Engineering a Stronghold

Built after the War of 1812 to protect Savannah's vital port, Fort Pulaski was a state-of-the-art military fortification. Its design combined the expertise of French engineer Simon Bernard, who brought knowledge of European fortress design, and U.S. Army engineer Joseph Totten, who adapted those ideas for American defense.

Constructed by a mix of free and enslaved laborers, the fort's towering brick walls stand today as a powerful symbol of engineering innovation and human resilience.

As you walk through the fort's interior, take a moment to reflect on the ingenuity, determination, and legacies of those who built, defended, and preserved this remarkable structure.

The Basics

Time: 30-40 Minutes

Distance: About ⅓ Mile

Directions: See the tour stops on the Map (back page). Begin at the first drawbridge for the first stop, follow the sidewalk to the demilune for the second stop, then enter the fort. Walk clockwise around the first level for the remainder of the tour stops until you end back at the demilune.

Safety:

- No running or shouting.
- No climbing on walls, cannons, or mounds.
- **Caution: The fort does not have railings for stairwells or on the upper level. Avoid walking near the edges and closely supervise young children.**

Stop 1: The Moat

Before Fort Pulaski could rise, engineers had to tame this island.

- In 1829, Cockspur Island was just a soggy salt marsh that vanished at high tide.
- Fresh out of West Point, Lieutenant Robert E. Lee took on his first Army assignment in 1829: transforming this island into solid ground.
- He designed a network of **dikes** and drainage ditches to hold back the tides and support the massive brick fort.
- Enslaved laborers dug a canal linking the moat to the Savannah River, allowing engineers to control its depth.
- At 7.5 feet deep, the moat wasn't just for show—it was a serious obstacle for any enemy trying to storm the fort.

? Why do you think engineering the land and water around Fort Pulaski was just as important as building the fort itself?

➔ Cross over the first drawbridge and follow the sidewalk until you see a sign titled "The Demilune" on your right.

Stop 2: Demilune/Ravelin

You're standing on a triangular island called a **demilune**—French for "half-moon" – that originally looked much different than it does today.

- This defensive structure, borrowed from European castle design and sometimes referred to as a **ravelin**, was built to protect the fort's only entrance.
- The demilune is surrounded by the moat and once boasted 28 cannons!
- During the Civil War, soldiers added two kitchens and a mess hall, turning this defensive outwork into a vital support area.
- While the demilune looks different today, its role in protecting the fort from enemy ground attacks was crucial.
- At our final stop, you'll get a closer look at the mounds and tunnels that replaced the demilune's original features.

? How do you think the triangular shape of the demilune helped improve the fort's defense?

➔ Cross over the drawbridge and stop once inside the entryway.

Stop 3: Sallyport

The **sallyport** is the fort's only entrance and exit — and it was a masterfully engineered death trap.

- Massive wooden doors, original to the fort, guard both the upper and lower levels of the passage. Each door weighs over 2,000 pounds!
- Embedded in the lower doors are rows of iron rivets known as **"axe-breakers."** These earned their name in Europe for shattering the blades of attackers' axes — and their hopes of breaking through.
- To raise the **drawbridge**, two soldiers stationed inside would pull down iron levers, releasing counterweights that lifted the bridge in seconds.
- As the bridge rose, a **portcullis** — a heavy, iron gate (from the French *porte coulissante*) — would slam down in front of the doors, sealing the entrance.
- If invaders miraculously made it past the moat, drawbridge, portcullis, and the doors, they'd be met with a barrage of musket fire through narrow slits in the walls called **loopholes**, and devastating blasts from the cannon you see before you.

The drawbridge being raised in the 1960s.
NPS PHOTO

? Why do you think forts in the 1800s still used ideas from the Middle Ages? What does that tell you about how people learn from the past?

➔ At the top of the sallyport, take a left. Feel free to walk through the rooms on your left as you walk towards the end of the walkway. Enter the first large, archway and follow the wooden floor to the left to reach Stop 4: The Demibastion.

Stop 4: Northwest Demibastion

Step inside this fort within a fort, or **demibastion**, from a French word meaning "a projection from a fortress."

- Fort Pulaski's rear wall has two demibastions that extended beyond the main wall, one on each end, designed to protect the drawbridge and the sallyport.
- Each demibastion was armed with three cannons, giving cannoneers the ability to fire in multiple directions and cover blind spots.
- This original 24-pound Flank Howitzer could shoot along the entire length of the wall, creating a deadly crossfire with its twin in the opposite demibastion.
- Look down – those curved grooves in the floor once held iron tracks that let the cannons pivot smoothly, helping the gunners aim quickly and accurately.
- Soldiers from the 48th New York whitewashed the interior walls during the Civil War to better reflect candlelight at night.

? The demibastion was designed to create a deadly crossfire. Do you think this kind of defense was more about stopping enemies or scaring them away? Why?

Cannons in the demibastions were positioned to protect the demilune and sallyport from attack.
NPS/J IRVING

➔ Return to the brick walkway and take a left. Stop at the first arched room – casemate – you encounter: Casemate 47. Casemate numbers are painted at the top on the gray doors.

Stop 5: Casemate 47

Ever wonder how soldiers in the 1800s moved massive cannons without forklifts or trucks? Meet the **sling cart**—a simple machine that did a big job.

- These giant-wheeled contraptions in front of you aren't replicas—they're the last original Civil War sling carts left in the country.
- They worked using basic physics: huge wheels + a long lever = serious lifting power. The cannon barrel would hang beneath the axle, making it easier to move without snapping the cart—or your back.
- The smaller one is a **Hand Sling Cart**, used for lighter cannons that could be pulled by people instead of horses.
- The big one on the left weighs 2,500 pounds—before adding a cannon! Ideally, horses would pull it, but in preparation for the bombardment of Fort Pulaski, 250 U.S. soldiers used ropes to pull sling carts with massive siege cannons across the marshes of Tybee Island.

Why do you think the sling cart used such large wheels? How would smaller wheels have changed the effort needed to move it?

Hint: Think about the difference between skateboard and bicycle wheels.

Continue on the brick walkway and stop at Casemate 45 when you see a large tripod.

This sling cart is being used to move heavy artillery.
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Stop 6: Casemate Gin

After using a sling cart to haul a cannon to its destination, it still needed to be lifted onto its carriage. How? Just ropes, pulleys, and some serious ingenuity.

- What you're looking at is a **casemate gin**—short for "engine"—a clever machine that used **levers and pulleys** to hoist cannons into place inside the fort.
- The average Fort Pulaski cannon weighed as much as two pickup trucks (10,000 pounds)! Lifting that with muscle alone? Not happening.
- Here's how it worked: a rope was tied to both ends of the cannon barrel and hooked onto the gin's iron hook.
- That rope ran through a series of pulleys and around a **roller** on the right side.
- A soldier would insert a long wooden lever—called a **maneuvering spike**—into a notch in the roller and start turning it. As the roller turned, the cannon slowly rose into the air.
- For cannons that needed to be placed on the top level of the fort, they used a much taller version called a **Garrison Gin.**
- It was all about using **simple machines** to multiply force—turning a few soldiers into a powerful lifting crew.

Compare and contrast the casemate gin with modern lifting equipment like cranes or forklifts. What advantages do we have today that Civil War soldiers didn't?

Continue along the brick walkway and stop at the casemate before the next stairwell.

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Stop 7: 42 lb Seacoast Cannon

Third System forts like Fort Pulaski were designed to stand strong against powerful cannons – including blasts from massive guns like the one in front of you.

- This original Model 1831 42-pounder Seacoast Cannon was one of the most powerful and reliable weapons of its time, built to defend forts and protect the coast from enemy ships.
- Why "42-pounder"? That's the weight of the iron cannonball it fired—a flying bowling ball with enough force to hit targets up to a mile away.
- Each **casemate** (arched room) was designed to hold one of these cannons, aiming through an **embrasure** (window opening) to fire at approaching ships.
- Fort Pulaski's walls are 7 to 11 feet thick, built to absorb direct hits from cannons just like this one.
- The fort's engineers were so confident in its strength that one declared, "you might as well cannonade the Rocky Mountains as Fort Pulaski."
- A team of 5 trained soldiers worked together to load and fire this cannon, managing one shot every 5 minutes through a careful, coordinated process.

? How do you think better artillery eventually changed the usefulness of forts like Fort Pulaski?

➔ Walk around the corner until you see three casemate cannons in a row.

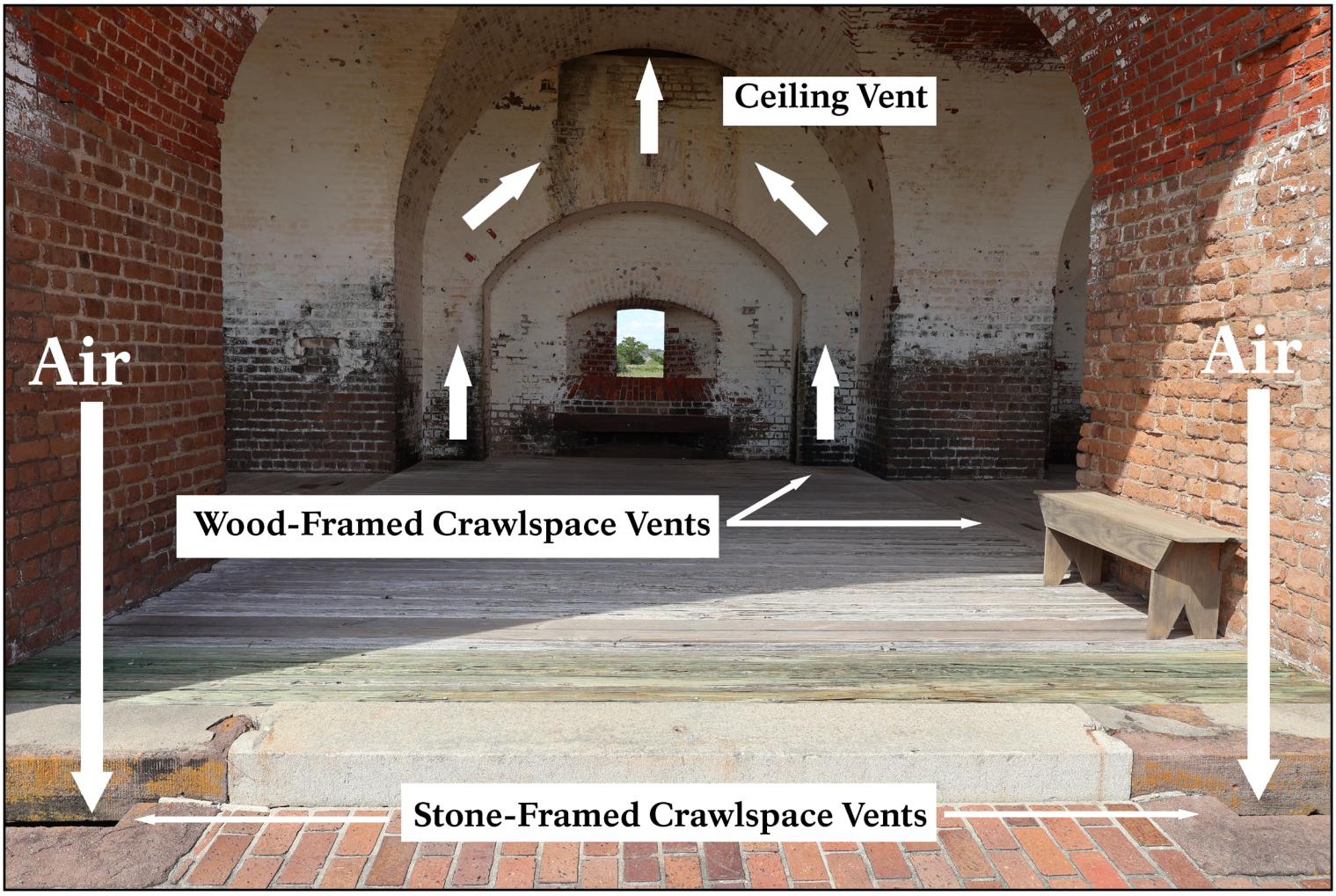
Stop 8: Three Casemate Cannons

These casemates weren't just rooms—they were custom-designed battle stations built to handle the power of massive cannons like the three you see here.

- Each cannon barrel rested on a rolling carriage, which moved back and forth on a **chassis** with elevated wooden tracks.
- To fire the gun, cannoneers used large levers to roll the cannon forward into "battery position." After firing, the cannon's recoil pushed it backward, and the chassis' tracks helped slow it down naturally—right into position to reload.
- Want to aim left or right? The entire chassis could pivot along curved iron tracks built into the floor.
- Each shot used 3–5 pounds of black powder, filling the room with thick, choking smoke.
- To clear the air, engineers built a clever ventilation system: sandstone air slots outside the casemate pulled fresh air under the hollow wooden floors. (See image on next page.)
- Look for the floor vents near the cannon's muzzle—air was drawn up and out through the ceiling vent, creating a full-circle airflow system.
- What didn't engineers include? Ear protection. Firing a cannon in a brick cave was deafening—and they did it over and over again.

? If you were redesigning these casemates today using modern technology, what would you keep the same and what would you improve?

➔ Continue walking through the casemates or along the brick walkway, past the prison, and enter Casemate 16.



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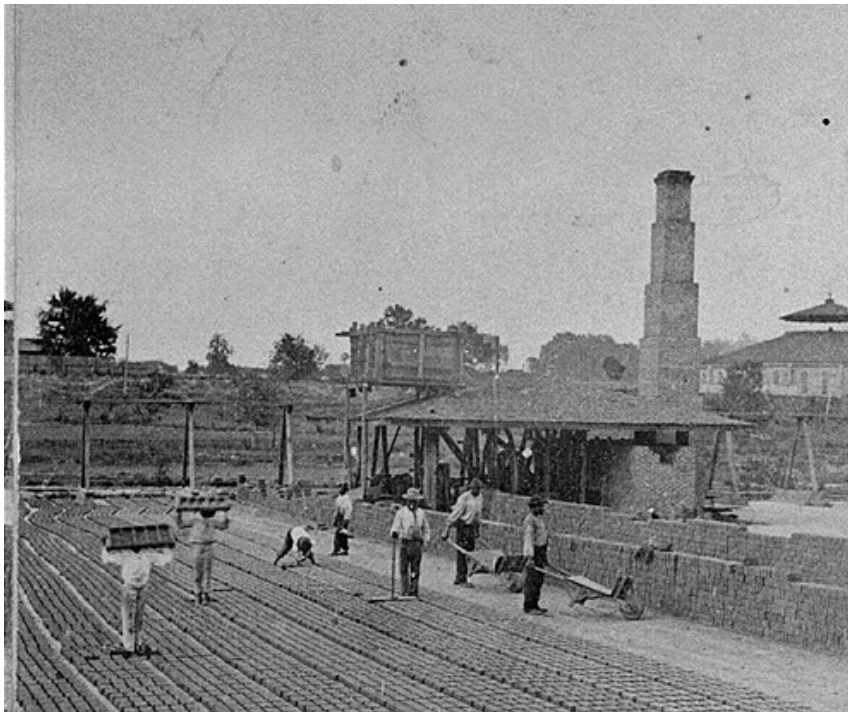
Stop 9: Casemate 16

Fort Pulaski's strength wasn't just in its walls—it was in the people who built them. Can you spot the fingerprints in the bricks of the damaged window?

- The fort was constructed using over 13 million bricks, made from two types: durable "rose red" bricks from Maryland and Virginia and local "Savannah Grey" bricks. You can spot the difference in color in the columns around the 6-foot level.
- These bricks were crafted and laid by enslaved laborers, whose skill and endurance made this engineering feat possible.
- During the drying process, enslaved children flipped wet bricks by



Bricks being made in Macon, Georgia, in 1876. The bricks used in the construction of Fort Pulaski were made using the same techniques.

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hand, leaving behind fingerprints—small, unintentional marks of their presence.

- These bricks were placed deep within the walls, but after the fort's bombardment during the Civil War, the damage revealed the fingerprints, bringing their story into the light.
- Though denied the right to read or write, the resilience, ingenuity, and labor of enslaved men, women, and children are etched into the very structure of this fort.
- Their contributions are not just part of Fort Pulaski's past—they are part of its engineering legacy, and a reminder that every brick tells a story.

? How does knowing this change the way you see the fort?

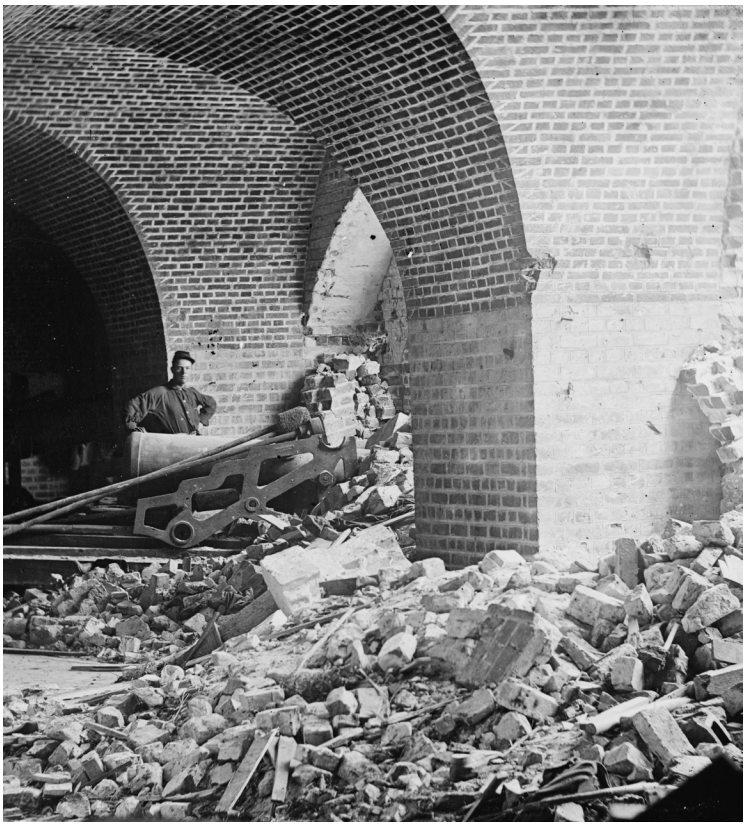
➔ Continue walking to the next corner where you will see three bricked up walls in succession.

Stop 10: Southeast Angle

At first glance, these walls look solid—but look closer. You might spot the scars left by a game-changing Civil War battle.

- In 1861, Georgia joined the Confederacy and seized Fort Pulaski, believing its 7.5-foot-thick brick walls were unbeatable.
- But in April 1862, the U.S. Army launched a bold attack from Tybee Island using a new weapon: rifled cannons.
- Unlike old smoothbore cannons, these fired spinning, bullet-shaped projectiles that could smash targets from 5 miles away.
- In just 30 hours, U.S. rifled cannons blasted holes through the walls, threatening Fort Pulaski's powder magazine and forcing the Confederates to surrender.
- A fort that took 18 years to build fell in less than two days—proving that old defenses couldn't stand up to new technology.
- Determined not to defend a fort riddled with three gaping holes, U.S. soldiers patched the massive breaches six weeks later with the very bricks you see before you today.

? Can you think of a modern example where new technology made an old system or structure suddenly outdated—like rifled cannons did to brick forts?



A soldier stands in the rubble created by the bombardment of Fort Pulaski.
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➔ Return to the brick walkway and continue walking clockwise around the fort's interior until you reach the final casemate on your left before the stairwell. Walk to the railing near the sign and spot the missing floors.

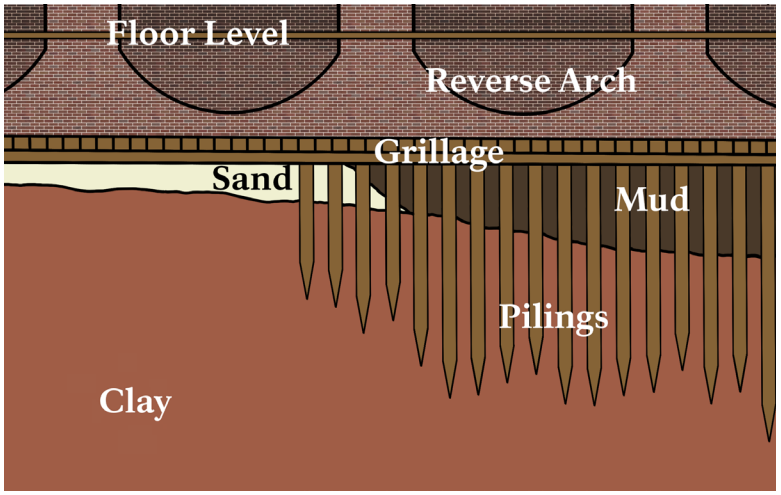
Stop 11: Southwest Demibastion

In 1925, a lightning strike ignited a fire that destroyed the wooden floors in the casemates below, uncovering the hidden engineering genius beneath Fort Pulaski.

- With the floorboards gone, you can now see the fort's hidden engineering: a support system strong enough to bear the weight of 13 million bricks.
- Beneath the visible arches are reverse arches—curved supports that help distribute the massive weight above.
- Under those arches lies the **grillage**, a wooden platform that spreads the fort's weight evenly across the marshy ground.
- And anchoring it all are 5,000 wooden **pilings**—some driven as deep as 70 feet—forming a foundation that has lasted over 160 years.
- This layered system shows how 19th-century engineers overcame the challenge of building a massive brick fort on soft, coastal marshland—an incredible feat of design and labor.

What does this fort's construction teach us about the relationship between natural environments and human-made structures?

➔ Return to the brick walkway and continue walking clockwise around the fort's interior, past Olmstead's Quarters, and enter the next open door on your left.



Model showing the grillage and pilings supporting the heavy walls of the fort. Not to scale.
NPS/J. IRVING

Stop 12: Cisterns

Built on an island surrounded by saltwater, Fort Pulaski relied on a self-sustaining rainwater collection system built into its walls.

- The roof wasn't just for cover—it was part of the system. Beneath the grass was a layer of crushed oyster shells that acted like a natural filter, cleaning rainwater as it soaked through.
- That filtered water flowed into basins hidden above the casemate ceilings, then traveled through lead pipes down into massive underground tanks called **cisterns.**
- Each of these cisterns could hold up to 20,000 gallons of water. With ten tanks in total, the fort could store 200,000 gallons—enough to keep the soldiers supplied for months.
- When soldiers needed water, they simply lifted a floor hatch and lowered a bucket into the tank below.
- The system was so well-designed that it still collects water today—though no one drinks it anymore (thanks to those old lead pipes).

If you were designing a fort today in a similar location, what materials or technologies would you use to improve the water system?

➔ Return to the brick walkway and exit the fort. Cross the drawbridge and return to the demilune.

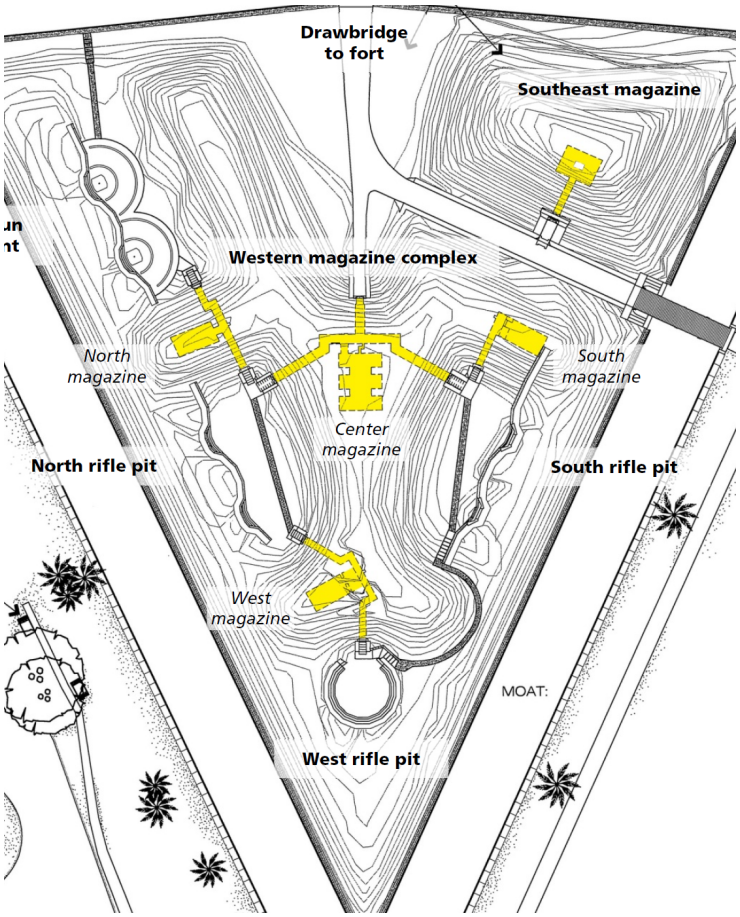
Stop 13: Demilune Mounds

At your last stop, you learned about the original purpose of the demilune. But after the Civil War, this structure got a serious upgrade—because brick walls were no match for modern firepower.

- When rifled cannons tore through Fort Pulaski's brick walls in 1862, it was a wake-up call: traditional masonry couldn't stand up to new weapons.
- Engineers turned to a familiar solution—dirt. Late Civil War battles fought in trenches proved that earthen fortifications could absorb cannon fire far better than brick.
- After the war, instead of burying the entire fort under mounds of earth, engineers focused on reinforcing the demilune, the triangular outwork in front of the fort.
- They built large earthen mounds to shield new gun platforms with underground magazines to safely store ammunition.
- For the foundation of the mounds, engineers built the mounds on a foundation of **tabby**—a durable concrete made on-site from oyster shells, sand, lime, and water.
- In 1895, the biggest mound—nicknamed "Big Bertha"—was added (Labeled in the image as Southeast Magazine). Inside was a radio switchboard that could send electric signals through thick black cables to detonate underwater torpedoes in the Savannah River.
- Though no cannons were ever installed and no torpedoes ever fired, these upgrades show how fast military engineering had to evolve to keep up with changing technology.

? Why might the military have invested in building features such as the demilune mounds and Big Bertha even though they were never used?

➔ You are welcome to enter the demilune tunnels and explore! Please help us preserve the mounds by staying on walkways and not climbing on them.



The underground portion is highlighted in yellow.
NPS PHOTO

Conclusion

Now that you've completed the tour, you've seen that Fort Pulaski is more than just bricks and cannons—it's an engineering marvel that showcases the ingenuity, determination, and legacy of those who built, defended, and preserved it. It stands as a powerful reminder that architecture and engineering are not frozen in time, but are living records of innovation, adaptation, and progress. By learning and sharing its story, you can help the National Park Service protect this historic site for generations to come.

Map