Walking/Cycling Tour of Saint Anthony Falls

Name:

Lab Instructor:

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Background Information for the Walking/Cycling Tour of Saint Anthony Falls

Tour Logistics
Some of the tour’s last stops are in Water Power Park, which is only open from dawn to dusk April 1 through Oct. 31. So you cannot complete the full tour at night.

Note that the stops are not equally spaced so do not get discouraged by how many are on the bridge. Once across the bridge, the stops are more widely spaced until you come to the falls’ overlook near the tour’s end. For the bridge stops, the tour uses the bridge’s streetlamps as location markers. These are offset from one another on the upstream and downstream sides of the bridge so note when the tour shifts from one side of the bridge to the other.

It should take 2 to 2½ hours to complete the 2.4 mile tour. Wear comfortable walking shoes. Depending on weather, water and sunscreen may be appropriate or umbrella and raincoat. Realize that it can be much windier on the open bridge than city streets, so if the weather is cool take along a sweater or jacket to be more comfortable. If you wish to spend a little longer, you can explore the Lower Heritage Trail at the river level or visit the Mills City Museum. The museum’s Flour Tower experience concludes with one of the best overhead views of the falls area, although the ‘Endless Bridge’ of the Guthrie Theatre has almost as nice a view and is open to the public (without an admission charge). The Guthrie is open from 8 a.m. to 11 p.m. (except for Mondays, when it closes at 8 p.m.)

A ‘Nice Ride’ drop off station is on 6th Ave, just south of University if you wish to rent a bike on campus to get to the tour.

Directions to the start of the Saint Anthony Falls Walking/Cycling Tour
The east end of the Stone Arch Bridge is one mile from the traffic circle at Pillsbury Drive and Pleasant Street.

If you are walking, simply go to University Avenue, turn left (northwest) towards downtown Minneapolis and walk across the freeway to 6th Avenue (roughly nine blocks). Turn left (southwest) on 6th Avenue and walk three blocks to the bridge.

If you are driving, take 4th Street to 6th Avenue, turn left and go three blocks to Main Street. You should be able to find parking on Main Street or in the surrounding area, although it may be metered parking.

Note that the alternate bike route shown includes a short walk across the suspension bridge and sidewalk behind Roy Wilkins Hall.

1 This estimate does not include travel time to get to and from the tour area. If you walk from campus the combined tour and commute will be ~4.5 miles.
Background Information on Saint Anthony Falls
(Read BEFORE starting the tour.)

As one gazes at the Minneapolis skyline, it can be difficult to grasp that the whole city owes its existence to a waterfall, whose heavily reengineered incarnation now only serves as a backdrop to pedestrian and bike trails. However, before the advent of long distance power delivery, waterfalls provided crucial sources of power. Falling water could drive machinery or power turbines linked to milling operations. Saint Anthony Falls provided the energy that drove one of a growing nation’s largest sawmilling operations and later powered the world’s greatest flour milling operation. Minneapolis grew up around those sawmills, flour mills and their supporting businesses. The falls not only affected the development of Minneapolis and Saint Paul, but indirectly the state and Upper Midwest region. Not surprisingly, the falls that drove these changes was itself a product of change.

Origin and Evolution of Saint Anthony Falls

Saint Anthony Falls’ story began roughly 12,000 years ago, south of what is now downtown Saint Paul, as floodwaters draining an immense glacial lake in western Minnesota encountered and evacuated an old sediment-filled glacial valley to form a waterfall over a half-mile wide and 175 feet tall. This huge waterfall rapidly eroded its resistant ledge to retreat up the Mississippi River Valley to the spot were Fort Snelling would later stand. In that area, the waterfall split in two, with a larger waterfall continuing its rapid retreat up the Minnesota River Valley to eventually disappear while a smaller waterfall began a more leisurely retreat up the Mississippi River. It was this waterfall, slowly cutting a bluff-lined river gorge with secondary waterfalls like Minnehaha Falls and Bridal Veil Falls, that eventually arrived in what is now downtown Minneapolis.

Shortly after the waterfall reached this point, its earliest European visitors arrived and christened it Saint Anthony Falls. In its original, natural state, Saint Anthony Falls was considered one of a growing nation’s most scenic locations. However, milling operations were not kind to their host. The waterfall was exposed, broken away, undercut, and generally abused by the industries that relied on it. This culminated in a disastrous tunnel collapse that cut through the falls and would have ended their existence. To prevent an economic catastrophe, the waterfall was reconstructed as a reinforced concrete slope, creating the falls we see today.

Saint Anthony Falls owes its existence to a fortuitous set of geological factors and events. At the most basic level, there are three geologic components (besides flowing water) necessary to explain the waterfall’s existence and behavior. (1) Soil and sediment layers have to be thin enough that the river cuts down to and flows across the underlying rock (bedrock). A river flowing through loose sediment and soil cannot form waterfalls; it has to be in contact with a hard resistant rock. (2) Bedrock in the area has to consist of stronger rock capable of resisting erosion to form the waterfall’s edge (and the vertical walls of its bluff-lined river gorge) that is underlain by weaker, more easily eroded rock. It is the erosion and removal of this underlying weaker rock that causes the overlying rock to break off to form the waterfall edge. (3) If you only had these two components, the overlying resistant rock would protect the underlying weak rock from eroding and the waterfall would only retreat very slowly as the resistant rock was worn away a millimeter at a time. A third component, often overlooked, is a network of vertical fractures through the overlying resistant rock that allows water to reach and erode the underlying weaker rock. As the underlying rock is eroded away, large blocks of the overlying rock separate along the fractures and collapse to form a new waterfall edge. Similar collapse along other fractures formed the vertical cliffs that line the downstream river valley.

Hence, most erosion did not occur at the exposed front of the waterfall, but far below the river floor, as water flowing down fractures removed underlying softer rock to undermine the edge of the resistant rock. As a result, Saint Anthony Falls did not slowly retreat upriver as individual grains were eroded from its rim but rather episodically leaped upstream as meters-wide blocks broke free to collapse into the cascade below.
Economic Impact of Saint Anthony Falls

Almost from the beginning, Euro-American visitors recognized the economic potential of Saint Anthony Falls. When Zebulon Pike first purchased the land for Fort Snelling from the Dakota in 1805, he extended the boundary of the purchased land to include Saint Anthony Falls as he accurately foresaw that the water flow over Minnehaha Falls might not be constant enough throughout the year to power a sawmill. Consequently, the first mill at the falls was an army sawmill built on the falls’ west bank.

Sawmilling - Since Fort Snelling’s sawmill was on the west bank, the army maintained control of that riverbank, leaving only the east bank available for commercial milling operations. Sawmills were built on platforms over the river so water falling beneath the platforms could drive the saws. When the military later relinquished their claim on the west bank, a second set of sawmill platforms were erected on that bank. For sawmills, the river not only provided power, but brought the raw materials. Tree trunks cut in northern logging operations were conveniently floated downstream to be cut and processed at the mills.

Flour milling - Although logging operations would continue to consume the northern forests for several decades, a competing industry began to supplant sawmilling operations at the falls. Railroads brought wheat from the western prairies to be milled, transforming Saint Anthony Falls into the world’s largest flour milling center. In contrast to the saw mills, the flour mills were built along the river banks, where trains could easily deliver raw materials and take away the processed flour. Underground tunnels diverted water from the upstream river to flow beneath the mills and drop down vertical shafts to drive turbines that powered the mills. As more mills lined the banks, this unseen network of tunnels grew. It was one of these tunnels, carelessly constructed in 1869, that collapsed and nearly ended milling operations at Saint Anthony Falls.

Hydroelectric Power – Water-driven turbines can generate electricity as well as directly power machines. On September 5, 1882 Saint Anthony Falls became the site of the nation’s first commercial hydroelectric power center. Although the original plant, and even the island it stood on, has long since vanished, hydroelectric power is still generated at the falls through power plants on Hennepin Island and at the Lower Saint Anthony Falls dam.

Supporting Industries – Early sawmilling and flour milling operations led to a diverse range of supporting industries at the falls. Saws that could cut through tree trunks in seconds made short work of an arm. As a result of the waterfalls’ early sawmilling operations, Minneapolis moved to the forefront of the nation’s artificial limb industry. Machine shops to build and repair milling equipment, along with barrel making for storing and shipping flour, were among the many supporting businesses to spring up around the falls.

However, it should be noted that there are a number of businesses, commonly associated with the river, which were NOT tied to Saint Anthony Falls. Despite its historic sign above the Hennepin Avenue Bridge, the Grain Belt brewery was located upstream in northeast Minneapolis, not at the falls. Minnesota’s brick making industry was south of downtown Saint Paul, where exposures of a thick clay occur that are not present at the falls. Other clay deposits even further downstream formed the base for Redwing’s pottery industry. Although Minnesota has many industries that relied indirectly on the river and surrounding geologic resources, the falls only supported a subset of these industries, only those that specifically depended on the energy captured by its falling water.

Abandonment and Rediscovery

Milling operations at the falls began to decline after 1930, although it was not until 2003 that the closing of the Pillsbury A Mill brought an end to nearly two centuries of milling at the falls. Decades of heavy industrial use had left the riverfront area an unattractive, neglected area. Beginning in the late 1960s and early 1970s a few innovative restaurants began the area’s restoration. By 1984, upscale housing complexes brought wealthier residents, and political power, to the area. By 1988, local citizens created the Saint Anthony Falls Heritage Board to promote and protect the neighborhood. Six years later, the Stone Arch Bridge was transformed into a pedestrian walkway and bicycle trail. Mill Ruins Park began in 2000 and three years later the Minnesota Historical Society opened its Mill City Museum in the ruins of the old Washburn A Mill, with a new Guthrie Theater as a neighbor. More recently, the 2007 opening of Water Power Park brought the public literally to the falls’ edge. Although much remains to be done, the transformation from neglected industrial sprawl to attractive urban park is a national model of renewal.
This fall, we are offering a walking tour of Saint Anthony Falls as an extra credit option in ESCI 1001. Although the tour guide begins and ends at the east end of the Stone Arch Bridge, you can start and finish the tour anywhere along its route. The start of the tour is roughly one mile from campus (2 miles round trip).

The tour itself is slightly less than 2½ miles and follows paved trails. If you prefer, you can complete the tour by bicycle. Realize the tour is in a public park so you should take common sense safety precautions recommended for any public area. Carry a cell phone with you if possible (your lab instructor may ask for photos of your tour), and remain aware of your surroundings. Completing the tour with a friend is a good idea, especially if you are doing it in the evening.

If you wish to transform the tour into a social event, there are restaurants and a movie theatre along the east riverbank, while downtown Minneapolis lies just west of the river.

Numbers in the image below mark the tour's sixteen stops, while letters indicate other notable features.
Geology Tour of Saint Anthony Falls

Stop 1 – East side of Stone Arch Bridge
In the absence of other criteria (like parking) you can start the tour at the East End of the Stone Arch Bridge (three blocks south of University Avenue on SE 6th Avenue). The Stone Arch Bridge is an 1883 railroad bridge that was converted to a pedestrian walkway and bike trail in 1994. Walk to the green Information/Postings Kiosk just before the bridge begins. Although the kiosk’s Saint Anthony Falls Heritage Trail map differs slightly from this walking tour, the two are close enough to use the kiosk map (and its many reiterations on historic markers along the tour) for orientation.

Right now, you are standing on the old portage trail used by the Dakota and Ojibway to carry canoes and goods past the falls. The portage trail began further upstream and ran through this area nearly a mile downstream to the University campus. One side of the kiosk reproduces a George Catlin sketch that shows the portage as it appeared when Catlin visited the falls in 1835. To early visitors the falls was variously a forced detour for river traffic, a place of natural beauty, or one of spiritual power, although later settlers would primarily value the falls in terms of their physical power.

Other kiosk images attest to the falls’ evolution over time. The sketch by Peter Rindisbacher includes islands below the falls that no longer exist. A side map illustrates the recent retreat of the falls’ edge as noted by different visitors over time, while a map above shows the fall’s long-term migration since the last ice age. Originally, the falls began as a much larger waterfall south of downtown St. Paul that retreated upstream to the area where Fort Snelling later stood. At that point, the waterfall split into two smaller waterfalls, one of which retreated up the Minnesota River Valley to eventually die out, while the other, even smaller, waterfall retreated more slowly up the Mississippi River Valley to become the present Saint Anthony Falls.

Question 1a – According to the maps, how long did it take for the ancestral waterfall to retreat from the downtown St. Paul area to the juncture at Fort Snelling?

Question 1b – How long did it then take the smaller waterfall to retreat a similar distance from the Fort Snelling area to its present position in downtown Minneapolis?

Optional Staircase Stop – Close up view of Bluff Rocks
If the staircase just north of the bridge is open, you can walk down to the third landing to get a closer view of the bluff rocks and fractures while answering Question 2. Otherwise you can see the same features from a distance at Stop 2. After seeing the rocks, return to the bridge level to continue the tour.

(Continuing down the stairs will provide you a nice view of the bridge from below and access to the Lower Heritage Trail along the river level. However, you might want to wait to explore this area until after you finish the tour.)

Stop 2 – Overview of Bluff Rocks
On Stone Arch Bridge, by the first street light on the bridge’s upstream (north) side.
From this point you should be able to look down over the bridge’s edge to see an exposed section of the bluff rock just upstream of the wooden stairway landings. However, if trees are in full leaf, it can be difficult to see the rocks, so you can refer to the photograph at right. The buff colored rocks comprise the Platteville Formation. These layers of physically resistant carbonate rock form the edge of the waterfall and the cliff faces of the surrounding bluffs. Weaker rock, called the St. Peter Sandstone, underlies the exposed Platteville rock. Easily eroded, the St. Peter Sandstone underlies the grass-covered slope that extends from the base of the bluff walls to the river below. You should also be able to see vertical fractures (breaks) that run through the exposed Platteville rocks layers. Anomalously flat surfaces seen on some of the bluff cliff exposures formed as blocks broke off along these fracture surfaces.

Question 2 – From the tour’s background information, what role did these fractures play in the origin and retreat of Saint Anthony Falls?
Between stops 2 and 3, you are crossing the river’s east channel, which lies between the east bank and Hennepin Island. The view upstream should give you some sense of the size of the valley formed by the retreat of this relatively small portion of Saint Anthony Falls, as the bridge surface lies at the same level as the top of the bluffs. The waterfalls that cut this gorge are now hidden within Excel Energy’s Hennepin Island Hydro Generating Station or buried beneath the Main Street electric distribution center.

**Stop 3 – ‘Sawmilling: The City’s First Industry’ historic marker located by the 4th streetlight on the upstream side of the bridge.**

Begin by looking at the upstream view. Below the Pillsbury A Mill, close to the river level, you should be able to see masonry around a riverbank tunnel (beyond the furthest upstream footbridge). This is the exit (tail trace) for a tunnel that diverted water from the upstream river. The diverted water then flowed beneath the mill and dropped down shafts to physically turn turbines that drove the mill machinery. Similar tunnels existed beneath all the mills that were later built on the riverbanks. However, the first commercial milling operations were not located on the riverbanks but on platforms built out over the rushing water.

Long before the flour mills were built, sawmills built on river platforms cut timber from upstream logging operations. Platform structures were cheaper than riverbank mills and upstream logging operations could float logs directly to the platform sawmills. The central image on the historical marker shows how the area before you looked during its sawmilling era. From the 1840’s to 1870’s, these sawmilling operations drove Minneapolis’ founding and initial growth. By the 1870’s, flour mills began to become more economically important at the falls. While sawmilling continued to be an important part of Minneapolis’ industry and actually reached their peak operation in the 1890s, sawmill operations by then had converted to steam power and moved upstream, leaving the falls’ waterpower for more profitable flour mills.

**Question 3a** – From the historical marker, what occupational risks did sawmilling operations hold for their workers?

**Question 3b** – What risks did these operations hold for the community that surrounded them?

Before moving on to the next stop, take a moment to cross to the downstream side of the bridge. On the riverbank close to the Stone Arch Bridge’s east end is the University of Minnesota’s steam heating plant (with four dark smokestacks), which once supplied power for the electric trolleys that dominated Minneapolis streets for over forty years. Downstream, below the new 35W bridge lies the Lower Saint Anthony Falls dam, completed in 1956, with a line of yellow pilings to guide barges to the dam’s lock. From beneath the Stone Arch Bridge, a gravel barrier separates the barge channel from the more turbulent central river flow. The isolated, eroding stone structure just below the Stone Arch Bridge once supported the old 10th Avenue bridge. After a new 10th Avenue bridge was built further downstream (close to campus, on the other side of the 35W bridge) the older one here was removed and its iron used in our WWII war effort.

**Old 10th Avenue Bridge and its sole remnant, much of which later fell during the high water flow of spring 2014.**

*(Photo on left courtesy of Hennepin County Library)*

Return to the upstream side of the bridge to continue on to the next stop.

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2 The old 10th Avenue Bridge was part of 10th Avenue S, the new 10th Avenue bridge is part of 10th Avenue SE, hence their different locations.
Stop 4 – By 8th streetlamp on upstream side of bridge.  
Excel Energy’s brown brick hydroelectric power plant lies beyond the Keep Back 500’ sign. Water released from its arched tunnels can occasionally create a great deal of turbulence (hence the sign). The lighter colored building to the west (left) was built on the foundation of an 1857 paper mill and houses the University of Minnesota’s Saint Anthony Falls Hydrologic Laboratory, which is the headquarters for the National Center for Earth-Surface Dynamics.

Once you have seen the view, take a few moments to examine the cut blocks of stone that form the base of the bridge railings (as well as the bridge itself). These are blocks of Platteville carbonate, marine rocks that formed roughly 450 million years ago when this area was covered by a large inland sea. By comparison, the oldest dinosaur lived 215 million years ago and Tyrannosaur rex only left the world a mere 65 million years ago. Although the vertical shafts seen on the sides of many blocks were holes drilled to quarry the stone, the rest of their surface features reflect their marine origin. Many blocks exhibit fine horizontal lines on their sides that formed as individual layers of mud deposited across an ancient seafloor. Other blocks have holes that formed from the dissolution of fossil fragments of marine shells, while the blocks’ top surfaces often display an irregular pattern that formed as organisms burrowed through mud to leave traces in their wake.

Although the blocks were cut to a uniform width, note that their length varies. The length of the blocks reflects the spacing between fractures in the original rock, which should give you an idea of the size of the blocks that fell off into the channel during the waterfall’s natural retreat.

**Question 4** – Based on the average length of the railing blocks, how far apart were most of the Platteville’s vertical fractures?

a) Less than 1'  b) 1’ to 4’  c) 4’ to 8’  d) 8’ to 12’  e) over 12’

Stop 5 – By 11th streetlamp on upstream side of bridge – at National Historical Civil Engineering Plaque.

This stop provides a nice upstream view of the only remaining section of waterfall in the west channel, running between the lock on the left to Saint Anthony Falls Hydrological Laboratory (SAFL) on the right. The sloping surface beneath the falling water is NOT a dam. It does not hold back water, but covers a rock cliff and the upstream river is only a few feet deep. Between this waterfall and the SAFL building are two grass-covered spillways (one that ends in a concrete slope) that were originally built to funnel water around the falls during periods of high flood water. These are now being used as an outdoor stream lab for modeling river flow. For hydrologic experiments, geologists and geo-engineers at the laboratory can also divert part of the river’s flow through the building’s basement to test physical models of stream patterns and dam removal. You will get a chance for a closer view of the outdoor stream lab at Stop 15.

The present waterfall is the only part of Saint Anthony Falls that was never used for industry. Platform mills for sawmilling were first built across both sides of the river; one spanned the east channel while another stood in the area now occupied by the massive lock to your left. Later both riverbanks were lined by flour mills. However this central area was left open. Early on, it was also left dry for most of the year as low dams were built upstream to funnel water to the mills on either side. Exposed to winter cold, ice freezing in fractures broke up the rock more quickly, threatening to erode the center of the river more rapidly than the sides. Eventually mill owners realized that they needed to allow some water to flow over the center to protect it from freeze and thaw cycles while still sending most water to the mills. Ironically, the unused portion of the falls is now the only easily seen remnant of the original waterfall system.

Father Hennepin (1680) initially claimed that the natural falls alone were 50’ to 60’ high, but Carter (1766) estimated them to be only half that height (30’). In 1823, Long and Keating actually measured the falls to discover they were only 16½’ tall, with downstream rapids contributing an additional 58’ drop. You are not looking at a natural waterfall but an engineered slope built in 1955 as the latest attempt to restore the falls after a catastrophic tunnel collapse in 1869 threatened their existence. As part of this construction, the downstream rapids were cleared away which altered the waterfalls’ height. If you look at the cement lock wall west of the falls, each of its cement layers is 5’ thick.

**Question 5** – Imagine a horizontal line that runs from the top of the waterfall to the lock wall (shown at right). If you then count the number of cement layers between that line and the downstream river, you can estimate the height of the present falls as being:

a) 15’–25’  b) 25’–35’  c) 35’ to 45’  d) 45’ to 55’  d) 55’ to 65’  e) over 65’

Stop 6 – 'Changing the Shape of the Falls' historical marker by 13th streetlamp on upstream side of bridge.

Note that the bridge widens in this area and the stone railing base has been replaced by metal. This part of the Stone Arch Bridge was replaced by a metal span when the lock was constructed to allow barges to pass beneath the bridge.

**Question 6a** – From the historical marker content, how did logging operations affect the natural retreat rate of the falls?

**Question 6b** – Look at the sketch showing the waterfall geology. As drawn, the water falling over the falls could never reach the sandstone further back from the edge. So what features are missing from the image that would be necessary to explain the falls’ retreat? (You can refer to the tour’s background information if you are having trouble with this one.)
Cross over to the downstream (south) side of the bridge. For the rest of the Stone Arch Bridge, the tour will stay on the downstream/west bank side of the bridge. Two islands used to lie beneath this part of the bridge, islands with very different shapes and histories. Spirit Island was a small rocky point that stood near what is now the end of the gravel barrier for barge traffic while Upton Island was a large low sandy bar that extended from below the bridge to where the lock now stands.

According to Dakota traditions, Spirit Island’s name originated when a Dakota mother named Anpetu Sapa (Dark Day) committed suicide to protest her husband’s decision to take a second wife. When her tribe arrived at the falls, instead of landing to make the portage with the others, she propped her infant son up in the canoe and paddled out over the falls, singing her death song. Their spirits were thought to inhabit the island and at times people claimed that the sound of her voice singing to her child could be heard through the roar of the falls. Although Spirit Island was too small for mills or houses, its rock was a tempting resource for a growing city looking for building materials. In 1895, a railroad spur was built out to the island and a spiritual place of the Dakota was quarried away.

In contrast, Upton Island was not rock, but a low sandy island that became industrialized shortly after Fort Snelling released the west bank area for settlement. Sawmills were built on a large platform where the lock currently sits. After sawmilling left the falls to the flour mills, Upton Island ended up making history as the site of the nation’s first hydroelectric power plant, which began generating power on September 5, 1882 twenty-five days before the more famous Vulcan Street Plant opened in Appleton, Wisconsin.³ Despite its historic nature, Upton Island was removed to make way for the lock and barge channel. The historic marker at Stop 7 includes an image of Upton Island prior to the lock construction.

Stop 7 – Historic markers at second streetlight on downstream side of bridge from the point where the bridge widens.

The nation’s first central hydroelectric power plant was built on Upton Island just downstream of the present lock gates (right). Although neither the plant, nor the island it stood on, remain the image at left shows the base of an immense electric tower the company built in downtown Minneapolis to demonstrate the greater efficacy of electric street lighting compared to the older gas lights. In the background you can see the second Hennepin Avenue suspension bridge. (MHS photograph)

Question 7 – From the historical marker, what role did the First Street Canal play in milling operations?

³ The previous year, 1881, a flour mill on the American side of Niagara Falls converted one of its water wheels to produce hydroelectric power for a line of streetlamps for tourists, but the Upton Island station was the nation’s first central hydroelectric power plant.

⁴ The original Washburn A Mill exploded violently on May 2, 1878 creating a firestorm that burned much of the west bank mill district. Its replacement stood until 1991 when a fire destroyed the building. When originally built in 1880, the second Washburn A Mill was the world’s largest flour mill.
Before leaving at Stop 7, look downstream along the west bank to find the dark blue Guthrie Theater. The theater’s ‘Endless Bridge’, which extends over the road and riverbank, provides a nice optional overlook between Stops 10 and 11.

Stop 8 – Black stone in bridge railing between 5th and 6th streetlights since Stop 7 (after bridge narrows - on riverbank side).

Look down over the west side of the bridge (downtown Minneapolis side) to see Mill Ruins Park, the exhumed remains of a portion of the tunnels and basement structures of the missing west bank mills. Similar tunnels ran beneath the West River Parkway to power mills that now house the museum and apartments.

There are three gated tunnels in the wall at the northern end of Mill Ruins Park. You cannot see the closest of these unless you lean over the railing (something that is not necessary if heights bother you). You can hear this tunnel as it carries the greatest water flow and was once part of the City of Minneapolis’ water supply. You will have an opportunity to see these tunnels closer up at the next stop.

As you look down, you can see a large, fallen, partially buried block of Platteville lying just beyond the end of the metal walkway. Blocks this size or larger were left scattered in the river channel as the waterfall retreated, creating a perilous gauntlet for boats until the Army Corps of Engineers removed them in the 1950’s. Although the city of Minneapolis owed its existence to Saint Anthony Falls’ hydropower, the city of Saint Paul owed its own financial debt to the retreating waterfall. The fallen blocks that choked the downstream channel meant that Saint Paul controlled river traffic and remained a pivotal transportation hub for many of the goods produced in Minneapolis mills.

At the downstream end of the grassy slope, there is an exit tunnel with cement walls poking out of the riverbank. Upstream of that tunnel are a number of gravel-filled channels that were once the tail races for tunnels beneath the mills that once lined the riverbank.

**Question 8** – How many tail races (now filled with gravel) are there between that tunnel and the three gated tunnels in the upstream wall of the park? (As each tail race represents one or more mills, this should also give you an idea of how many mills once stood on this slope.

Continue to the west end of the Stone Arch Bridge and follow the black railing on your left to go under the bridge and towards the parking lot for the Upper Saint Anthony Lock. Cross the road at the end of the parking lot and continue to follow the sidewalk and black railing as they curve back beneath the Stone Arch Bridge towards the Guthrie Theater. Just past the end of the black railing, turn right and take the stairs down to the metal walkway of Mill Ruins Park. If you are on bike, you can continue down the trail for bike access to the park. Follow the metal walkway to the overlook by the three gated tunnels in the upstream (north) wall of the park that you saw from Stop 8 above.

On your way down to the trail, before you pass under the bridge, you will walk past two stone supports that once held the southern edge of a railroad span for trains that brought wheat from western Minnesota farms to the flour mills. Beyond them, in Mill Ruins Park, you can see two of the iron girder supports for the same railroad lines (photo on right shows bridge around 1885).
Stop 9 - Mill Ruins Park overlook at end of metal walkway close to three gated tunnels.

The fallen block of Platteville rock you saw from the bridge lies just beyond the end of the metal walkway. Two of the gated tunnels in the upstream wall were tail races from flour mills, but the one closest to the river was once part of the city’s water supply system.

Take a moment to look at the walls the tunnels are in. At the bottom, the walls are built of masonry but the solid sections above are actually in-place Platteville rock. The large flat surfaces are the sides of fractures along which large blocks broke away (or were quarried off to make room for mills). The seamless transition from masonry to natural stone mimics the intersection of the area’s geology, river processes and human activities that ended up defining its history. Note that the masonry part of the wall only goes to the top of the tunnels. Construction workers here took advantage of the same natural geology that was responsible for the falls. They cut the tunnels through the soft, easily removed St. Peter Sandstone and used the stronger, more resistant Platteville layers as natural tunnel roofs. Since the sandstone was soft, they had to cover its surface with masonry to protect it from being eroded.

**Question 9** – Compare the height of the masonry wall covering the Saint Peter, to the height of the Platteville rock layers exposed above. The Platteville rock layers comprise how much of the bluff’s total height?

a) ~1/10  b) ~1/4  c) ~1/2  d) ~3/4  e) ~9/10

Retrace your route back under the bridge and up to the parking lot by the entrance to the Upper St. Anthony Lock and Dam. Instead of crossing the road (Portland Avenue) to the parking lot, turn left and walk along the road under the Stone Arch Bridge to the intersection of West River Parkway and Portland Avenue. The sidewalk runs out after a few feet so be careful to watch for traffic.

Stop 10 – Corner of West River Parkway and Portland Avenue.

There are a number of things to see at this intersection. On the northeast corner, a large circular stone is mounted on the wall behind the gold-lettered Mill Ruins Park sign. This is a grinding stone that was used in one of the early flour mills along the river. Originally flat millstones like this were used to grind flour, but eventually the mills improved on a European invention by using large steel rollers to grind flour more finely and more efficiently, resulting in both a better quality product and higher production.

Across Portland, the southeast corner of the intersection is close to where the first sawmill stood at Saint Anthony Falls. This was the government sawmill for Fort Snelling. Because of this sawmill, the west bank of the river remained part of Fort Snelling for a longer time than the east bank, so the falls’ earliest commercial milling operations began on the east side.

Although sawmilling, flour milling and hydroelectric power became the primary industries at Saint Anthony Falls, the original industrial models for the falls were textile mills on the east coast, like those around Lowell, Massachusetts (which served as the backdrop for ‘Lyddie’, a Newbery Medal winning book by Katherine Paterson). The Lowell textile industry idea was so strong that ‘New Lowell’ was one of the original names proposed for Minneapolis. However, as it turned out, only one textile company ever ended up finding a place at the falls. Sawmilling and flour were better matches to the region’s resources.

**Question 10** – Looking at the buildings along the west bank, what is the name of the lone textile company that did end up calling Saint Anthony Falls home?

Water still flows through the old First Avenue Canal that lies under the renamed West River Parkway. Until a few years ago, the parkway was a wood plank road built over the canal, although now the only vestige of its previous form is the wooden sidewalk running down to the Mill City Museum. If you have time after the tour, the Mill City Museum’s Flour Tower exhibit not only provides insight into the lives of mill workers during the flour milling period, but ends with one of the more spectacular views of the falls area. Although the museum charges admission, the Guthrie Theatre next door will let you walk out on their ‘Endless Bridge’ (the long blue corridor that extends out above the West River Parkway) for free and the view from the Endless Bridge is nearly as nice. You can reach the Guthrie Theater by the West River Parkway, but if snow is on the ground, it may be easier to walk down South 2nd Street (the next street west). If you have not been to the Guthrie Theater, you owe it to yourself to go, as it is one of Minneapolis’ more memorable buildings.

Another less memorable, but once infamous building is two blocks south of the Guthrie Theater on 11th Avenue S. There were once three red light districts encircling Saint Anthony Falls and the building at 212 11th Avenue S is the only building in Minneapolis originally built as a brothel that has survived to the present day. It is an optional stop, but how often do you get to tell your family or friends that you had to visit a brothel for your Earth Science class? (well, okay an ‘ex-brothel...’)

Building originally built as a brothel.
From either Stop 10 or the Guthrie Theater’s ‘Endless Bridge’, return to the west end of the Stone Arch Bridge.

Stop 11 - Green Information/Postings kiosk just north of the west end of the Stone Arch Bridge.

Although working around the machinery of the flour mills was considerably safer than working at the earlier sawmills, flour milling had its own set of risks for mill workers and neighboring businesses.

**Question 11a** – From the kiosk information, what caused the original Washburn A Mill to explode on May 2, 1878?

Control of water power at the falls did not just affect the Minneapolis area. A total of six dams were built upstream in the headwaters of the Mississippi River to ensure a stable year-round supply of water to the mills at the falls. This stability came at a cost, a cost not paid by those who profited by the mills.

**Question 11b** – From the kiosk information, what problems did these upstream dams pose for native tribes?

*The remainder of the tour focuses on how activities at the falls affected the surrounding area and notable historic buildings. However, Water Power Park (Stops 13-15) is closed from Oct. 31 to April 1, so if you are completing the tour between those dates, you can use the map on page 5 to answer Question 12 and then return to the EAST end of the Stone Arch Bridge and take the walking path by the green Information/Postings kiosk (Stop 1) north to answer Question 16. Between April 1 and Oct. 31, follow the directions below.*

From Stop 11, walk northwest (upstream) along the walking path towards the Hennepin Avenue Bridge. At the end of the black fence just north of the green kiosk, you pass over one of the entrance tunnels to the complex of tailraces you saw in Mill Ruins Park. The walking path will take you below the 3rd Avenue Bridge and there are a number of historical markers along the way for your enjoyment.

As you walk towards the Hennepin Avenue Bridge, you should be able to see the old Standard Mill (built by Minneapolis’ first mayor Dorilus Morrison in 1879) and the Crown Roller Mill and Boiler House which operated from 1880 to 1950.

The riverbank’s transition from industrial area to urban park began when Reiko Weston moved her parent’s restaurant Fuji Ya from downtown Minneapolis to the riverside. Something of a visionary, Reiko built upon and incorporated the old mill ruins into her building’s foundation rather than destroy them. Although trains would continue to rumble across the Stone Arch Bridge for a decade after she opened, other restaurants and bars began to join her along the river, eventually leading to the area’s renewal. Ironically, Fuji Ya become one of the earliest victims of that renewal, when the Minneapolis Parks took over the property in 1990 as part of a yet unfulfilled renovation project.

Some of the original mill buildings and supporting structures managed to survive to the present, although all now serve different purposes.
As you reach the Hennepin Avenue Bridge, there is a ‘Bridging the Stream’ historical marker with information on the bridge’s background. The original Hennepin Avenue Bridge was the first bridge to cross the Mississippi River anywhere in the country. Over the years, three of the four Hennepin Avenue Bridges built were suspension bridges. Parts of the second bridge’s base and cable suspension structure are preserved under the bridge. Once you have seen the old cable connections, take the stairs or bike ramp on the downstream (south) side up to the bridge level. You want to stay on the downstream side of the Hennepin Avenue Bridge so you can see the falls area.

Second Hennepin Avenue Bridge (Minnesota Historical Society)

Stop 12 – Midway across Hennepin Avenue Bridge on the downstream side overlooking the falls.
Looking downstream, you can see the Stone Arch Bridge through the 3rd Avenue Bridge supports. A line of large yellow pilings guide barges toward the west side lock, while behind the yellow pilings, turbulence marks water flowing over a horseshoe-shaped dam. You can refer to the tour’s cover map to get a better idea of the dam’s shape. This dam was an early, and rare, collaboration between two competing towns at the falls. Although Minneapolis would eventually grow to cover both sides of the river, it was originally limited to the west bank while the older town of Saint Anthony controlled the east bank. Business interests in the two towns were intense rivals of one another yet both cooperated to build the original horseshoe dam above the falls.

Question 12 - Looking at the design of the horseshoe dam, what benefit would this dam provide mills on both sides of the river?

Continue across the Hennepin Avenue Bridge, turning at the first street (Wilder Street) on the right to walk down to Nicollet Island (you should be able to see the Nicollet Island Pavilion straight ahead). Nicollet Island is named after a French explorer who worked for the United States government to create the first accurate maps of Upper Midwest watersheds. In 1836, while on one of his many mapping excursions, Nicollet camped for several days at the falls with Ojibway friends and his voyageur crew.

Turn left at the intersection of Wilder and Merriam Streets to walk across the iron bridge to the east bank. (If you like to ring bells, you can first stroll over to the Bell of Two Friends on the river path west of the intersection.) As you approach the iron bridge, a historical marker on the right gives some of Nicollet Island’s history, but the bridge has its own story. The span was once part of a railroad bridge a mile upstream of Nicollet Island and was floated downstream to its current location in 1986.

The sculpture at left based on the design of a 2,000 year old Japanese bell was presented to Minneapolis by its sister city of Ibarki, Japan in 2001.

The Nicolet Island Inn began as a sash, door and blind manufacturing plant, and then served as a Salvation Army men’s shelter for sixty years until developers reopened it as a restaurant and inn.

Similarly the Nicolet Island Pavilion began as an industrial boiler works in 1892.
Continue across the bridge towards the intersection of Merriam and Main Streets. The stairway straight ahead leads to Our Lady of Lourdes, the oldest church in Minneapolis (originally built as a Universalist church in 1857 and remodeled as a Catholic Church in 1877).

Buildings along Main Street include some of the oldest masonry structures in Minneapolis. Just before you reach Main Street, turn right and follow the brick trail along the riverbank edge. A number of interesting historical markers line the trail.

After a fire destroyed an original factory, the Levin Brothers built a five-story factory and warehouse in 1917 at 29 Main Street that later became the Riverplace apartment complex.

The Pracna building at 117 Main Street was originally a saloon and upstairs residence until Prohibition forced its conversion to a warehouse and machine shop (with rumors of a brothel operating in the old upstairs residence area). Peter Hall bought the building in 1969 and opened it as a restaurant in 1973 as one of the earliest modern restaurants on the east riverbank.

The buildings at 127-129 Main include some of the oldest masonry buildings in Minneapolis. Captain John Martin built the center building (four windows wide) in 1858, that his neighbor Francis Morris imitated (although he only had space for three windows). The upper floors served as professional offices, while the lower floors housed two newspapers until the building was purchased by the Union Iron Works and converted to a factory.

The cream colored brick building to the south is the Upton Block (now the Astor Café). Built in 1855, the Upton Block is the oldest commercial building in Minneapolis, built in 1855. Originally a general store, it also saw duty as a hardware store, iron foundry, and windmill factory before its present existence as a café.

Before the trail passes beneath the 3rd Avenue Bridge, there is a small historical marker ‘The Whirlpool’ that lies close to the point where the Eastman tunnel collapsed on Oct. 5, 1869, during its construction between Hennepin and Nicolet Islands. It was the collapse of this tunnel that nearly ended milling operations at Saint Anthony Falls. When the tunnel collapsed, water could bypass the falls, cutting mills off from their source of hydropower. Local businesses tried to repair the falls without success and only the intervention of the Army Corps of Engineers saved the milling industry by repairing and rebuilding the falls.
South of the overlying 3rd Avenue Bridge, there is another green Information/Postings kiosk, across from an open courtyard area on Main Street. Kiosk photos show how this area looked during the 1860s sawmilling era and an earlier 1850’s Metis oxcart train visit.

Just beyond the kiosk and to the right is the gated entrance to Water Power Park. As you enter the park, there are two historical markers on the left that detail some of the early history of hydroelectric power at the falls. Upstream, along the riverbank, is the now closed entrance to the water tunnel that ran below the Pillsbury A Mill and whose exiting tail race you saw close to the tour’s beginning. From this tunnel, water flowed south beneath Main Street to downstream riverbank mills through a smaller version of the west banks’ First Avenue Canal.

### Water Power Park
Stops 13-15 take place in Water Power Park, which is only open from 6 a.m. To 10 p.m. from April 1st to October 31st. If you are completing the tour at a time that Water Power Park is closed, you can just skip questions 13 to 15.

**Stop 13 – Water Power Park walk just across the first bridge.**
After you cross the bridge on the Water Power Park walk, there are six information panels in the middle of the path. Look at the first of these, labeled ‘Waterpower 101’, and use it to answer the following question.

**Question 13** – Why did dam, head race and tail race construction increase hydropower potential compared to the natural waterfall?

Continue on the path towards the sound of the waterfall. The path crosses two grass-covered areas that were originally spillways to safely carry excess water past the falls and mills during floods. Although it is tempting to go directly to the falls overlook, keep on the right path to head towards the furthest upstream overlook. You will pass a simple unimpressive concrete square that is actually the cap to a shaft dug by the Army Corps of Engineers to build a large underground wall or dike in their quest to save the falls. Army engineers realized that the falls retreated due to water moving down fractures through the Platteville cap rock to erode the St. Peter Sandstone beneath. To prevent this, they built a large subterranean wall beneath the Platteville Formation that spans the river channel, designed to prevent further erosion of the underlying sandstone. This wall is one of the more impressive structures at the falls, but this solitary concrete block is its only surface expression.

Proceed to the upstream overview of the horseshoe dam, by the ‘A Horseshoe for the River’ historical marker. Although it is easy to focus on the water flowing over the horseshoe dam (especially during high water flow), realize that the goal of the horseshoe dam is to divert a deep, steady supply of water to the two river banks, not to create a picturesque waterfall. Only excess water makes it over the horseshoe dam, consequently the water flow on the dam’s other side is significantly deeper than in the channel below you.

**Turn downstream and take the path on the right to the falls overlook.**

**Stop 14 – Overlook of Saint Anthony Falls**
The roar of the falls was once the heartbeat of the city and much of the Upper Midwest economy. This last stretch of open waterfall is the only vestige left of the waterfall system that was the reason for Minneapolis’ existence. Obviously, the slope below you is no longer a natural waterfall, but an engineered concrete apron that was constructed in 1955. Check the historical markers for background on the various attempts to modify and preserve the falls that date back to 1866. Recent proposals have suggested that we should undo some of these modifications and attempt to recreate areas of natural waterfall. However, with the Platteville Formation ending upstream beneath the Hennepin Avenue Bridge, any attempt to recreate a natural waterfall would have to accept that a natural fall would continue to slowly retreat upstream to its eventual demise.

**Question 14** – From the historical markers, why did development initially take place faster on the east bank of the river, than on the west bank?

Turn back towards Main Street, but follow the path to the right of the power line poles to reach the Outdoor Stream Lab overlook.

**Stop 15 – Overlook of Outdoor Stream Lab.**
St. Anthony Falls Hydrologic Laboratory’s Outdoor Stream Lab was built in one of the spillways originally built at the falls to safely channel floodwater past the mills and falls. Another old spillway forms the grassy area just to the east.

**Question 15** – What is the purpose behind the Outdoor Stream Lab?
Return to Main Street and turn south (right), taking the path along the river. There are historical markers in front of the Main Street Power Station and along both sides of the path as you pass by the Pillsbury A Mill. Also across from the mill, there is a staircase that leads down to the Lower Heritage Trail, which winds through the lower river flat area and has a second entrance at the stairway you saw at the beginning of the geology tour. If you have time after the tour, you might consider exploring the lower river flat area. For now though, stay at the street level. Past the Father Hennepin Park sign, follow the walking trail along river back towards the Stone Arch Bridge. The first historical marker to the left provides background for the Pillsbury A Mill.

Just before you reach the water fountain to the trail’s left (and the park shelter beyond), there is a small historical marker on the right of the trail titled ‘Pettingill’s Wonderful Water’. (If you are completing the tour between Oct. 31 and April 1, you can reach stop 16 by taking the walking trail on the East end of the Stone Arch Bridge north past the park shelter on the left and drinking fountain on the right.)

Stop 16 – Pettingill’s Wonderful Water historical marker.
A natural spring and health spa once existed along the river at the base of the river bluffs below. This spa flourished at a time when many believed that natural springs offered near-miraculous health benefits and similar spas sprung up across the country for wealthy visitors.

**Question 16** – With all the interest in the health benefits of natural springs, why was this spa abandoned in the early 1880s?

The Salisbury and Satterlee Company built a five story red brick building at 221 Main Street in 1892 as part of a box spring and mattress manufacturing complex. They later added a smaller two story addition in 1909 at 201-205 Main Street. The Jefferson Company, which owns St. Anthony Main, purchased both buildings in 1977 and renovated them.

At one time, the Pillsbury A Mill was the largest flour mill in the world. Built in 1881, the mill could produce four thousand barrels of flour (120 tons) a day. The Pillsbury A Mill was also the last active mill at the falls (closing in 2003) and was the last industry at the falls to run on direct water power (the last water wheel was removed in 1960).

This is the last stop on the Saint Anthony Falls Geology Tour. You can continue down the trail to the tour’s starting point or you might consider exploring the Lower Heritage Trail or crossing the Stone Arch Bridge to visit the Mill City Museum. The lower river flat area has many small trails, but it is a more remote part of the park, so it might be better to explore it with friends than on your own.