



- **8-ft conveyance tunnel** – As part of the Ship Canal Water Quality Project, there will be two 8-ft conveyance tunnels that will bring stormwater and sewage flows from the Queen Anne and Ballard neighborhoods to the larger storage tunnel for treatment at the Westpoint Treatment Plant. The type of tunnel boring machine (TBM) being used to dig out the 8-ft conveyance tunnel is also called a “Slurry TBM” because it mixes a clay-like substance (aka slurry) with the removed soil. The mix helps to keep the right level of pressure in the tunnel so the soil can be safely removed to the surface. Once at the surface, the soil and slurry are separated. The slurry is reused, and the soil is removed from the site to be reused elsewhere. The TBM moves forward by pushing off installed tunnel segments. It is operated remotely from the surface. [See our tunnel boring machine comparison chart to learn more!](#)
- **18-ft storage tunnel** – A 2.7-mile long, 18-ft, 10-in interior-diameter tunnel that extends between Ballard and Wallingford. During heavy storms, the tunnel will capture more than 29 million gallons of untreated stormwater and sewage from six different overflow pipes and temporarily store it until the treatment plant is ready to manage it. The eastern end of the tunnel, in Wallingford, will be about 40-ft below the ground. The western end of the tunnel, in Ballard, will be about 100-ft below the ground, allowing the tunnel to drain by gravity towards the pump station in Ballard. [See our tunnel boring machine comparison chart to learn more](#) and read more about MudHoney below!
- **Adit** – Short, horizontal underground tunnel segments that connect vertical shafts to a tunnel. Our crews are constructing adits at our East Ballard and Fremont sites.
- **Basin** – An area of land where stormwater collects and drains into a common outlet.
- **Bucket cutters** – A cutterhead tool that is used to keep the edge of the tunnel clean when tunneling takes place.
- **Combined sewer overflow (CSO)** - Sewer pipes in Seattle carry sewage away from homes and buildings to be treated at King County’s treatment plants, before being discharged into the Puget Sound. In some neighborhoods, the same sewer pipes also carry untreated stormwater (rainwater) from roofs, drains, and streets. During heavy rains, if the amount of sewage and stormwater exceeds the system’s capacity, the untreated excess overflows into nearby bodies of water, and can harm fish, wildlife, and swimmers. This is called a combined sewer overflow (CSO).
- **Conveyance pipes or connecting pipes** – Pipes that connect the existing combined sewer system pipes to vertical shafts. In broader terms, these pipes connect the existing sewer network to the storage tunnel.
- **Cutterhead** – The front of the tunnel boring machine (TBM). The cutterhead has a variety of tools to get through the dirt (technically called soil or glacial deposits) that it will encounter as it moves forward underground. Depending on the TBM, these tools can include double-disc cutters, scrapers, bucket cutters and chisels.
- **Diversion structure** – An underground structure that diverts excess untreated sewage and stormwater from the existing pipes to the storage tunnel during heavy rains. Without the

- diversion structure in place, the excess untreated flows would get released into a nearby body of water.
- **Double-disc cutters** – A cutterhead tool that is used to dig through hard soil and boulders.
- **Effluent** – Liquid waste or sewage discharged into a body of water.
- **Gantry crane** - A crane built on rails so that it can easily move back and forth over its worksite, similar to cranes you would see at a port. Our gantry cranes help us move things in and out of the excavation shaft.
- **Ground monitoring** - Ground monitoring is a robust system of instruments that help crews measure ground movement. Crews will install monitoring instruments at fixed points on pavement, utilities, and structures so that they can measure movement throughout the project area. [Check out our ground monitoring factsheet to learn more.](#)
- **Guide walls** – Small walls that outline wall construction to help accurately place slurry walls or secant piles. Guide walls are about 3-ft deep and 2-ft thick.
- **Jet grouting** – A soil stabilization technique that uses pressure, water, and a slurry substance known as soil-cement or grout to create columns that form panels or blocks underground. Crews start by drilling deep holes into the soil before injecting grout at high pressure into the hole. The soil is then replaced with grout, which hardens into columns. This produces a strong, non-toxic foundation that is quieter and creates less vibration than other soil stabilization techniques.
- **Man-locks (also known as pressure chambers)** - An airlock that allows crew members to go in and out of spaces with differing air pressures. Man-locks will provide access for crew members to the front of the cutterhead during maintenance stops to change out tools.
- **MudHoney** – The name of our approximately 18-ft tunnel boring machine (TBM) that is tunneling the 2.7-mile-long storage tunnel. Find out more about how MudHoney got its name [on our website](#). MudHoney is an Earth Pressure Balance TBM. These types of machines are specifically made to tunnel in soil with high water pressure, and the cutterhead is designed for the ground conditions that are present along the tunnel alignment. To maintain a consistent pressure between the TBM cutterhead and the soil we're digging, the Earth Pressure Balance TBM monitors the amount of soil being excavated with the expected amount based on how far it has moved.
- **Outfall** – A pipe that discharges sewer and stormwater flows into a body of water during heavy rain events. The Ship Canal Water Quality Project is focused on six outfalls along the Ship Canal. After the storage tunnel is complete, we anticipate an average of no more than one overflow event per outfall per year.
- **Pressure/decompression chambers** - An airlock that allows crew members to go in and out of spaces with differing air pressures. These airlocks will provide access for crew members to the front of the cutterhead during maintenance stops to change out tools.
- **Pump station** – A structure that pumps sewage and stormwater from a lower elevation to a higher elevation. For the Ship Canal Water Quality Project, the pump station will be in Ballard. It will pump flows from the storage tunnel to a pipe that will carry them to King County's

Wastewater Treatment Plant in Magnolia.

- **Scrapers** - A cutterhead tool that is used to loosen materials such as sand and gravel.
- **Screw conveyor** – A corkscrew-like machine that transports excavated soil from the front of the TBM to the trailing gear, which will then move to the excavation shaft in Ballard to be transported off-site.
- **Screen wall** – A tall plywood wall that surrounds a construction site on several sides. It helps to dampen construction noise, reduce the spread of dust and debris, and keeps the public at a safe distance. Screen walls were installed at the Ballard and Wallingford shaft sites.
- **Secant pile wall** – A construction system used to support underground excavations. A secant pile wall is made up of overlapping vertical concrete piles, which together hold back surrounding dirt to allow for excavation and underground construction. Secant pile walls will be used to construct the vertical shafts in Fremont, Queen Anne, and Wallingford.
- **Segment** – A curved concrete form. For our storage tunnel, six segments form [a tunnel ring](#).
- **Segment erector** – Behind the cutterhead, two mechanical arms lift, using a strong vacuum, and place curved segments into their ring arrangement to create the tunnel’s exterior wall. The TBM then uses propulsion jacks to push off of the concrete ring to move forward.
- **Sewage** – Also known as wastewater, sewage is the “used water” produced from homes and businesses, such as by flushing toilets, washing clothes, or turning on a shower.
- **Slurry wall** – A thick, circular ring of reinforced concrete used to support underground excavation. For the Ship Canal Water Quality Project, slurry walls allow for excavation of interior soils while keeping the excavation from collapsing. Size example: In Ballard, the slurry wall has an inside diameter of 87-ft, is 210-ft deep, and is 4-ft thick.
- **Soft ground** – Any type of soil that is not solid rock. MudHoney, our 18-ft storage TBM, is digging through hard, glacially condensed soil with cobbles and boulders, but because it isn’t solid rock, engineers still refer to this soil as soft ground.
- **Soil remediation** – A construction technique used to prepare a construction site. The contractor removes contaminated soil from the construction site, disposes of it safely, and replaces the removed soil with clean soil.
- **Soil stabilization** – A construction technique in which loose soil is strengthened to prepare for underground construction. During soil stabilization, the contractor may inject different materials into the soil or freeze it to make the consistency better able to handle heavy equipment and excavation.
- **Stormwater** – Any form of water that originates from rain, including snow and ice melt. Stormwater can pick up and carry numerous pollutants into our waterways.
- **Tiebacks** – A horizontal rod or heavy-duty cable used to support retaining walls during construction of underground structures. One end of the tieback is secured to a retaining wall and the other is anchored to the ground horizontally. Often tiebacks extend into the road right of

way. Usually, tiebacks are kept in place and disconnected (or de-tensioned) after the permanent wall or building structure is completed.

- **Propulsion jacks** – The propulsion jacks are located behind the cutterhead. The TBM uses these arms to push off of the segments that have been placed into a ring behind it. This is the method MudHoney, our 18-ft storage TBM, uses to move along the alignment.
- **Trailing gear** – Essential equipment that is pulled behind the tunnel boring machine (TBM) while tunneling takes place. Equipment includes the control room (where a machine operator sits to drive the TBM), ventilation equipment, mechanical, electrical, and instrumentation equipment, the conveyor system and muck transport system, a slurry injection system, and other tools.
- **Tunnel boring machine (TBM)** – A machine used to excavate and construct tunnels. The machine digs through soil, breaking it up and removing the tunnel spoils to build a tunnel in its place. Some are operated from a control room within the TBM, others are operated remotely. [See our tunnel boring machine comparison chart to learn more!](#)
- **Tunnel ring** – Each tunnel ring is made up of six segments that fit together to form the wall of the tunnel. After each ring is installed the tunnel boring machine (TBM) will use jacks to push the TBM forward as it excavates soil and installs the next tunnel ring.
- **Tunnel spoils** – Dirt, soil, or other debris that are excavated during the tunneling process. The storage tunnel spoils will be removed via the vertical shaft in Ballard.
- **Utility relocation** – During construction projects it may be necessary to relocate or adjust existing utilities to accommodate construction activities. This may include street lighting, traffic signal facilities, water, sewer, and drainage mains.
- **Vent shaft** – A vertical shaft to allow air release from the storage tunnel while it is filled with water. The vent shaft is connected to a facility that removes odor from the vented air.
- **Vertical shaft** – Large, underground structures holding vertical drop pipes that carry sewage and stormwater from the combined sewer system into the storage tunnel. Vertical shafts also provide maintenance access to the storage tunnel. Size example: In Ballard, the vertical shaft will be approximately 100-ft deep and 90-ft wide.
- **Vertical concrete piles** - Piles made of concrete that are cast into place inside a hole bored into the ground. These piles are used as foundation for the secant pile wall. Some piles are reinforced.
- **Water main** – The primary pipes municipal water travels through across the city. The City of Seattle owns watermains, while private property owners own pipes that branch off watermains and funnel water to their homes and businesses.