The Impact on Great South Bay of the Breach at Old Inlet

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This is the sixth in a series of reports describing the evolution of the breach at Old Inlet and the impact it has had on water level and water properties in Great South Bay. This report also updates the aerial surveys and includes all the observations of water level and salinities through January 28, 2013. Since the last report, we have retrieved the sensor at Barrett Beach, which completes the analysis of water level data through the time of super storm Sandy, Figure 1. All the sensors have been redeployed while the Bellport sensor is reporting its data realtime through the GSB Observatory website (http://po.msrc.sunysb.edu/GSB).

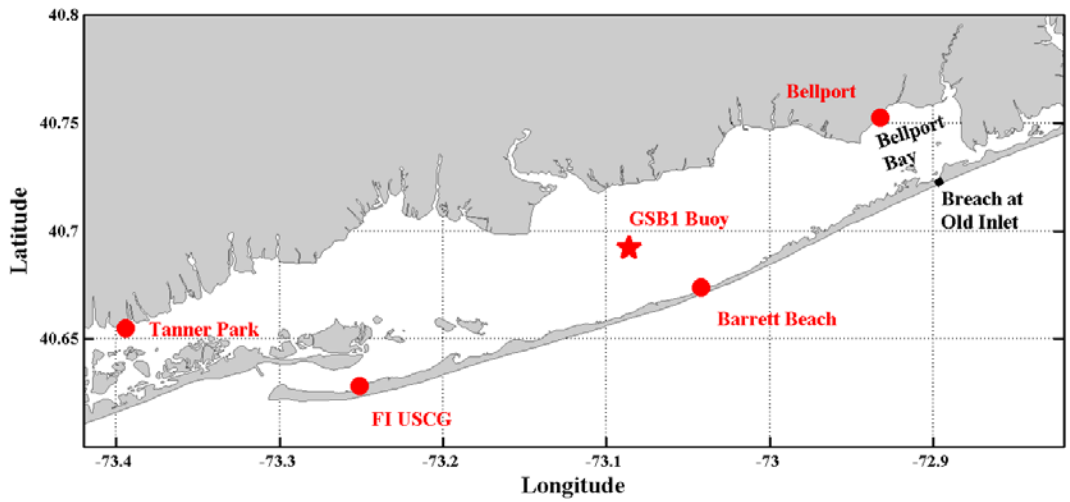

Figure1. Map showing the location of the breach at Old Inlet, GSB1 buoy and the sensors deployed around the perimeter of the Bay included in this report.

The latest aerial overflight took place on January 27th at noon eastern standard time. To illustrate the the ongoing evolution of the inlet, a photo from the previous flight on January 6th is shown in Figure 2. The January 6th photo shoot took place shortly after the two storms that occurred in late December. At that time, an offshore bar had formed along the eastern beach and moved onshore creating a series of ridges and runnels that eventually connected to the ebb shoal. The ridge/runnel system extended all along the beach to the east and so was not inherently associated with the inlet morphological dynamics. As the offshore bar moved onto the beach, it cut off the east channel and forced all the tidal flow to use the west channel, causing it to enlarge and move into the center of the inlet. The ebb shoal delta that had been prominent in earlier photos had eroded away. Significant deposition had occurred along the eastern edge of the inlet, especially at the northern end, while along the western edge of the inlet, there had been considerable erosion with the shoreline moving up to the scrub line.

Figure 2. Aerial photo taken by J. Flagg and C. Flagg on January 6, 2013.

In the three week period between the photos in Figure 2 and Figure 3 (1/6-1/27), there has been a period of strong, but not storm, winds out of the west, and in the last week the weather has been cold enough to freeze much of eastern Great South Bay. The evolution of the inlet on the bay side was not that extensive, but there were significant changes at the ocean end, Figure 3. The offshore bar that was in the process of moving shoreward on January 6th has completed that process, and the sand associated with the ridge and runnel system along the eastern beach has completely joined the beach. The sand, which was part of the offshore bar that extended into the inlet, has attached itself to the eastern edge of the inlet, while the sand at the northeast corner of the inlet has disappeared. The ridge and runnel system that had been prominent along the eastern beach has now formed along the western beach and extended into the inlet forming a new ebb tidal delta, while the main channel appears to have shifted slightly to the east as a result. And there has been some additional erosion of the dune to the west.

The water was extremely clear during this latest over flight, which permits a good view of the channels in the back bay area. These channels show up quite prominently in Figure 3 as does the extensive area of sand deposited in the Bay as a result of the inlet formation and overwashes to the east. It now appears that there is one major channel to the west close along Fire Island and two possibly shallower channels to the northeast past Pelican Island. There had been snow during the previous week so anything that shows up white is clearly above the high tide line and that includes a number of portions of the new sand islands.

Figure 3. Aerial photo taken by C. Flagg and D. Richards on January 27, 2013.

For the flight on January 27th, a video camera was fixed to the plane so that it looked straight down providing photos with minimal spatial distortion and from which one can make direct measurements. A mosaic of video snapshots (courtesy of Mark Lang) taken of the inlet from a height of 2000 feet is shown in Figure 4. To get a scale, one can use the remnants of the Old Inlet dock that measures about 52 meters from the cross of the "T" on the northwest end to the last piece of the dock to the southeast. If we use that as a scale, the narrowest part of the inlet is about 85 meters across while the deepest part of the channel, marked by the darkest colors, appears to be about 25 meters across. The narrowest part of the channel to the west is also about 25 meters wide while the channels to the northeast, although not that well defined, vary from 10 to 20 meters wide. The flood delta shows several lobes and channels, and it is clear that some sand deposits are now above water, since there is white snow evident in many places that in the past were under water. At the ocean end of the inlet, the light colored sand shows quite a bit of shoaling to the west and even a small bar forming along the eastern edge of the main channel.

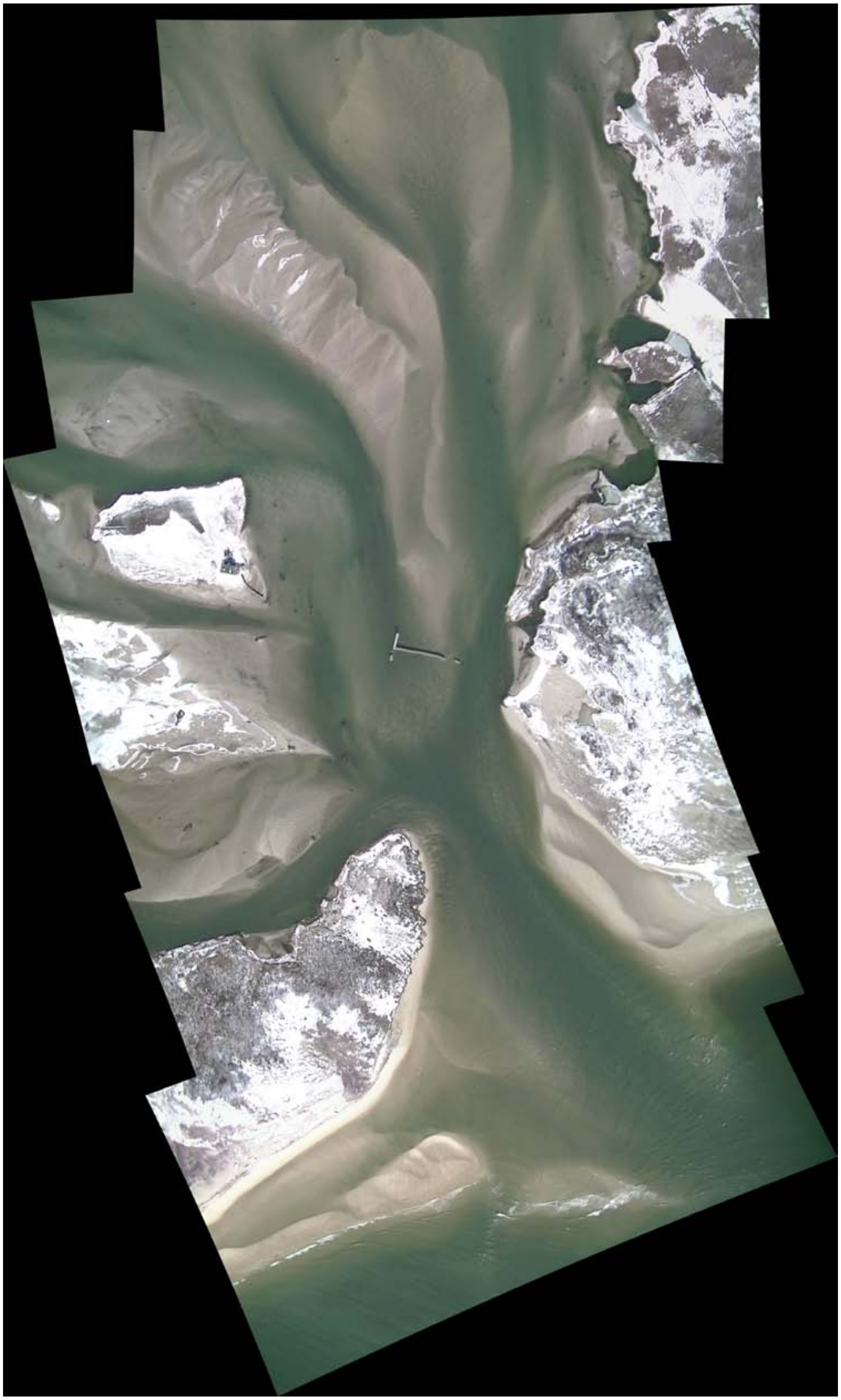

Figure 4. A mosaic of video snapshots of the inlet taken on January 27, 2013 by C. Flagg and D. Richards.

One of the recurring questions is what happened to the water levels before and after the breach occurred at Old Inlet. The last report presented results from tidal analyses at three sites. This report adds results from the tidal analysis for the M2 tidal component for Barrett Beach. Again, there has not been any change in the tidal range at any of the sites, while the times of high tide in the eastern Great South Bay have been shifted earlier by 18 minutes at Bellport and just 3 minutes at Barrett Beach.

Table 1. M2 tidal analyses before and after the formation of breach at Old Inlet

	Before Sandy		**After Sandy**	
	Amplitude, m	**Phase, Deg**	**Amplitude, m**	**Phase, Deg**
Bellport	**0.16**	**102.8**	**0.16**	**93.8**
Barrett Beach	**0.15**	**100.3**	**0.15**	**99.0**
Fire Island Inlet	**0.23**	**11.7**	**0.22**	**12.4**
Tanner Park	**0.20**	**63.1**	**0.19**	**62.6**

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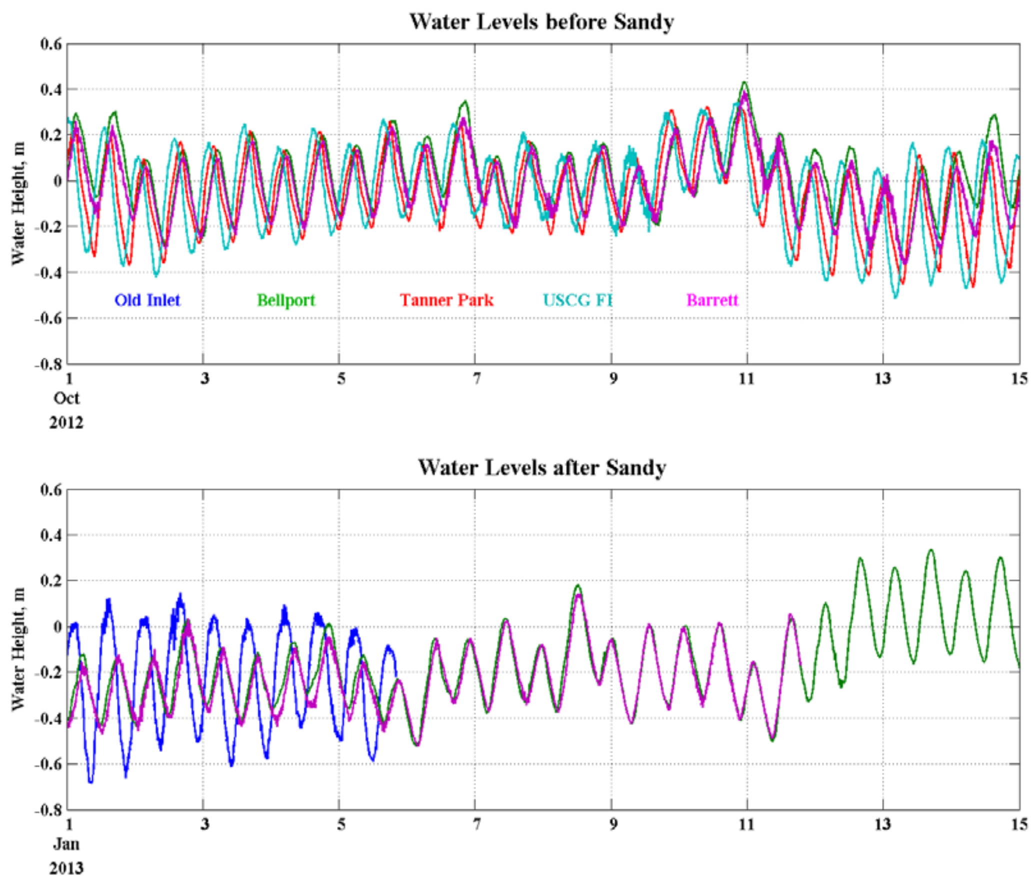

Figure 5. Water levels before and after super storm Sandy and the breach at Old Inlet.

A more graphic display of the similarity of the tide range at the sites before and after the opening of the breach is given in Figure 5, which shows the water level records for two 14-day periods. The Bellport and Barrett Beach records are essentially identical before and after the breach, and it is clear that the general tide ranges have not changed. While it is not shown in this figure, the constancy of the tide range continues to the end of the Bellport record. In this figure the tidal range at the dock at Old Inlet (blue) is larger than that at Bellport. This was a recent development that occurred as a result of the late December storms and indicates that there is reduced transmittance between the inlet and Bellport Bay.

The addition of the water level record from the pier at Barrett Beach confirms the amount of storm surge in the eastern end of Great South Bay reported earlier, Figure 6. Barrett Beach is located about half-way between Bellport and the Fire Island USCG base, and so one might expect it to indicate a surge half way between the two stations. Figure 6 shows the records from all four instruments deployed at the time of super-storm Sandy where it is clear that the Barrett Beach record looks more like Bellport than either of the more western locations. This suggests that the “pivot” point about which the water level rotates in the Bay is farther west of Barrett Beach, perhaps off Islip; thus, points west of Islip can expect high water during strong east winds, while the eastern half of the bay experiences an initial drop in water level.

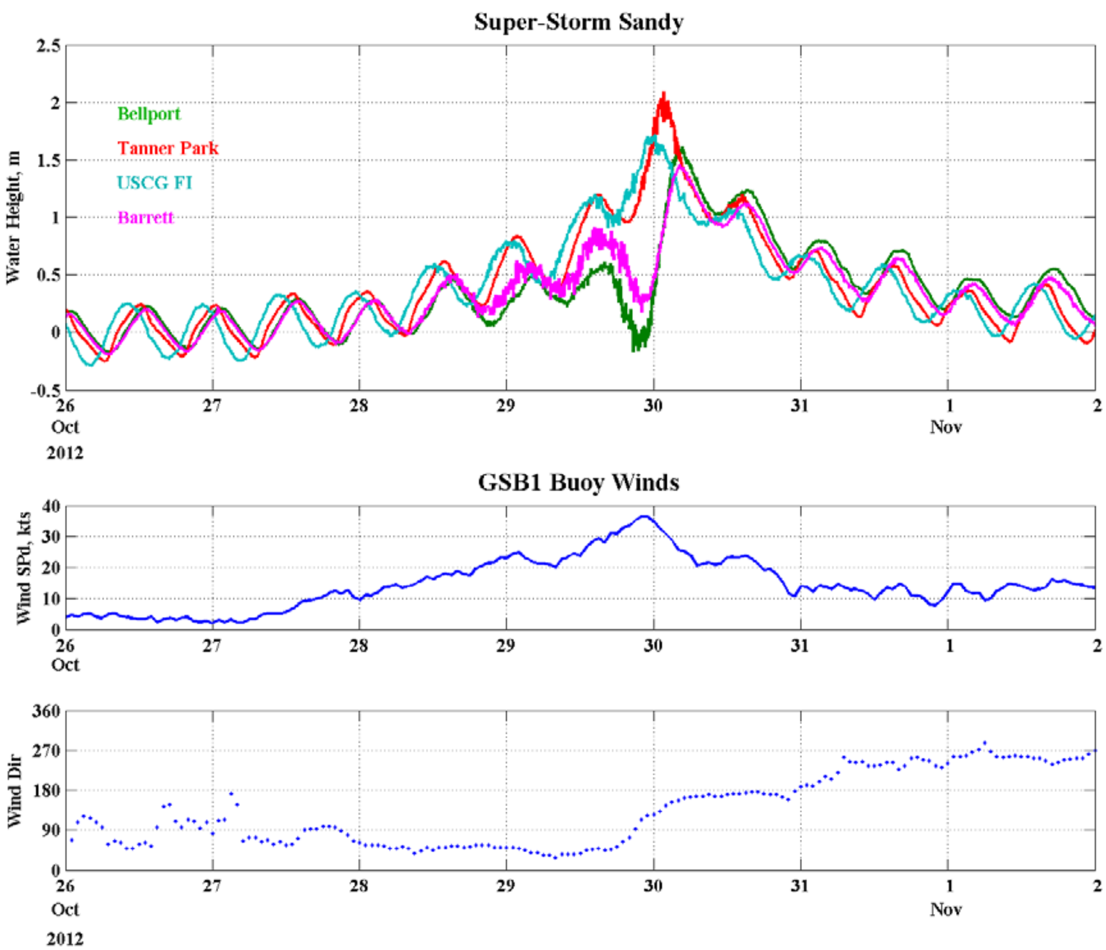

Figure 6. Water level records from sensors deployed during super storm Sandy and the wind speed and direction from the GSB1 buoy.

Another important aspect of the breach and the greater exchange with the ocean deals with the presumed improvement in water quality. Water quality usually involves nutrient loading and the presence of coliform bacteria, both of which are associated with local sewage runoff and long residence times. These measures have been shown in the Great South Bay to increase with the distance from the inlets. As a result, Bellport Bay, at some 20 miles from Fire Island Inlet, had one of the highest nutrient loads of any of the open water reaches of the larger Bay. It also had one of the lowest salinities at around 24 psu (practical salinity units). Salinity is not the same as either nutrients or coliform, but there is vastly less of either in the ocean waters just offshore of Fire Island; thus, increased salinity is an indicator of shorter residence times and improved water quality. As Figure 7 shows, there was a dramatic increase in salinity in Bellport Bay immediately after the inlet opened, and it has remained significantly higher ever since, averaging some three to four psu higher than its historic norm. Note that the salinity at Barrett Beach, which used to be higher than Bellport, is now significantly lower. Sometimes storms lower the salinity in Bellport Bay quite noticeably as fresh water is drained from Carmans River, Beaverdam Creek and directly from shore runoff. Sometimes the fresh water impact is dramatic as it was on December 27th during a torrential rainfall event. At other times, when there is an extended period of east winds that cause an increased influx of ocean water through the inlet, salinities in the Bay can reach nearly oceanic numbers.

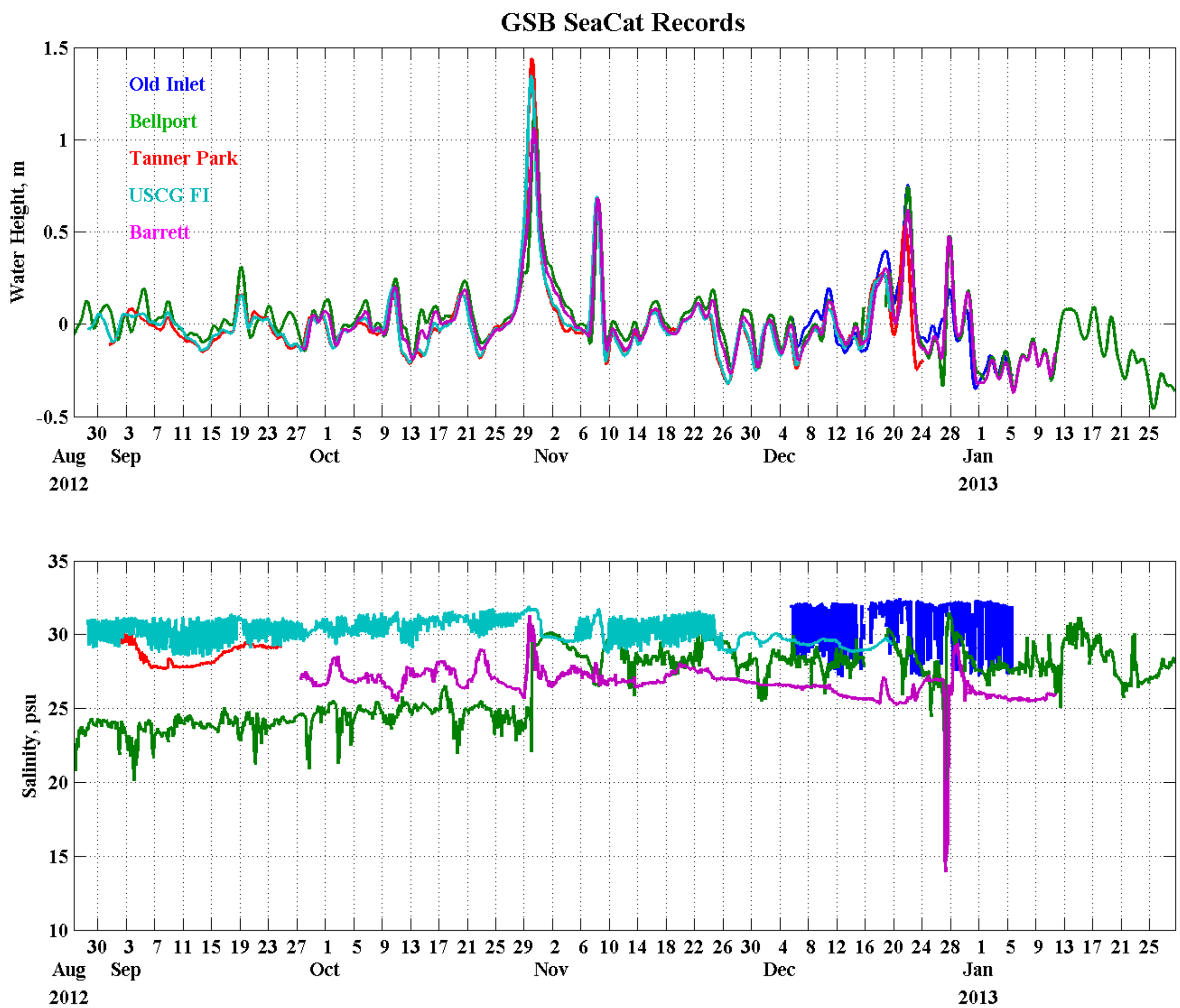

Figure 7. Results from the sensors arrayed around the Bay. The top panel shows the low-passed water level records from all five sites while the bottom panel shows the salinity records.