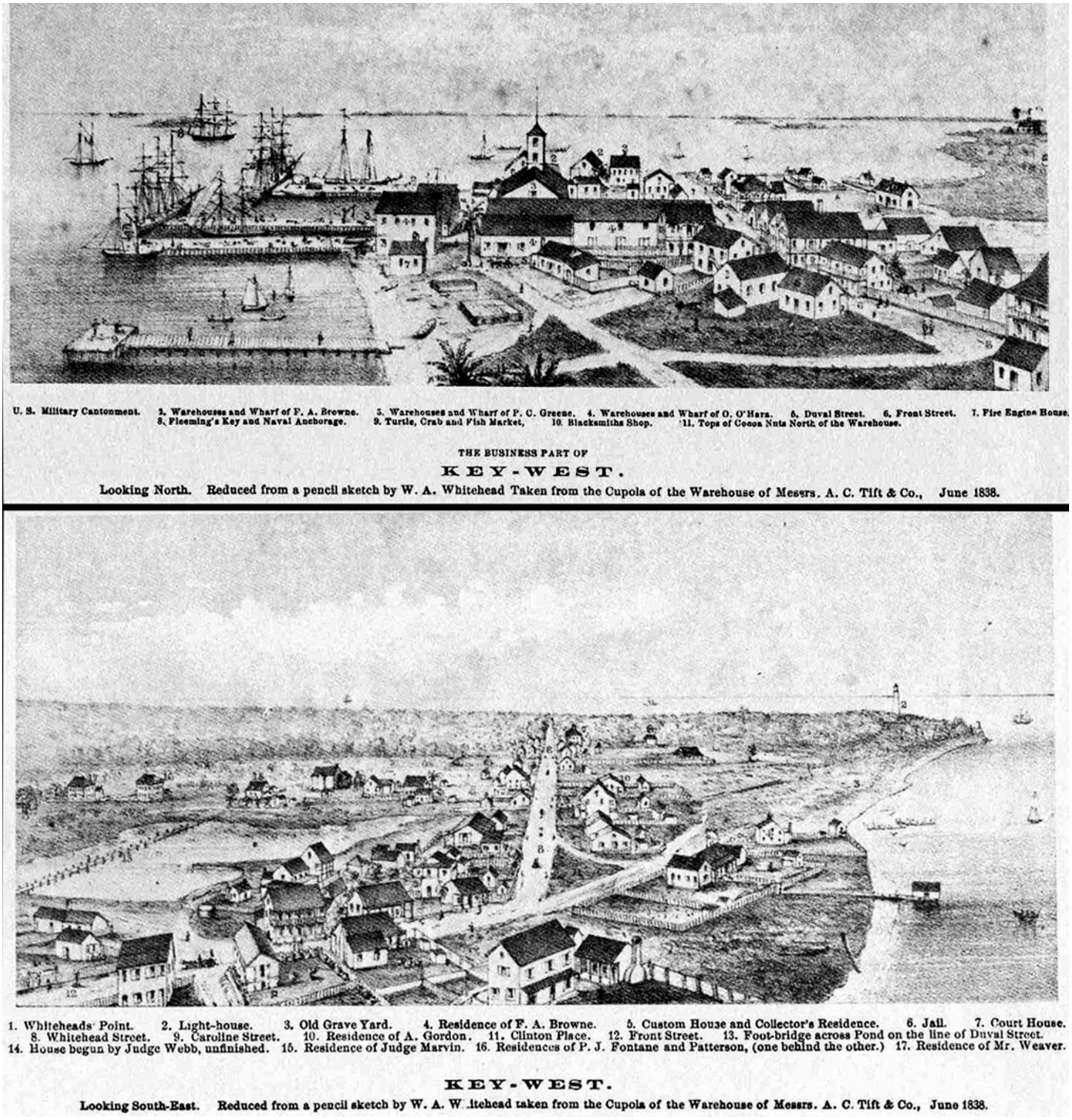
The report of Lt. Wm. C. Pease, who was onboard the US Revenue Cutter **Morris**, relates the story of his vessel as it was toyed with by the hurricane in the Key West Harbor (Pease, 1846). As he wrote in his frightening sketch, "The current was running by us at the rate of twelve miles an hour, the vessel laying broadside to it as well as the wind, made her labor very heavy…" The cutter's anchor chains threatened to part because of the tremendous force being exerted on them by the wind and the sea, and the crew was forced to cut away their mainmast to help stabilize the vessel. And they struggled to keep the vessel afloat; the pumps were going non-stop, supplemented by the crew's furious bailing. To add to their problems, buildings and debris from the town that had been swept to sea created additional hazards for the ships in the harbor. Pease lamented that because of floating wreckage, the harbor was a veritable junkyard: "At 4 P.M., the air was full of water, and no man could look forward for a second; houses, lumber, and vessels drifting by us; some large sticks of timber were turned end over end by the force of the current, and the sea was running so high, that as it broke over us, it brought lumber, casks, &c., &c. on board, and carried them across our decks." Soon after, the **Morris** began to drag anchor and be carried away by the wind and the current. The crew had no idea where they were headed – "…our compasses flew round in such a manner that they became useless," wrote Pease. Not too long after they were cast adrift, a heavy sea struck them, which rolled the **Morris** on its side. This jolt carried away everything on the decks and shifted the equipment stored below. In a desperate attempt to right their unstable vessel the crew heaved the cutter's iron guns overboard, "all hands expecting momentarily to go to the bottom," said Pease.

Sometime after night had fallen, the **Morris** struck bottom and held fast, despite being persistently battered by the wind and seas. At the dawn of next day, Pease and his men found the cutter in two feet of water on the shoal flats north of Key West. "Around [us] are wrecks of every description; one ship on her beam ends, three brigs dismasted, all three schooners; three vessels sunk in a small channel, and four vessels bottom up. How many persons attached to these vessels have been drowned I am unable to say," wrote Pease.

Commodore John Sloat, aboard the USS **Perry** also gave a shipboard perspective of the hurricane. The **Perry** had just left Havana for Charleston when it was caught in the storm, and it had the unfortunate fate of riding the full circuit of the wind through the Florida Straits. The **Perry** was first driven southward and nearly dashed on the Cuban coast, when the wind switched and sent it northward toward the reefs of the Florida Keys. The *Perry* was eventually hurled upon a shoal approximately 40 miles east of Key West. After reaching Key West, Commodore Sloat wrote a letter to his superiors in Washington, which was published in a number of newspapers (Sloat, 1846). "During the night it commenced blowing a gale, and on Sunday it increased to a tremendous hurricane, such as has never been witnessed in those seas," he noted. "During the whole day and Sunday night the brig was driven before it at the rate of 12 or 13 miles per hour, and no one on board expected her to live from one moment to another," he wrote about the **Perry's** being hijacked by the storm. At last the brig struck the reef but was quickly carried over the rocks by the high water to a shallow bar, where it came to rest, still in one piece with all hands safe and sound. But things were not good. "At daylight [Monday] we found we were within a mile of one of the Baya Honda Keys, and several wrecks near us. On board of one, not half a mile from us, twenty lives were lost out of twenty-one," Sloat reported of the sad scene around them.

Another member of the **Perry's** crew (who, for unknown reasons, wrote anonymously) described the brig's harrowing passage even more vividly: "We lost all knowledge of our position, and were driven at the mercy of the winds and the waves – where we were going or where we might strike, no one could tell. We could do nothing more. Two or three men to steer, and one officer to watch the course, were all that were required. It was next to impossible to make the voice heard, and the few orders were conveyed principally by signs. All hands were on deck, and we waited our fate in silence. Oh! What an awful day was that!" (Anonymous, 1848).

This same crewman described the scene after the storm had passed, and the **Perry** had gone aground. A small boat sent from the brig inspected the damage in Hawk Channel between Bahia Honda and



Key West, 1838, by William Whitehead. From Key West the Old and the New (Browne, 1912) The upper image shows Key West's working waterfront, from the Bight to the Harbor. The lower image looks southward, with the Key West lighthouse visible at the upper right. The salt pond is to the left. In 1846, Key West would have been approximately twice the size of the town depicted in these images. Photo credit: Monroe County Library.

Key West. The boat's crew reported back to the **Perry**; "In pulling down inside the reef, they found the whole channel filled with boxes, barrels, bales, &c, the cargoes of wrecked vessels. The whole coast was strewed with wrecks."

As the **Perry's** crew observed, many vessels in and around Key West and the Florida Keys suffered damage or destruction. According to Stephen Mallory, the Northwest Passage Lightship broke from its

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moorings and, with anchor chains dragging from its bow, was blown stern-first some sixty miles into the Gulf of Mexico. At least twenty-six vessels of varying design were lost or damaged at Key West. Four or five vessels lay bottom up near the island, and another twenty-one were scattered up and down the reef. All but one of the Key West wrecking fleet was lost or damaged. Some vessels were carried onshore by the surge. "One large brig drove up into the woods, and now she stands without her masts, perfectly upright, and no water near her!" wrote the **Perry's** anonymous correspondent. A schooner carrying a new light for the Tortugas lighthouse was lost near those islands. And there were other ships that simply vanished, leaving only circumstantial evidence to tell of their loss. In one case, unaccompanied bales of cotton floated eerily into Key West Harbor, "… some vessel, cotton loaded and not yet heard from, must have been in the hurricane and suffered from its violence," wrote the *New Orleans Daily Picayune's* correspondent.

Damages

As has already been made evident, the force of the wind and water caused considerable damage to both the island and town of Key West, but eyewitness accounts provide remarkable specifics about nature and scale of these injuries. The damage to the buildings of Key West was absolutely catastrophic. The exact number of structures standing on the island in 1846 is not known, but from the various accounts it appears to have been somewhere around 500 buildings. Of these, over 95 percent were rendered uninhabitable. As Stephen Mallory reported, "Every building in this town was more or less injured, all but eight (as far as I can learn) were blown down, floated to sea or unroofed. Four fifths of the real estate are destroyed." This same devastation is echoed by all of those who commented. Fort Taylor's Capt. Dutton said, "…of about 400 houses, large and small; there are not more than 10 or 12 left standing or in a habitable condition, and those are much shattered…" Reaffirming this observation, the writer for the *New Orleans Daily Picayune* said that, along with the severe damage suffered by all of the town's warehouses, "…the streets of Key West are full of lumber, and not six out of six hundred houses but what are either unroofed or blown down." The combination of wind and water was simply too much for the town's houses, and their destruction was nearly complete.

And it was not just wooden houses that were ruined; other, much more substantial buildings suffered, too. The newly built Marine Hospital, a strong stone and masonry building along Key West's western shore, was nearly destroyed. According to Stephen Mallory, some of the damage to the hospital occurred when the surge, some 5 to 6 feet deep at that part of the island, destroyed a nearby wharf, the remains of which were then carried into the southeast corner of the building. Another renegade raft of timber then hit the hospital from the northwest. These impacts damaged the structure on two sides up to a height of twenty-five feet. Additionally, the wind removed the building's roof except for the mainframe and principal rafters. Those inside the hospital were terrorized as the building appeared to be coming apart from above and below. "The occupants of the Marine Hospital were expecting every moment to go into eternity. It is a large stone building, and being surrounded with 5 feet water, running by six miles an hour, cutting the sand out from the foundation…" wrote Lt. Pease. And, much as described by Mallory, Pease also noted that thirty feet of one wall had been removed and fifteen of another. Apparently, it was only through sheer luck that the hospital was left standing at all. "The U.S. marine hospital suffered much, and if the gale had continued much longer, would necessarily have fallen," wrote the reporter for the *New York Herald*.

Construction on the US government's Fort Taylor had started in 1845, and the completed fort was to be a large masonry structure sitting on a stone foundation in 10 to 12 feet of water off the southwestern shore of the island. The beachfront grounds used as a base camp for the construction were approximately one-half mile south of the town, and the hurricane damage was exceptionally bad near this part of the island. By the time the storm left, all of the equipment employed in the fort's construction was wrecked, scattered, and washed into town. "The wharves, bridges, houses, lighters, boats, tools, machinery, and materials, ordnance stores in short, all have been swept way, and mixed up with the general ruin," wrote Captain George Dutton. Lumber intended for the project was blocking many of the streets, and even substantial objects like cannon carriages and crowbars were found in the middle of town. The camp's stable was carried by the surge for 200 feet, but it came to rest intact, with the horses and mules surviving inside. One of Dutton's men survived the chaos by floating for 300 yards toward the hospital on the wheel of a cannon carriage. Four men were swept by the water from the construction camp's barracks to

their deaths. The only structure that was not damaged at the fort was a brick cistern built onto the bedrock. A discouraged Capt. Dutton wrote bluntly to his superiors, "In brief terms I have to report the total destruction of all the works thus far erected for the construction of the fort." Like Dutton, Stephen Mallory saw nothing salvageable from the fort project. "The works under the Engineering Dept. here are destroyed and in fact they are now in a worse condition than when they were before their commencement," he wrote.

The lighthouses, one at Key West, and another, seven miles to the south on the reef at Sand Key, both of masonry construction, were two of the other substantial structures in the area. But both buildings also had a fatal design flaw: neither was founded upon the bedrock (Anonymous, 1846 d). As the pounding waves and rushing water scoured the sand and coral rubble out from underneath them, both lighthouses collapsed; their destruction was complete. The *New Orleans Daily Picayune's* writer said bleakly, "Key West light-house and dwelling attached are entirely gone. The spot where they stood is covered by a white sand beach." Commodore Sloat noted similarly, "Of the lighthouses at Key West and Sand Key not a vestige remains; Sand Key is washed away, so that the sea flows over it." By Stephen Malloy's tally, twenty people died while trying to find refuge at the two lighthouses – fourteen at Key West; six at Sand Key.

Not even those who were already dead were spared disruption by the storm. There were two cemeteries on the island in 1846, a military one near the Marine Hospital, and a public one behind the natural dune ridge paralleling the southern beachfront. Both of these burial grounds were destroyed. Mallory described a macabre scene along the south shore where the graves had been disinterred, "…the dead were scattered through the forest many of them lodged in trees…" And of the military cemetery he wrote, "the dead from Comm. Porter's grave yard with the site of the yard are entirely washed away…" The *New York Herald* reported that sixty hurricane-exhumed bodies were reburied after the storm.

As for the other structures on the island, the hurricane's damaging effects were all-inclusive – no building was immune. "The churches, Episcopal and Methodist, both fell; and the new stone edifice for the Methodists, is likewise down,' reported the *New York Herald*. All of the wharves were destroyed, and none of the warehouses designed to hold salvaged goods from wrecked ships avoided damage, noted Lt. Pease. Stephen Mallory reported that the entire works of the Lafayette Salt Company, on the eastern end of the island, were completely washed away.

The one place relatively unscathed after the storm was the U.S. Army barracks on the north-central shore of the island. These structures "escaped with less damage than any other buildings, but they have been slightly damaged," wrote Com. Sloat. But the Army did lose some of their stores and wagons, which were carried into the harbor.

The unnamed writer from the US Brig **Perry** summarized the post-hurricane scene at Key West, and he painted a bleak picture: "The town itself is in ruins – not a house uninjured – many blown away entirely, and some gone to sea, while others are sunk in the harbor. Trees torn up by the roots lie scattered in every direction, while those yet standing are shorn of their limbs, blackened and shriveled, as though a withering fire had passed over them. All, all is in desolation…"

Deaths

There were many deaths that resulted from the 1846 hurricane. But because of the confusion in the aftermath of the storm and, perhaps, attrition to the historical record, the exact figure will probably never be known. Nonetheless, relatively accurate accountings can be made from the eyewitness accounts to get at least a sense of how many people lost their lives on that day. As was said before, fourteen were killed when the Key West lighthouse fell, and six died at Sand Key. Four men at Fort Taylor were lost. Three men died when the Pilot Boat **Lafayette** sunk; the Brig **Exchange** lost the 1st mate overboard; a man named "A. Wilson" died when the Sloop **Frankford** capsized; nineteen drowned on the schooner **Villa Nueva** when it went down; and four or five vessels were found wrecked with no sign of life and no bodies onboard (Anonymous, 1846 a). The number of dead on shore was nearly as great. Beside the fourteen killed when the lighthouse fell, twelve others are listed as having been killed by flying debris, collapsing structures, or being carried away in buildings that were swept to sea (Anonymous, 1846 e). But there were probably more. The writer for the New York Herald said, "Our own loss here is about 40. Some few have been found and buried." Bodies were found days after the storm, mixed in the debris and rubble. The *New Orleans Daily Picayune* reported, "Dead bodies are occasionally dug out from under the ruins, and no one can tell how many there are remaining. As far as can be ascertained, fifty persons have lost their lives…"

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For the record, sixty dead are recorded across the various historical accounts, with an unknown number of missing. But whatever the exact figure, for a town of approximately 1,500 people, the losses were significant.

Geological Alterations

The forces of the hurricane affected more than just the people of Key West and their property. There were also physical alterations to the area's islands themselves. Perhaps most significantly for Key West, the salt pond that occupied the center of town was irreversibly changed. According to one report, "The great gale of October 11th, 1846, so altered the configuration of the island by the washing up of the sand, that the pond ceased to receive its tides…" (Maloney, 1876). With a barrier blocking its flow, the pond became stagnant and a detriment to the community. So much so, in fact, that in 1853, a previous edict to keep the pond open and clear was reversed, and the owners of the submerged lots within it were required to fill them. (As a direct result of the hurricane of 1846, the heart of much of modern Key West's tourist district now occupies these filled wetlands, including Sloppy Joe's Bar and the Old City Hall.)

In December of 1846, it was reported that Sand Key, which had been completely obliterated immediately after the hurricane, had re-emerged. This time, though, the sand and rubble island was some fifty feet to the west of its original position. Where the Sand Key lighthouse and keeper's quarters had been was two feet under water (Anonymous, 1846 f).

Reconstruction

The Key Westers of post-hurricane 1846 may have been shocked and stunned by what had happened to them, yet they had little choice but to move forward and rebuild. Sitting on one of the most remote territories of the United States, they would have had to migrate many miles by sea to reestablish themselves anywhere else. Not only would it have been logistically difficult, but abandoning Key West probably did not make economic sense either, especially if continued growth in the wrecking and fishing industries was feasible. So, the residents of the island stayed, and they did rebuild. Some 30 years after the storm, the Key West historian Walter Maloney remembered the post-hurricane reconstruction with pride as he wrote of the courage of the island's inhabitants, "They did not stop to shed tears over their misfortunes. The sun rose the morning after the storm to behold active limbs and stout hearts clearing the ground of the debris, and the waning moon of the next night shone upon the bright hammer of the mechanic as he drove firmly home the nails in the reconstruction of their homes and their businesses" (Maloney, 1876).

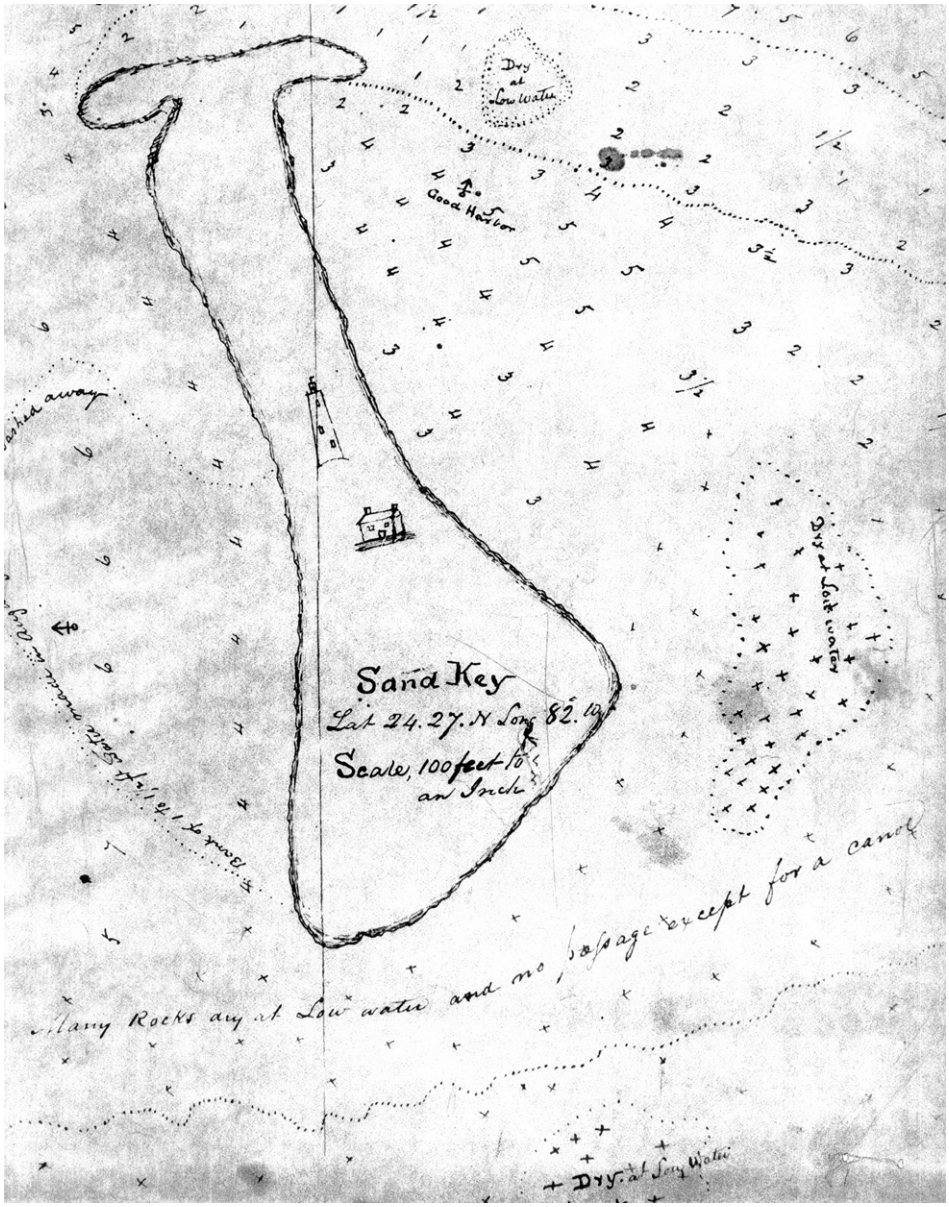
The situation as it was recorded by eyewitnesses immediately after the storm was a bit different. The writer for the *New York Herald* simply sent out a plea for charity: "Will the benevolent not come up and give us a helping hand, strengthen us amid our distress, and yield to those who in their sorrow are truly to be pitied, some of their sympathy and excess of worldly comfort?" Indeed, the needs of the post-hurricane Key Westers were many. With the destruction of virtually all the town's dwellings, there was a terrible homeless problem. According to the *New Orleans Daily Picayune*, the housing situation was relieved to some degree through the generosity of the U.S. Army's Quartermaster, who allowed many of these people to occupy the barracks. Adding to the difficulty, most of the town's water supply was mixed with salt water because the island's cisterns had been flooded by the surge. And there was a shortage of food; much of it washed away or otherwise ruined. According to the same newspaper account, the Captain of the Revenue Cutter **Morris** salvaged the stores from aboard a wrecked schooner and gave them to the Methodist minister to distribute to the needy. And, unlike Maloney's glowing recollection of the situation, Stephen Mallory saw great difficulty in rebuilding due to a shortage of supplies and labor. "Not a slate can be procured here; not a carpenter to perform the work, without paying him exorbitant prices," he wrote. Even into the next year, the shortage of labor and supplies was so acute that two Bahamians who had recently immigrated to the island found it more feasible to ship their homes from the Abacos than to struggle to build new in Key West (Kerr, 2005; Starr, 1972).

There were problems for those working and traveling on the water, too. Within a week of the storm's passing, a ship was wrecked west of Key West because of the lack of lighthouses (Anonymous, 1846 g). Shortly after this wreck happened, the crew of the Cutter **Morris** erected a day-marker consisting of a sixty-foot tall staff with a black ball on the top near the site of the ruined Key West lighthouse to help alleviate danger to shipping (Anonymous. 1846 f). Eventually, a temporary lightship with an apparently feeble light was put in place on the reef, but despite its inadequacy, it was still there four years later. "The light-ship stationed near Sand Key is old, and the light miserable. Several vessels and much valuable cargo

have been lost, by the neglect of the government to build a light-house on Sand Key to replace the one destroyed by the hurricane of 1846," the frustrated insurance agent John Hoyt wrote from Key West (Hoyt, 1850).

Years later, the storm's effects were still evident to visitors, with the loss of vegetation being the most noticeable. One writer describing the island after an 1850 visit said, "Key West looks like a place where nature "has been and gone" – a few utterly blasted trees, (killed and stripped of bark by a hurricane four years ago,) being the only sign I saw of indigenous vegetation." (Willis, 1854). And even two years after that, the damage to Key West's vegetation was still apparent, as was noted by a visitor who said, "The unoccupied parts are covered with low stunted wood and bushes, the larger trees having been prostrated by the destructive gale of 1846." (T., 1852). Even in the early 1880's – some thirty five years after the hurricane – the renowned 19th century marine scientist Louis Agassiz noted that on Key West "…even at present, the rushes, driven upon it by the flood [of 1846], may be seen among the trees and bushes, at a height equal almost to its loftiest summit."

And the scars were not just evident in the island's landscape and vegetation. The hurricane's survivors had been changed, too. Writing two years after the storm, the anonymous crewman who had ridden it out it out onboard the US Brig **Perry** wrote "It is actually painful to me at times to think of [the hurricane]; the mind becomes wearied in dwelling upon the awful sights then witnessed." He was not alone in his unease. Those at Key West had seen the worst that nature had to offer, and they were wary. They knew to be afraid



Sand Key, pre-1846, showing the lighthouse and light keeper's quarters. Photo credit: Monroe County Library.

when bad weather threatened. Key West attorney William Hackley commented on this anxiety in his diary as another storm threatened, and the islanders restlessly awaited its arrival. "During the night I was up several times to look at the barometer. At 11P.M. it was 29.42, at 5 A.M. 29.45, at 6A.M. 29.46. The wind during the night was fresh with some rain and this morning it looks [to be] threatening a gale, the people last night were nailing up windows and securing their houses till late. The hurricane of 1846 has made cowards of us all," he confessed (Hackley, 1853).

Estimating the Hurricane's Force

Judging solely from the eyewitness accounts, the storm was a major hurricane, but with no identified observations taken at Key West during its peak, an understanding of the storm's intensity has to be deduced from a variety of sources. We know there were barometers being used on the island at the time, but if any readings were recorded, they have not been found. Fortunately, though, three barometric pressure readings taken when the storm was at Havana have

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survived from there. Even though these observations were made 100 miles away, they serve as the most reasonable measures of the storm's intensity at Key West.

When the storm was at Havana, one of the lowest barometric readings ever – 27.06 inches of mercury (916 millibars) – was reportedly recorded (Garriott, 1900, p.58). It has been suggested that, with its extreme and poorly documented "outlier" position, doubts about its accuracy are warranted (Fernández-Partagás, 1993). Fortunately, though, there were at least two other observations recorded at different locations in Havana, though, and these readings were both quite similar. The first was a measure of 27.74 inches, or 939 millibars (Anonymous, 1846 h, Garriott, 1900 p.59). The other, recorded aboard the Steamship **Thames** in Havana Harbor, was a reading of 27.70 inches of mercury (938 millibars) (Hast, 1847). At 938 or 939 millibars, the hurricane (at least when it left Cuba) was a category four storm, perhaps approaching category five strength. According to the Saffir-Simpson scale of hurricane intensity, a category four storm would have had winds between 131 and 155 miles-per-hour (Caldwell, 2009). More specifically, according to the Dvorak Current Intensity Chart, a storm with a barometric pressure of 938 or 939 millibars would have sustained winds of approximately 143 miles-per-hour (NOAA, 2007). It is difficult to know if the storm strengthened before striking Key West, but, judging from the survivors' accounts, it does not appear to have weakened in any way.

The storm surge at Key West in 1846 certainly came higher than it ever has again. As stated before, the water was observed to have run at depths of three to five feet through what was then the town in the northwest corner of the island, and at seven and a half feet over the less-elevated eastern side of the island. After the hurricane, Capt. Dutton of Fort Taylor drew a sketch of the western end of the island and included the storm's high-water line His mark is at what is approximately the 8-foot elevation contour today. In an inset on the same drawing, he shows the high-water at 8 ½ feet above low tide. As a bit of additional evidence to confirm these measurements, Capt. E. B. Hunt of the US Army Corps of Engineers noted, "The gale of 1846 raised the water to within seven feet of the apex [of the island]…" (Hunt, 1863). Combining all of the figures and observations supports, Dutton's estimate of the storm surge that inundated the island. If by one measure the water was seven and a half feet on the eastern portion of Key West, where land rarely exceeds one or two feet in elevation, and by another it came to within seven feet of the island's highest point, a fifteen-and-a-half foot peak, the storm surge in 1846 must have been somewhere between eight and nine feet above normal. These measures would be consistent not only with Capt. Dutton's measure, but with the other eyewitness accounts of the town's severe flooding. According to modern maps, most of the then inhabited portions of Key West would have ranged between two to eight feet above sea level (City of Key West, 2005), meaning the water affected virtually everyone.

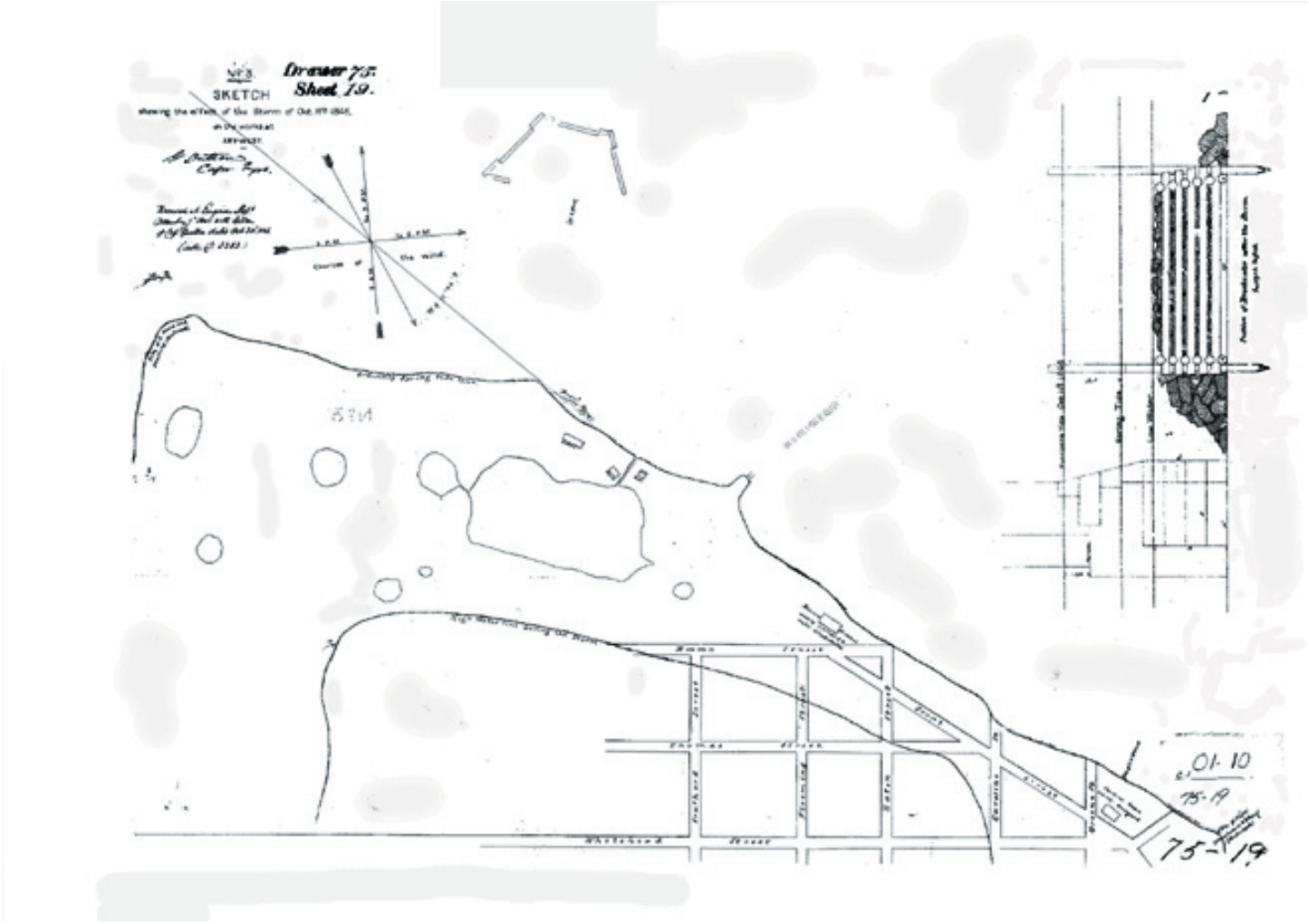
What Lessons Can We Learn?

Assuming the past is prologue, the lessons of the 1846 hurricane are important ones for modern Key Westers. The storm certainly appears to have been the most powerful in the island's history, but that does not mean it will forever retain that dubious honor. There is every reason to believe what happened then will likely happen again – but the next time, if people are armed with the knowledge of the past, the effects should not be a surprise.

The historical evidence clearly confirms that Key West was hit by a very large and powerful hurricane in 1846; one that was at least a strong category four storm. There have been many direct hits and close calls at Key West since, but never a storm to equal the one that came ashore then. Some of the lessons provided by the accounts of the hurricane's survivors are obvious (i.e. it is never wise to stay on a boat during a hurricane), but some are not so evident. To help fill in these gaps, the destruction Key West suffered in 1846 provides authentic and concrete examples of what would happen in a repeat of similar events.

Though we have stronger structures than existed in 1846, there will still be significant damage from the wind. Fortunately, Florida's building code, and Monroe County's more than most, has been fortified in recent years so that newer structures are more wind resistant than ever. With these codes, newer buildings fare much better than those built before (Pielke, et al, 2008). So, as a result of improved construction techniques, wind damage to modern structures from a similar storm should be considerably less. But wind-borne debris in the form of tree-branches, roofing tiles, and pieces of buildings that did fail, among any number of other things, could not be avoided and would still cause damage to life and property.

Perhaps the biggest hurricane-related problem for Key West, though, and one that is not easily resolved, is that many, many homes



Sketch showing the effect of the Storm of October 11th, 1846, on the works at Key West by Captain George Dutton
To illustrate the damage at Key West to his superiors in Washington, Capt. George Dutton drew a sketch showing the effects of the hurricane on the western end of Key West. This sketch includes a number of important details about the storm. In the upper left, there is a series of arrows showing the wind changing from northeast to southwest as the storm progressed. These measurements are consistent with a direct strike on the island by a storm passing from south to north. Also, the high-water mark is shown. This mark follows what is roughly the island's eight-foot elevation contour. Additional features are also drawn, such as the locations of the lighthouse, the Marine Hospital, the Ft. Taylor construction camp, and the custom house. Photo credit: United States National Archives, Records of the Office of the Chief of Engineers, *Record Group 77*
Adapted from A Field Guide to Fort Taylor by James J. Miller (2005).

and businesses have been built in the lowest elevations of the island – areas that were uninhabited in the 1800's. This means that the damage from the same degree of flooding as occurred in 1846 would be much more extensive. A limited preview of this scenario was delivered with Hurricane Wilma in October of 2005, when a storm surge of 4 to 6 feet flooded over half of the island's homes (Kasper, 2006). Many who went through Wilma's flood were able to stay above the water by climbing onto counters, tables, or other furniture. But if Key West were to face a surge of 8 to 9 feet again, the many single-story homes built at ground level in the lowest elevations of the island would provide no shelter. Water would fill these dwellings almost to their ceilings, and their occupants would be forced into attics or onto roofs to avoid drowning. And, as was observed in 1846, it was not just the height of the storm surge that caused the damage – it was the swiftly rushing current, combined with wave action and floating debris, which worked to batter walls and undermine structures, causing them to collapse. Any building in a flood zone today, even those built of masonry or concrete, would be susceptible to this same sort of water-caused damage, and those that are built on soft ground such as fill or sand could be subject to undercutting and destabilization from scour.

An additional problem revealed in the 1846 experience was that

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many of the wooden buildings were not fastened to the ground and were swept away in the high storm surge and carried to sea. To this day there are still wooden homes in the older parts of Key West sitting untethered on stone pilings, anchored only by utility lines. There is little to prevent these structures from repeating the past and floating off their foundations in another severe flood.

Interestingly, none of the 1846 accounts mentions rain. The heavy rains often associated with tropical weather systems can also create a significant 2nd level of flooding, during or after a storm. The residents of 1846 Key West appear to have been spared such a scenario.

Today, we are fortunate to have an array of technology that allows us to track the progress of hurricanes in near real-time and predict where they are likely to strike, well before they make landfall. And the expected size and intensity of storms can be predicted with ever-improving accuracy. All of this information allows those who might be affected by a hurricane ample time to plan accordingly. Certainly, evacuation should be considered a basic option for Key Westers when any hurricane threatens, especially powerful ones. As has been seen, a strong hurricane like the one that struck the island in 1846 would show little mercy to those that chose to stay. At least four percent of Key West's inhabitants died in the 1846 Hurricane. (With a population on the island estimated at 23,262 (Anonymous, 2010), four percent today would translate to well over 900 people dead!) And those people died in a number of ways: some drowned in boats; some drowned in their homes; some were swept to sea; some were crushed by falling buildings; and others were struck by flying debris. There was simply nowhere safe at Key West during the monster hurricane of 1846. And there won't be again.

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Sand Key Lighthouse drawn by William Whitehead. Photo credit: Monroe County Library.

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