

# ALEXRENEW TUNNEL BORING MACHINE (TBM) BROCHURE

PUBLIC INFORMATION & EDUCATION AWARD

## Hazel: A Visual Timeline

### Our Subterranean Star: A Visual Timeline

Hazel's legacy will live on long after the RiverRenew tunnel system becomes operational. The tunnel Hazel constructed will prevent millions of gallons of combined sewage from polluting the Potomac River each year, setting the foundation for a brighter future for generations to come.

Scan here to learn more about Hazel's journey!

- Investigations & Preliminary Design** (Sep. 2018 – Oct. 2019): RiverRenew engineers and crews drilled 97 borings to characterize the ground along Hazel's tunnel alignment. This data was used to specify the type of TBM needed for Alexandria's geologic conditions.
- Final Design** (Dec. 2020 – May 2021): RiverRenew engineers designed Hazel specifically for Alexandria's geologic conditions, ensuring she could dig through clay and aluminum soil layers at depths of 120 feet below the ground surface.
- Fabrication** (Jan. 2021 – Apr. 2022): World-renowned TBM manufacturer, Herrenknecht, fabricated Hazel from scratch at their factory in Schwanau, Germany.
- Factory Testing** (Apr. 2022): RiverRenew engineers traveled to Germany to perform rigorous, multi-day tests of all TBM systems and components to ensure Hazel would perform effectively during her dig.
- Shipping** (May 2022): All 380 tons of Hazel were disassembled before making their way to Alexandria, starting with a barge trip across the Mingo River.
- Welcome Ceremony** (Jul. 2022): The Alexandria community chose Hazel Johnson, mother of the environmental justice movement, as our TBM's namesake. We held a dedication for Hazel the TBM and began preparing for her big dig!
- TBM Lowering** (Aug. 2022): A 225-ton crane lowered Hazel into a 140-foot-deep shaft at AlexRenew. Hazel's front link and tail shafts were then fit together.
- TBM Launch** (Nov. 2022): Hazel began rotating by breaking through the shaft's wall. As she dug, RiverRenew crews added all 163 parts of her trailing gear, one piece at a time.
- Stop at Royal Street** (Jun. 2023): Hazel reached the intermediate shaft, receiving routine maintenance and inspection before resuming her dig. Crews installed a conveyor belt booster and ventilation systems to prepare for the rest of her journey.
- Completed Tunnel** (Mar. 2024): Hazel reached the finish line, safely burrowing through the walls of the Potomac Street shaft and completing the Waterfront Tunnel!

**Hazel**  
A visual timeline and detailed description of the tunnel boring machine (TBM) that helped AlexRenew complete a once-in-a-generation environmental project.

To capitalize on the public's fascination with the technology behind its RiverRenew Program, AlexRenew created a foldout brochure to highlight Hazel, the tunnel boring machine (TBM), utilized to create a waterfront tunnel along the Potomac River.

### What's Inside Our Tunnel Boring Machine?

It takes all hands to keep Alexandria's waterways clean, but only 10 people at a time to manage all the mechanisms inside this high-tech, 460-foot-long underground factory.

- Thrust Rams**: 12 thrust rams propel the TBM forward as their hydraulic cylinders push against the permanent tunnel lining.
- Airlock**: Due to the high pressure inside the excavator chamber, workers need to be brought up to pressure in the airlock when they enter and returned to atmospheric pressure when they leave.
- Main Drive**: The main drive uses its 6 T10 kilowatt electric motors to turn the cutterhead.
- Cutterhead**: As the cutterhead spins, strong tools called cutters and scrapers break up soil ahead of the TBM before it enters the excavation chamber.
- Screw Conveyor**: The screw conveyor withdraws material from inside the excavation chamber and deposits it on the conveyor belt for transportation out of the tunnel.
- Control Cabin**: In the control cabin, the TBM operator controls the machine, manages all her onboard systems, and communicates with engineers and mechanics.
- Segment Feeder & Erector**: The segment feeder brings tunnel segments to the remote-controlled segment erector, which lifts and places them using a vacuum plate. Workers then bolt the segments in place.
- Shield**: A thick steel shield houses the TBM's critical components, seals off the tunnel from the surrounding ground, and provides a safe space to erect segments.
- Segment Crane**: The segment crane picks up individual concrete tunnel segments delivered from the surface and places them onto the segment feeder.
- Grout Tank & Pumps**: These tanks store a quick-setting cement mixture called grout, which pumps into the gap between the permanent tunnel lining and existing soil as the TBM advances.
- Tunnel Lining**: 8-inch-thick, precast concrete segments make up the permanent tunnel lining. 6 curved segments form one "ring" of tunnel, 4.5 feet long and 12 feet in diameter.
- Conveyor Belt**: The conveyor belt runs the full length of the TBM, transporting excavated soil (or muck) out of the tunnel.
- Electrical Equipment**: Switches and panels safely distribute 5 megawatts of electricity to the TBM's various motors and components.
- Cooling Unit**: The motors and gearboxes on the TBM can get HOT! An onboard cooling system prevents this critical equipment from overheating.
- Bentonite Tank**: As the TBM digs, crews must condition the soil around her to make it easier to mine and travel out of the tunnel on the conveyor belt.
- Lavatory**: Nature calls in tunnels, too!
- High-Voltage Cable Box**: The TBM's high-voltage power cable needs enough slack to allow the machine to advance forward, so crews attach it to the tunnel wall as she travels.