



Issued August 25, 2022

MIR-22/22

## Collision between *Baxter Southern* Tow and BNSF Coal Train

On November 13, 2021, about 2343 local time, the towing vessel *Baxter Southern* had pushed its tow of four empty barges against the shoreline of the Upper Mississippi River at mile 372 near Galland, Iowa, when a BNSF coal train transiting the track along the shoreline struck the bow rake of a forward barge that was overhanging the railroad track.<sup>1</sup> Two locomotives and ten hopper cars (loaded with coal) derailed, and six of the derailed hopper cars entered the river. A sheen was observed in the river following the derailment. The two train personnel sustained minor injuries. Damages to the locomotive and freight cars were estimated at \$1.9 million. The barge sustained minor scrapes.



**Figure 1.** The *Baxter Southern* after the casualty. (Source: US Coast Guard)

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<sup>1</sup> (a) In this report, all times are central standard time, and all miles are statute miles. (b) Visit [nts.gov](https://www.nts.gov) to find additional information in the [public docket](#) for this NTSB investigation (case no. DCA22FM004). Use the [CAROL Query](#) to search investigations.

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<b>Casualty type</b>	Collision
<b>Location</b>	Upper Mississippi River, mile 372, near Galland, Iowa 40°30.4' N, 091°22.4' W
<b>Date</b>	November 13, 2021
<b>Time</b>	2343 central standard time (coordinated universal time -5 hrs)
<b>Persons on board</b>	8 ( <i>Baxter Southern</i> ), 2 (train)
<b>Injuries</b>	2 minor
<b>Property damage</b>	\$1.9 million est.
<b>Environmental damage</b>	Sheen observed in river
<b>Weather</b>	Cloudy with light snow, visibility 4 mi, winds east 20-25 mph, gusts up to 43 mph, air temperature 30°F, water temperature 34°F
<b>Waterway information</b>	River, depth 21 ft, width 4,800 ft



**Figure 2.** Area where the *Baxter Southern* tow and the BNSF freight train collided, as indicated by a red X. (Background source: Google Maps)

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## 1. Factual Information

### 1.1 Background

The 120-foot-long towing vessel *Baxter Southern* was built in 1966 and owned and operated by Southern Towing Company. The steel-hulled vessel had twin propellers and was powered by two 1,650-hp 645C EMD diesel engines.

The BNSF train (number CBAMMAS800A) was owned and operated by BNSF Railway Company. The train consisted of two locomotive units at the head end, one near the rear end, and 143 loaded hopper cars. The train weighed 20,227 tons and was 7,813 feet in length.

At the time of the casualty, the Mississippi River water level at the casualty site was 4.2 feet (high water was 18 feet and above).

### 1.2 Event Sequence

On November 9, 2021, about 0600, the *Baxter Southern* departed Spechts Ferry, Iowa, at mile 591, pushing four empty barges downbound on the Upper Mississippi River en route to Donaldsonville, Louisiana. The crew of the *Baxter Southern* consisted of a captain, pilot, engineer, mate, tankerman, and three deckhands.<sup>2</sup> The barges were arranged in two rows. Three of the barges (*STC 3020*, *STC 3031*, and *STC 611*) were 298 feet long, and the fourth barge (*STC 180B*) was 175 feet long. Overall, the tow was 716 feet long and 108 feet wide. The *Baxter Southern* used a marine radio as well as cell phones and a computer with satellite internet access to communicate with Southern Towing Company's dispatcher.

On November 11, the tow moored at the Linwood Dock in Pine Bend, Iowa (mile 475), for fueling. Due to winds exceeding 25 mph, the captain decided to keep the tow there until the winds had decreased to below 10 mph. On November 13 at 0600, the tow proceeded downriver.

About 0900, the BNSF train departed Burlington, Iowa, en route to West Quincy, Missouri, hauling 143 hopper cars loaded with coal. By design, the sides of each locomotive extended about 2 feet from the rails and had a ground clearance of 1 foot. One conductor and one engineer operated the train and monitored its progress from

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<sup>2</sup> *Pilot* is a term used aboard towing vessels on inland waterways for a person, other than the captain, who navigates the vessel.

the lead locomotive, BNSF 9251, as the train proceeded on the tracks. The BNSF train used radio channel 70 to communicate with the BNSF dispatcher in Fort Worth, Texas.

According to the captain of the *Baxter Southern*, about 2200, while the tow was under way at mile 384, the wind, which was blowing from the southwest and across the tow, gradually increased from 15 mph to about 20 mph with gusts as high as 40–45 mph. The captain stated that as the *Baxter Southern* tow proceeded downbound, the wind made it difficult to maintain the towing vessel's heading with four empty barges.

The pilot arrived in the wheelhouse at 2245 (the tow was near mile 375), and he and the captain reviewed the National Oceanic and Atmospheric Administration weather website and other weather applications related to area forecasts. The weather forecast for the area of the Mississippi River through which the *Baxter Southern* was transiting predicted southwest winds 10–15 mph with gusts up to 40 mph after midnight, changing to northwest winds 15–25 mph with gusts decreasing to 30 mph at noon the following day. The captain stated that he originally planned to tie up at Lock and Dam no. 19 (mile 364) to wait for the wind to decrease, but there were two tows ahead of them, and he knew that those tows would occupy all available mooring space at the lock. After assessing the forecast, the captain and pilot determined that, with the high winds continuing into the morning, it would be unsafe to proceed to the lock, since there would be no available space to dock or open shoreline for the tow to push up against. They also believed it would be unsafe to try to turn the tow around (top around) and find another place upriver to dock.

The pilot and captain discussed potential areas between mile 375 and Lock and Dam no. 19 to push the tug and barges up against the riverbank. Based on the pilot's previous experience in the area, they knew that there were trees and other obstructions on the left descending bank that would prevent the vessel from safely pushing up against the shoreline.<sup>3</sup> The pilot told the captain that there was an area on the right descending bank before the lock where he had previously seen barges pushed up against the riverbank.

The captain and pilot reviewed the vessel's Rose Point Navigation System, an electronic chart system (ECS), which was set on nighttime display mode. The ECS provided them with detailed electronic navigation chart information for the waterway the vessel was transiting, including depths and widths of the waterway, as well as river mile markers to assist with determining the position of the vessel. The electronic navigation chart also provided graphical information that could be queried by an operator to view additional information about the waterway. The captain and pilot saw an area marked by

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<sup>3</sup> The inland towing industry refers to the shorelines of Western Rivers as the left and right banks when traveling (facing) downriver. The left bank is called the *left descending bank*, and the right bank is called the *right descending bank*.

a magenta dashed line on the electronic navigation chart next to railroad tracks at mile 372, and both said they believed the area represented a fleeting area and that it would be safe to push up against the bank within it. The electronic navigation chart showed railroad tracks along the riverbank but did not provide the distance from the river to the tracks. The captain told the pilot to head to the marked area on the chart at mile 372 and place the tow up against the riverbank at that location to wait out the weather.

The captain then departed the wheelhouse at 2320, when the tow was near mile 373. By the time he returned about 10 minutes later, the pilot had the tow lined up and was proceeding toward the right descending bank at mile 372. The captain and the pilot knew that they were pushing up against an area near a railroad track, and they stated that, due to the high winds and nighttime conditions, they decided it would not be safe to place a crewmember as a lookout on the forwardmost barge (*STC 3020*) to ensure the barges did not cross the track. Instead, they planned to send crewmembers onto the barges after the tow was pushed up on the bank to check that the barges did not cross over the railroad track.

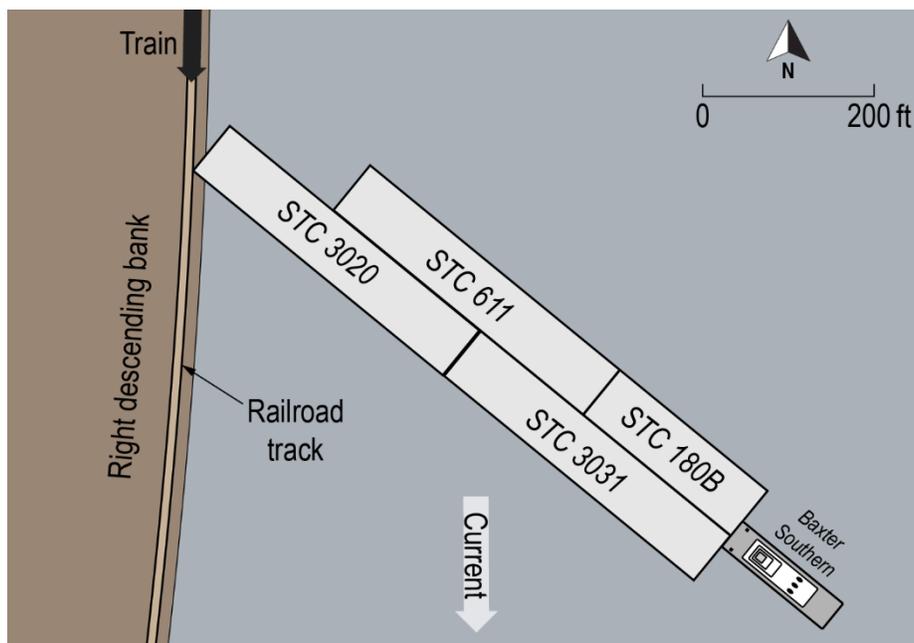
About 2336, the forward port barge, *STC 3020*, was pushed up on the shore, and the tug and tow were at an approximate 45° angle to the riverbank, with the stern of the *Baxter Southern* angled downriver. The pilot did not note any problems with the tow pushing up against the shore, and the captain departed the wheelhouse after the head of the tow was on the bank.



**Figure 3.** Snapshot of *Baxter Southern* ECS playback at 2336 showing the area marked by a magenta dashed line and the vessel pushed up against the riverbank. (Source: Southern Towing Company)

About 2338, three crewmembers were mustered and shortly afterward headed forward to verify that the forwardmost barge (*STC 3020*) was clear of the railroad track. The pilot turned on the vessel's search light atop the wheelhouse and pointed it toward the bow to illuminate the barges so the crewmembers could see where they were walking.

Before the three crewmembers (who were now on the *STC 3020*) could check the track clearance, they saw the headlight of the approaching train's lead locomotive as it appeared to the starboard side of the tow, coming around a slight bend in the tracks behind some trees about 2,000 feet away.



**Figure 4.** Approximate position of *Baxter Southern* tow pushed up against the riverbank as the train approached (scale approximate).

According to the lead locomotive's recorder data, at 2342:40, as the train entered a 40-mph section of the track, the speed of the train started increasing from 25 to 40 mph as the engineer increased the throttle (a postcasualty review of the locomotive data recorder showed the train passed the grade crossing about 2,700 feet away from the tow). Both the train conductor and the engineer saw the lights and the outline of the towing vessel and barges in the distance. They stated that the tow looked to them to be perpendicular to the shoreline about 1,000 feet ahead of them as the train was proceeding down the slight right turn in the track (according to the lead locomotive's data recorder, the train was traveling at a speed of about 37 mph). The conductor and engineer stated that they were not concerned because they could see that the towing vessel and barge were either in the river or up against the riverbank and it was common to see barges up against the shoreline of the river in this area.

When the train (still traveling about 37 mph) was about 300 feet from the tow's location, about 35 seconds after the conductor and engineer first saw the towing vessel and barges, the conductor and the engineer realized that a barge was overhanging the railroad track. At 2343:42, the engineer activated an "engineer-induced emergency" (according to the locomotive data recorder), causing the train's emergency brakes to apply on the three locomotives and all the freight cars.

On board the *Baxter Southern*, the pilot saw the approaching train, and he did not know if the tow was clear of the railroad track. After seeing the approaching train, the three crewmembers on the barges proceeded aft to the *STC 3031* and braced for impact in case the tow was not clear of the track. Although the train's emergency brakes had been applied and it started to slow down, the train was still proceeding toward the barge. The crewmembers and pilot stated that they saw sparks coming from the train. The pilot stated that when he saw the sparks and realized that the train would not be able to stop, he placed the *Baxter Southern's* engines in reverse to move away from the track and sounded the general alarm to warn the crew of the emergency.

About 2343:51, the left side of the lead locomotive, BNSF 9251, collided with the port corner of the *STC 3020's* bow, and the 2-foot overhang of the train impacted the deck of the barge, pushing it into the ground. The captain, who was in the galley and had felt a "slight bump," heard the general alarm and proceeded to the wheelhouse. The first locomotive derailed and tipped over to the right, landing on its side after impacting the barge, skidding on the ground before stopping, and causing the second locomotive, BNSF 9109, and ten hopper cars to also derail. Six of the hopper cars entered the river. The BNSF train's conductor and the engineer evacuated the forward locomotive on their own but sustained minor injuries.



**Figure 5.** Still images of video footage from locomotive BNSF 9251's recorder as the train approached the barge and derailed after hitting the barge. The forward barge of the *Baxter Southern* tow is outlined in orange. (Source: BNSF)

After the train derailed, the pilot moved the *Baxter Southern* away from the riverbank by 2344, and the captain entered the wheelhouse. He took the helm from the pilot and maneuvered the vessel into the center of the river and faced it upriver. About 2350, the captain began to notify company personnel and authorities of the casualty. After the captain received permission from the US Coast Guard, the *Baxter Southern* tow proceeded upriver to push up against another location (on private property) on the right descending bank near mile 373. None of the crewmembers on the *Baxter Southern* sustained injuries.



**Figure 6.** Aerial photo of the postcollision derailment of the two locomotives and eight hopper cars. Two additional hopper cars are submerged in the river. (Source: BNSF)

A damage survey of the barge *STC 3020* by a marine surveyor determined that damages resulting from the casualty were minor and did not appear to affect the structural integrity of the vessel. Investigators identified three horizontal indents on the forward port section of the bow rake and scraping to the deck just above the indents.



**Figure 7.** Postcasualty photo of the minor damage to the port bow rake of barge *STC 3020*. (Source: Coast Guard)

### 1.3 Additional Information

After the casualty, investigators reviewed video from the locomotive BNSF 9251. The video showed that the port bow rake of barge *STC 3020* extended about a foot over the railroad tie but did not cross over either rail. Postcasualty photos of the location showed an indentation where the barge had been pushed up against the riverbank. Coast Guard investigators determined that the distance from the railroad track to the riverbank was about 10 feet at the time of the casualty.



**Figure 8.** Aerial drone photo of the casualty site with a red arrow pointing to the indentation remaining in the ground where the forwardmost barge *STC 3020* was located (*left*). Close-up of the indentation from the barge in the shoreline next to the railroad track (*right*). (Sources: BNSF [*left*], Coast Guard [*right*])

The *Baxter Southern's* engine throttles were pneumatically operated, with air pressure transmitting the change in throttle movement from the operator in the

wheelhouse down four decks to the two engines in the vessel's engine room. The pneumatic throttles had a 4.5-second delay from the movement of the throttle to the engagement of the engine (the engines did not immediately respond to the movement of the throttle). The pilot stated that there were no indications that the engines or the throttle controls were not operating as designed at the time of the casualty.

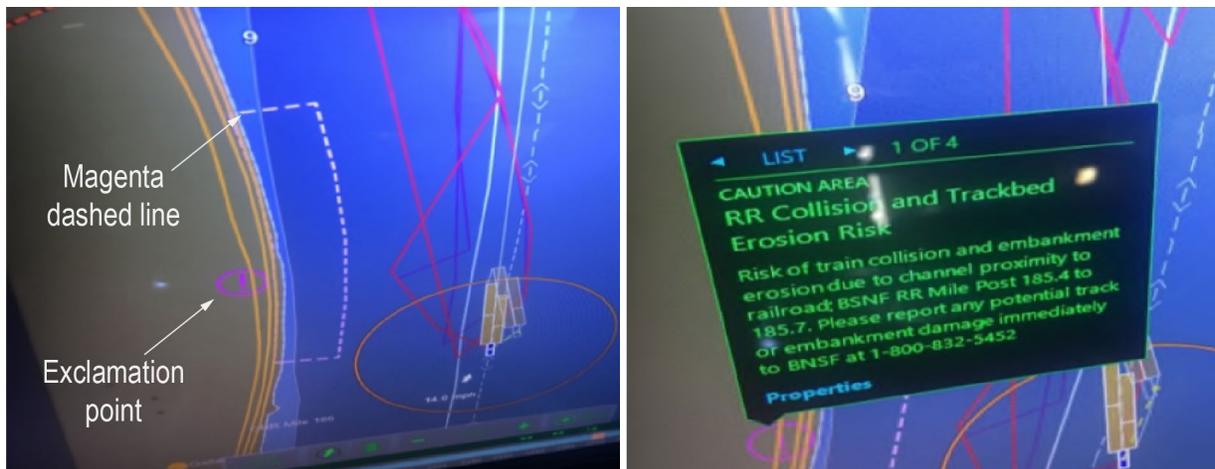
### 1.3.1 Electronic Chart System

Both the captain and pilot told investigators that they believed the magenta dashed line as seen on the electronic chart in Rose Point indicated a fleeting area because the pilot said that he had previously seen other towing vessels and barges against the shore in the general area of mile 372 (a review of automatic identification system data provided by Southern Towing Company to investigators showed that other towing vessels and barges possibly had pushed up against the shoreline in this area over a 6-month time frame before the casualty).

Next to the magenta dashed line near mile 372 on the electronic chart was an exclamation mark icon, which indicated that the area within the magenta dashed line was a "Caution Area" according to the ECS symbol reference table. On ECS navigational charts, magenta dashed lines with an exclamation mark show the limit of a caution area where mariners should be "made aware of circumstances influencing the safety of navigation"; there are no navigational chart symbols for a fleeting area.<sup>4</sup> In Rose Point, a user could learn more information about the caution area by selecting the exclamation mark via "cursor pick" (moving the mouse pointer over the area and clicking the right button of the mouse) to read the corresponding caution note. When the exclamation mark icon next to the magenta dashed line near mile 372 was selected, a box displayed the following information: "Caution Area: RR [Railroad] Collision and Trackbed Erosion Risk" and "Risk of train collision and embankment erosion due to channel proximity to railroad." Both the captain and pilot said they had training in using the ECS, but they stated they did not see the exclamation point icon by the magenta dashed line because the screen setting was in nighttime mode, making the exclamation point difficult to see.

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<sup>4</sup> Inland ENC Harmonization Group, "Encoding Guide for Inland ENCs," Edition 2.4.1 (March 20, 2018).



**Figure 9.** *Baxter Southern* Rose Point in nighttime display showing the area marked by the magenta dashed line and exclamation point (left, annotated by NTSB) and information contained in the corresponding caution note (right). (Source: Southern Towing Company)

### 1.3.2 Marine Safety Information Bulletin

After the casualty, on November 22, 2021, Coast Guard Sector Upper Mississippi River issued Marine Safety Information Bulletin 08-21, “Barge/Rail Collision Risk,” which advised towing vessel operators to use caution when pushing up against the shoreline where railroad tracks were located near the water’s edge in all river water level conditions to avoid encroaching on the railroad track.

### 1.3.3 Personnel

The captain had 27 years of experience working in the towing industry. He had held a valid Coast Guard credential as a master of towing vessels upon Western Rivers for 11 years. He stated that he had worked in the area of the casualty on the *Baxter Southern* for 6 months. The captain had completed Rose Point training (operation of Rose Point and how to interpret and manage its information) in April 2020.

The pilot had 32 years of experience working in the towing industry. He had been working on the *Baxter Southern* for less than 2 months. He stated that he had transited through the area of the casualty before and previously had stopped to push up tows there “probably half a dozen times.” The pilot had completed Rose Point training in March 2020.

## 2. Analysis

As the *Baxter Southern* and its tow of four empty barges moved downbound (generally southerly direction) on the Upper Mississippi River, they encountered strong

wind gusts from the west. The strong wind gusts made the situation unsafe for the tow to continue the transit as planned, and in the dark of night, it was also unsafe for the captain to try to top around the tow and head upriver. Additionally, there were two towing vessels ahead, and there was no available mooring space at the Lock and Dam no. 19 located 6 miles away. Therefore, it was prudent for the captain and the pilot to search for potential areas along the river to place the towing vessel and barges until the winds abated.

It is considered normal for tug and barges transiting on the inland waterways of the United States to push up against the riverbank—whether to wait for river traffic to decrease, bad weather to pass, for lock openings, or to conduct maintenance. While searching the electronic chart on the ECS for an area to push the tow against the shoreline, the captain and pilot stated that they assumed the area marked by a magenta dashed line next to the right descending bank near mile 372 was a fleeting area—where towing vessels and barges would be able to push up against the riverbank. However, the magenta dashed line actually represented a caution area, which warned of the risk of embankment erosion and of train collision due to the channel’s proximity to the railroad trackbed. The pilot was familiar with the area and stated that he had previously seen towing vessels and barges push up along the right descending bank near the caution area identified on the ECS. Neither the pilot nor the captain queried (cursor-picked) the exclamation point near the area on the ECS as a part of their navigational assessment to gather further information related to the dashed magenta line. Thus, they missed the cautionary information that stated the area presented a “Railroad Collision and Trackbed Erosion Risk.” Had the captain or pilot queried and read the associated information on the ECS, they likely would have realized the risk of pushing up against the riverbank in the caution area and may have sought another location to push up. Further, the captain and pilot each had over 20 years of experience on the Mississippi River and had extensively used Rose Point over the last several years; they also had completed training in the operation of Rose Point and interpreting its information. They should have been familiar with the magenta dashed line identifying the caution area and how to query the chart to see additional information about marked areas. After the casualty, Coast Guard Sector Upper Mississippi River issued Marine Safety Information Bulletin 08-21, which advised towing vessel operators to use caution in all river water level conditions when pushing up against the shoreline where railroad tracks were located near the water’s edge to avoid encroaching on the railroad track.

As the *Baxter Southern* tow prepared to push up against the riverbank, the captain determined that, due to the nighttime conditions and high wind gusts, it was unsafe to send a lookout forward on the lead barge, *STC 3020*. Instead, the captain had three crewmembers proceed up to the bow of *STC 3020* after the barge was pushed up against the riverbank to determine the location of the barge in relation to the railroad

track. Due to the train's approach within a few minutes of pushing up, the crewmembers did not reach the bow of the *STC 3020* before the collision.

After the pilot, who was in the wheelhouse, and the crew of the *Baxter Southern*, who were out on deck, saw the light of the approaching train as it came into view about 2,000 feet away from the tow, they had about 35 seconds to respond. On the train, the conductor and engineer did not have any indication that the *Baxter Southern* tow was pushed up against the riverbank before they visually saw the tow about 1,000 feet away. In addition, they did not realize that the bow of the *STC 3020* had encroached on the tracks until the train was about 300 feet from the barge and still traveling about 37 mph. At that point, the train's engineer activated the train's emergency brake on the three locomotives and all the hopper cars at 2343:42. After the *Baxter Southern's* pilot saw the sparks from the train and realized that the train was not going to be able to stop, he put the tug's engines in full astern to move the tug and barge away from the riverbank. However, the engines took 4.5 seconds to respond because of the pneumatic throttle control, delaying the movement of the towing vessel and barges from the riverbank at a time-critical moment. With only seconds to respond, the activation of the train's emergency brake and the placement of the tug's engines in full astern occurred too late to avoid the collision.

## 3. Conclusions

### 3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the collision between the *Baxter Southern* tow and BNSF coal train was the tow's pilot and captain not correctly identifying a caution area on the electronic chart before deciding, due to the high wind's effect on the tow's empty barges, to push the tow up against the riverbank alongside a railroad track.

### 3.2 Lessons Learned

#### Electronic Chart Systems

Electronic chart systems (ECS) provide a wealth of navigation information to mariners. Depending on user settings and other conditions, electronic chart display and information systems (ECDIS) can display the same feature(s) differently (compared to paper charts, which display the same information constantly). ECDIS enables users to obtain more information about a feature by querying through a "cursor pick."

Additionally, there are many features—including warnings and other navigation information—that can be obtained through a cursor pick that are not specifically noted in the default chart display.

Mariners should ensure they understand all symbols and applicable advisories identified in their ECS, and owners and operators should ensure that their crews are proficient in the use of ECS. For more information about chart symbols, mariners should refer to [U.S. Chart No. 1: Symbols, Abbreviations and Terms used on Paper and Electronic Navigational Charts](#) or the US Army Corps of Engineers' [Inland Electronic Navigational Charts](#).

Vessel	<i>Baxter Southern</i>	<i>STC 3020</i>
Type	Towing/Barge (Towing vessel)	Towing/Barge (Tank barge)
Flag	United States	United States
Port of registry	St. Louis, Missouri	St. Louis, Missouri
Year built	1966	1999
Official number (US)	506453	1086814
IMO number	N/A	N/A
Classification society	N/A	N/A
Length (overall)	120.0 ft (36.6 m)	297.5 ft (90.7 m)
Beam	35.0 ft (10.7 m)	54.0 ft (16.5 m)
Draft (casualty)	7.0 ft (2.1 m)	1.6 ft (0.5 m)
Tonnage	380 GRT	1619 GRT
Engine power; manufacturer	2 x 1,650 hp (1,230 kW); 645C EMD diesel engines	N/A

NTSB investigators worked closely with our counterparts from **Coast Guard Marine Safety Detachment Quad Cities** throughout this investigation.

The National Transportation Safety Board (NTSB) is an independent federal agency dedicated to promoting aviation, railroad, highway, marine, and pipeline safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974, to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person" (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)).

For more detailed background information on this report, visit the NTSB investigations website and search for NTSB accident ID DCA22FM004. Recent publications are available in their entirety on the NTSB website. Other information about available publications also may be obtained from the website or by contacting—

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