

The Upper Mississippi River Navigation Charts — Mapping Time and the River

By Ryan Johnson

Driving along the Upper Mississippi, it is hard to ignore the giant locks and dams segmenting the great river. Even at highway speed, keen eyes can pick out the slight ripples shimmering over the wing dams, built long ago to change the river's flow. Shoreline improvements, boat landings and campgrounds also mark the Army Corps of Engineers' impact on the Upper Mississippi.

The Corps has also made its mark with paper and ink. In the recent *Upper*

Mississippi River Navigation Charts, the marks are in pixels, with geo-referenced digital maps.

The Corps' involvement on the Upper Mississippi River dates back to 1820, when Congress appropriated \$5,000 for a reconnaissance survey of the Ohio and Mississippi rivers. Since then, it has produced dozens of surveys, maps and charts of the Upper Mississippi River. After the Civil War, Congress gave the Corps a more active role on the river, such as removing snags and building wing dams.

More recent generations are likely familiar with Corps Navigation Charts. These charts are full of navigational information, bridge clearances, amenities, historical place names and much more. Whether you have been on the river your entire life or are just beginning to explore it, the Upper Mississippi River Navigation Charts are a useful item to have onboard.

Two Rivers — Two Maps

Much like the river itself, the Corps' mapping efforts can be divided into two eras: Pre Lock & Dam and Post Lock & Dam. Construction of the lock-and-dam system began in the early 1930s. (There were already three locks and dams: one in the Twin Cities, one in Hastings, Minn., and the other in Keokuk, Iowa.) By 1940, the wild and temperamental Upper Mississippi was tamed by a series of 27 dams. The new dams were designed to hold back sufficient water to provide a minimum depth of nine

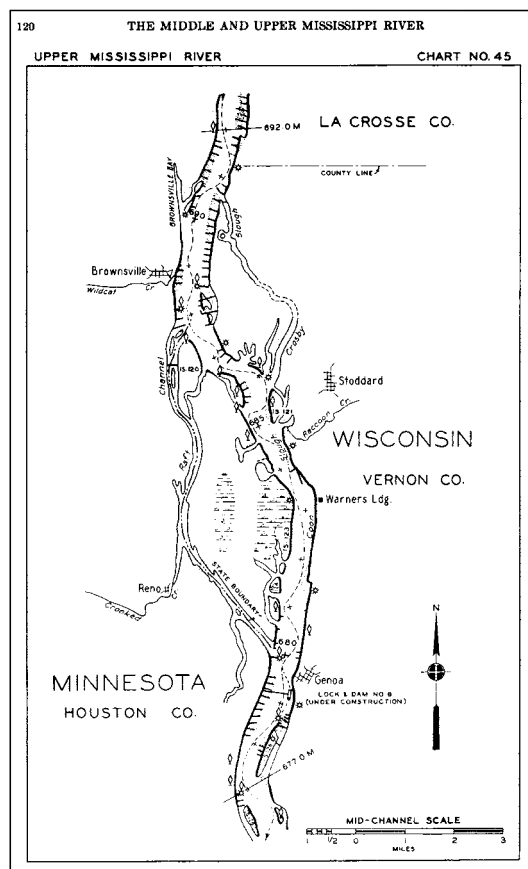
feet in the navigation channel.

When the project was completed the new charts served to aid navigation on a much more static navigation channel. Though the numerous pre-dam maps were beautiful products of difficult and exacting work, they were of little use for navigating the river. The natural meandering of the river and shift-

Updated charts were produced about every decade as the Corps revised information and adopted new technologies.

ing sandbars caused such significant changes that by the time the maps were printed critical data were already out of date in many places.

The lack of accurate and current charts in those early days of piloting paddlewheelers and log rafts created a need for other methods. Dr. Robert Mann, program coordinator with the Corps noted, "Complete reliance on maps to navigate the constantly changing, free-flowing Mississippi River was too much of a risk, and pilots relied mainly on their experience and own memory." To gain that experience before presiding over the helm of their own vessel, most aspiring pilots served an apprenticeship under an experienced river veteran. A good pilot's river senses were honed to the point of being able to navigate huge vessels burdened with



This 1935 chart was produced as the lock-and-dam system was being built. Note "Lock & Dam No 8 (Under Construction)."

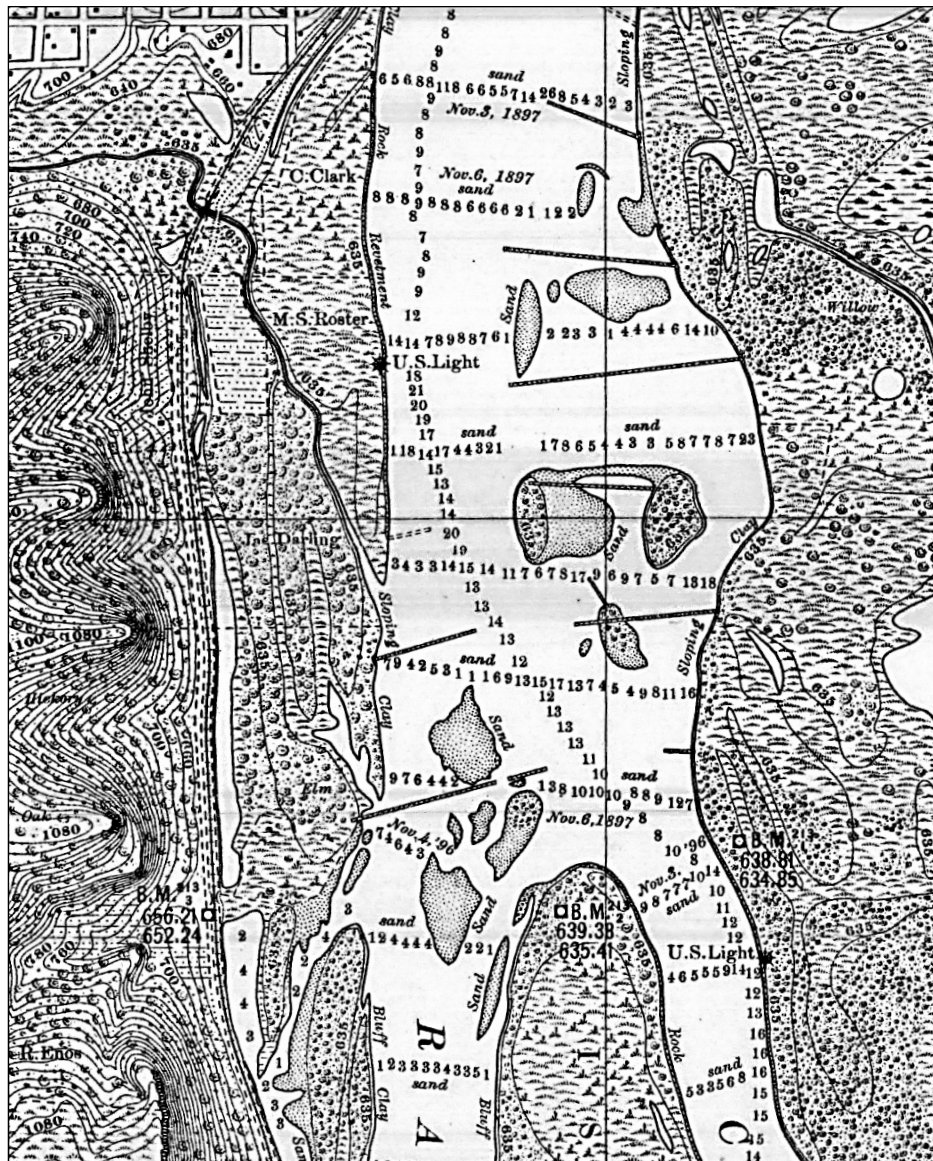
passengers and cargo safely through heavy fog, in complete darkness. The latest changes in the river were valuable trade secrets. Notes about daily changes and water levels were locked up to be shared only among pilots of the same company.

In 1935, in the midst of building the massive lock-and-dam project, the Corps published *The Middle and Upper Mississippi River (Ohio to Minneapolis)*. Printed in a convenient booklet and focusing on vital data, such as the navigation channel and markers and hazards such as wing dams or bridges, this can be considered as the predecessor of today's navigation charts.

The lock-and-dam system changed the river dramatically. When water levels above the dams rose, some low lying places, like Sabula, Iowa, became islands and some islands disappeared underwater. Silt closed up small channels and erosion, especially just upstream of dams, erased islands. Updated charts were produced about every decade as the Corps revised information and adopted new technologies, such as aerial photography, computer aided drafting and, most recently, GIS (Geographic Information Systems).

Ink, Pixels, GPS

Last summer I worked as a kayak guide enjoying the labors of introducing customers to the quiet beauty of the Tiffany Bottoms, near the mouth of the Chippewa River. Despite the loveliness of the backwaters, I often tired of our usual clearly defined route. Unfortunately, the complex maze of backwaters can confuse the most experienced river veterans who choose to wander into the unknown — not a good thing if you have paying customers expecting to make their dinner reservation. To break the monotony of our standard route I slyly hid my iPhone on my lap inside of my cockpit. At crucial junctions I would sneak a peek at my screen and proudly announce which direction to turn. On my screen the latest edition of the *Upper Mississippi River Navigation Charts* tracked my current position with a slowly moving blue dot. In addition to clearly depicting, with great accuracy, all of the backwater channels, the charts also show the position of



This detail from a 1897 chart of the river just downstream of Brownsville, Minn., shows the enormous detail that was put into this set of maps. The numbers across the channel are cross sections of the water depth. The numbers running down the channel indicate the depths along the "sailing line," or navigation channel. The straight lines jutting out from shore are wing dams. Note the elevations of the bluffs (on the left) and islands, marked with contour lines. Even property owners, tree species and soil types are noted. The dates that each section was surveyed are also indicated.

every navigation marker, wing dam and boat landing along the river.

The 2011 edition of the Corps' charts is available for free download on the web. This edition covers the Mississippi River from the Coon Rapids Dam, north of Minneapolis, downstream to the mouth of the Ohio River, near Cairo Ill., as well as the lower 25 miles of both the Minnesota and St. Croix rivers, which also have some towboat traffic.

A clear contrast to the aged style and patina of the 19th century maps, all 156 sheets of this edition are in

geo-referenced PDF format. Geo PDFs work like any standard Adobe PDF file on your computer, tablet or smartphone, but they have an embedded coordinate system hidden in the file. This allows you to use the charts with most GPS-enabled devices, which enables you to use your smartphone or GPS unit to display a navigation chart with your current position marked on the map.

The Corps has selected a popular mobile app named PDF Maps, by

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1875



1930



These four maps all show the same 10-mile stretch of the Mississippi, from Brownsville, Minn., (upper left corner) to Genoa, Wis., (lower right corner), which is now lower Pool 8 and the very top of Pool 9. Stoddard, Wis., is about a third of the way from the top, on the right.

The maps illustrate how mapping styles and the level of detail in the maps have changed during nearly a century and a half. Note that Reno

Bottoms, in the lower left corner of the maps, includes very little detail in the two oldest maps and increasing detail in the two newest maps, when map makers had the advantage of referring to aerial photographs.

A dashed line in the 1875 and 2011 maps marks the "sailing line," or navigation channel, the route that offered the most depth. The straight lines that jut out toward the channel on

the top of the newest three maps mark wing dams, which were installed in the river in the late 1800s to direct more forceful current into the navigation channel. The tiny numbers strung across the Raft Channel, Coon Slough and Crosby Slough in the 1930 map are detailed cross-sections that indicate the depth of the water every few feet.

The 1930 map is from a series of maps

1972

2011



sometimes called the “Brown Maps,” after N. W. Brown Inc., which contracted with the Army Corps of Engineers to survey the upper river and create the maps. These maps played an important role in figuring out where to build the locks and dams and their dikes on the river in the 1930s.

The contrast between the 1972 and 2011 maps and the earlier maps illustrates how dra-

matically the lock-and-dam system changed the river. The area in the bottom left of the map looks very much the way most of the river looked before the locks and dams were built. The straight lines that mark the boundary between the bottoms and open water are the dike that separates pools 8 and 9. Many of the narrow islands in the middle and upper middle of the 1972 map had disappeared a decade or two

later. Most of the narrow islands in the 2011 map were built during the last couple of decades to replace ones that eroded away after Lock and Dam 8 was built. River miles are marked by the numbers along the navigation channel in the 1972 and 2011 maps.

The 2011 map is part of the series that can be used with GPS devices to track a user’s location on the river. 🌊

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The mobile app PDF Maps uses the Geo-PDF navigation charts to display your current position when you are exploring the river. (Ryan Johnson)

Avenza Systems, to be the primary platform for the new Geo-PDF charts. This app, now available for both iPhone and Android phones, is striving to become the standard application for digital maps. The entire series of 2011 navigation charts can be easily downloaded for free — as well as hundreds of other maps — and used on your smartphone.

Careful eyes can pick out the traces of abandoned locks and dams, old channels and abandoned settlements.

I have been impressed with the accuracy and capabilities of the Geo-PDF app on my iPhone. Though cell phone reception along the Upper Mississippi is quite reliable, I suspect it might be a limiting factor in some areas.

The charts are also still available in paper form. Printed on durable 11-by-17-inch paper, the new charts are spiral bound and feature a beautiful shot of Lock and Dam 5 on the laminated cover. Hardcopies can be purchased online, by phone or in person at the Mississippi River Visitor Center located at Locks and Dam 15, near

the Rock Island Arsenal, in Illinois, for \$30. Although a hardcopy of the most recent chart is still required in the pilot house of every commercial vessel, nearly every big boat these days uses a more sophisticated electronic navigation system.

These latest charts are the result of working with a standardized database of line work for the maps from the Inland Electronic Navigation Chart (IENC) database as well as verification by information surveys conducted by the Corps and aerial photography taken between 2008 and 2010.

A Map is Worth 1000 Words

Overlaid on every line, symbol and label on the chart is a rich history. To some, the charts reads like an American novel. Names of channels, islands and rocks can date back to the earliest of the European explorers and in many cases, much older, recalling Native American place names. Careful eyes can pick out the traces of abandoned locks and dams, old channels and abandoned settlements. Pigs Eye Lake, Grey Cloud Island, Grand Encampment, Battle Island, Frenchtown Lake, Credit Island ... So despite the sleek and polished appearance of the newest charts, I hope you can still appreciate the deep history and beauty of this cumulative endeavor. 🌊

Ryan Johnson lives in Winona, Minn., and works as a kayak guide for Driftless Adventure Co.