

# PSE on bainbridge island

## Improving reliability

“Missing link” transmission line information session

August 16, 2021



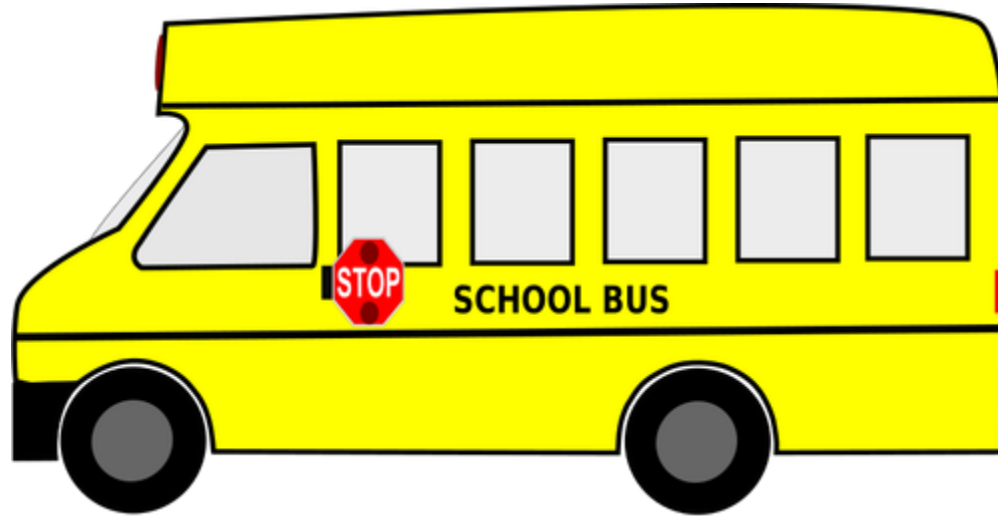
We'll begin at 5 p.m. — all participants will be muted.  
Technical difficulties? Please call or text Faiza Hassan, 206.412.2484



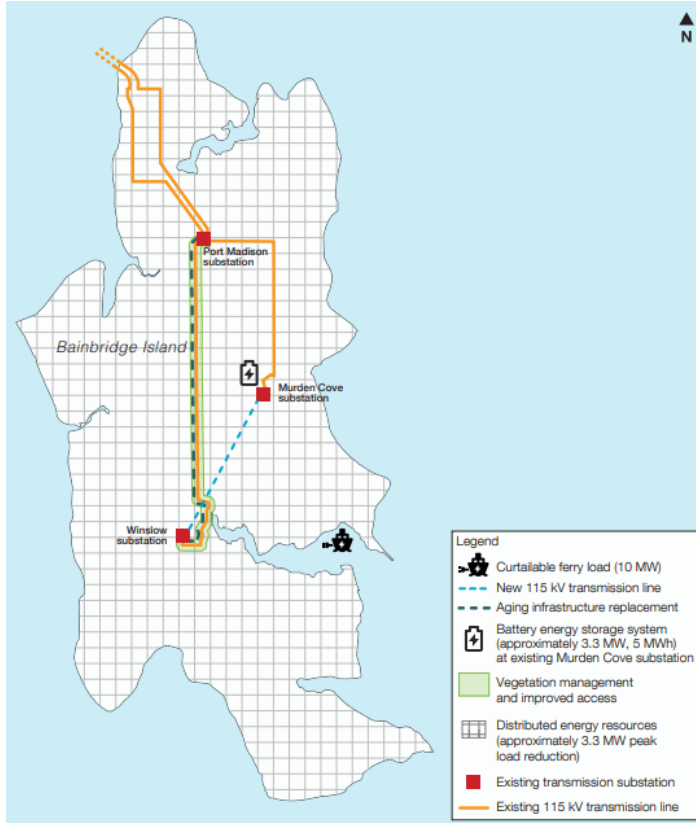
# Welcome Bainbridge Island!

# Safety moment – School Safety Awareness

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# Overview: Improving reliability and community interest



- Reliability on the island needs to be improved
- Solutions package components
- Community interest on undergrounding

# Meeting agenda

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- Opening – **5:00 p.m.**
  - Welcome and safety moment
  - Zoom webinar controls
- Presentation – **5:10 p.m.**
  - Undergrounding transmission lines, **Lowell Rogers, P.E., Oak Strategic**
  - Cost sharing and undergrounding processes, **Andy Swayne, PSE**
- Break – **5:30 p.m.**
- Q&A – **5:35 p.m.**
- Wrap up and next steps – **5:55 p.m.**

# Zoom controls

**Update your Zoom name if needed**

**Audio/video off**

**Raise your hand to speak**

Participants (1)  
Shivam ... (Host, me) Mute More >

Mute Stop Video Security Participants 3 Chat Share Screen Record Breakout Rooms Reactions Leave

Raise Hand yes no go slower go faster more

Unmute Me

The image shows a Zoom meeting control bar with several elements highlighted in red boxes and annotated with teal arrows. The 'More >' button in the top right participant list is highlighted, with an arrow pointing to it from the text 'Update your Zoom name if needed'. The 'Mute' and 'Stop Video' buttons in the bottom left are highlighted, with an arrow pointing to them from the text 'Audio/video off'. The 'Raise Hand' button in the bottom right is highlighted, with an arrow pointing to it from the text 'Raise your hand to speak'. The 'Participants' button shows 3 participants. The 'Share Screen', 'Record', 'Breakout Rooms', 'Reactions', and 'Leave' buttons are also visible. The bottom right corner features a 'Unmute Me' button and a 'Raise Hand' button with options: 'yes', 'no', 'go slower', 'go faster', and 'more'.

# For today

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Faiza Hassan  
is our meeting host.

Please text/call  
Faiza if you have  
technical difficulties:  
**206-412-2484**

- Large group: Muted with video off
- To ask a question during the Q&A: Use the chat box or raise your hand and wait for the facilitator to call on you
- Meeting conduct:
  - Listen to and appreciate the diversity of views and opinions
  - Actively participate in the group
  - Behave constructively and courteously towards all participants
  - Respect the role of the facilitator to guide the group process

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# Overview of Underground Transmission Line Construction

Presented to the Bainbridge Island Community

Lowell Rogers, P.E.

August 16, 2021





# Transmission

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Transmission lines form the backbone of the electrical system. The vast majority of this transmission system is made up of lines that are overhead. With proper vegetation clearances and maintenance, these lines are very reliable.

In some areas where overhead lines are not feasible due to insufficient right of way space, height limitations, or visual concerns, it may be preferred to construct the transmission lines underground rather than routing the line around the area of concern.



# Differences Between Transmission and Distribution

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In PSE's service area, distribution circuits are 34.5kV and lower whereas transmission circuits are 115kV and above.



12kV Distribution Line



115kV Transmission Line

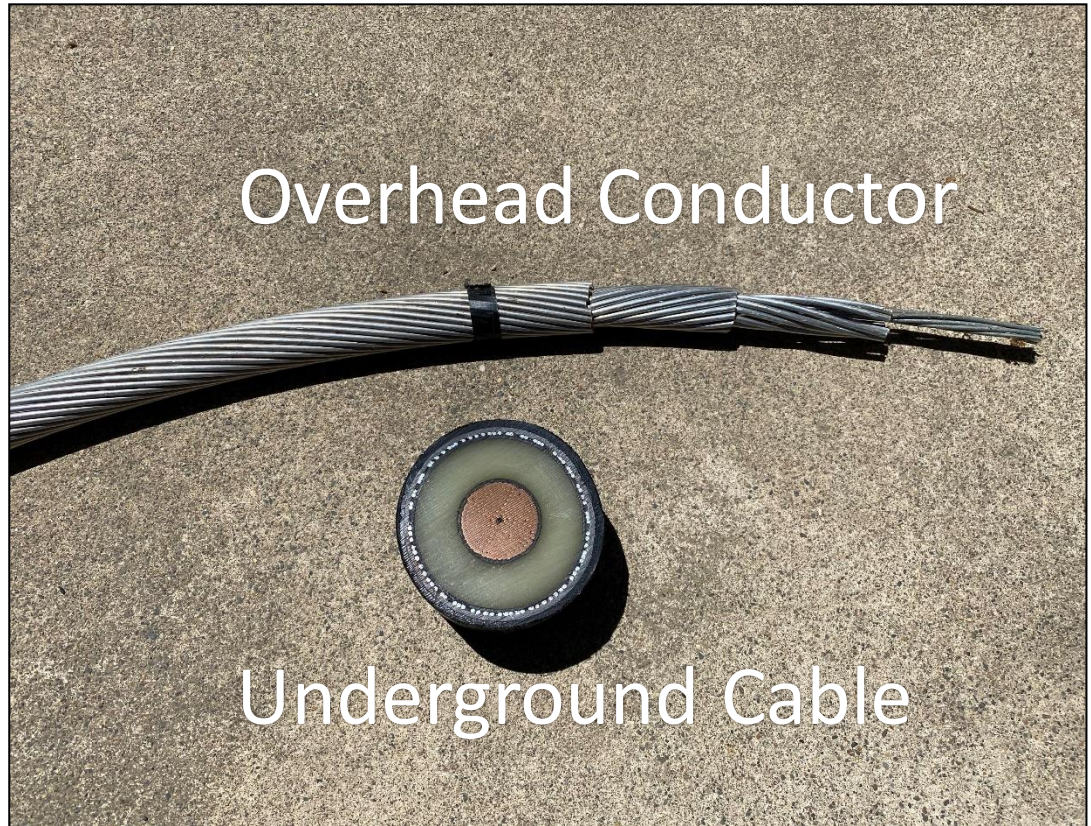


# Materials

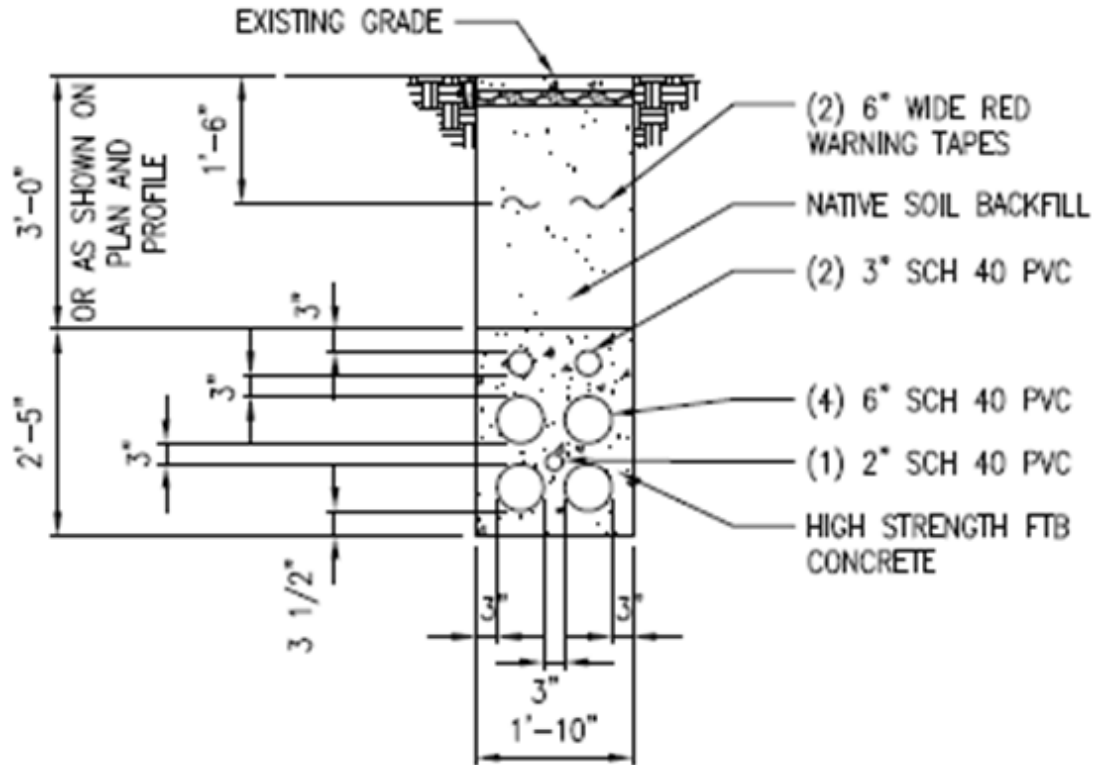
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Overhead conductor relies on the surrounding air to provide electrical insulation and cooling.

Underground cable is insulated internally and the heat that is generated is dissipated by the surrounding earth.



# Duct Bank Configuration



Typical Single Circuit 115kV Duct Bank Cross Section.

# Underground Transmission Construction Techniques



Cable Duct Bank Excavation



Cable Duct Bank

# Underground Transmission Construction Techniques



About 8 ft wide  
by 20 ft long by 9  
ft tall

Spaced every  
1,500-2,000 ft  
along the route.

Cable splice vault

# Underground Transmission Construction Techniques



**Cable Installation**  
Approximately 2,000 ft cable lengths



**Cable Splicing within vault**

# Underground Transmission Construction Techniques

Typical Transition Pole



Underground to overhead transition structures.

- Facilitates the transition of the underground cables to an overhead configuration.
- Often accompanied by an underground pulling box.





# Technical Feasibility

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There are situations where an underground transmission line isn't feasible.

- The required capacity of the line cannot be provided by underground cables.
- The length of the line is too great for conventional underground equipment.

# Project Specific Feasibility

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Where the length and capacity requirements are feasible using underground configurations, there are additional factors to consider:

- Do construction impacts cause unmitigable impacts?
- Are there codes that prevent overhead construction, such as nearby airport runways?
- Is the cost of underground prohibitive?
- Does the location of the line allow access for repair when damaged?
- Can the service area tolerate a lengthy outage if the line is damaged?



# Routing

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The route of an underground transmission line can be limited by the following:

- Steep slopes
- Ravines
- Geology (e.g. rock)
- Wetlands, bodies of water
- Environmentally sensitive or protected habitat
- Available space for the duct bank and splice vaults, particularly in areas with other underground utilities.

These factors will significantly increase the cost of underground transmission lines if they cannot be avoided.



# Environmental Impacts

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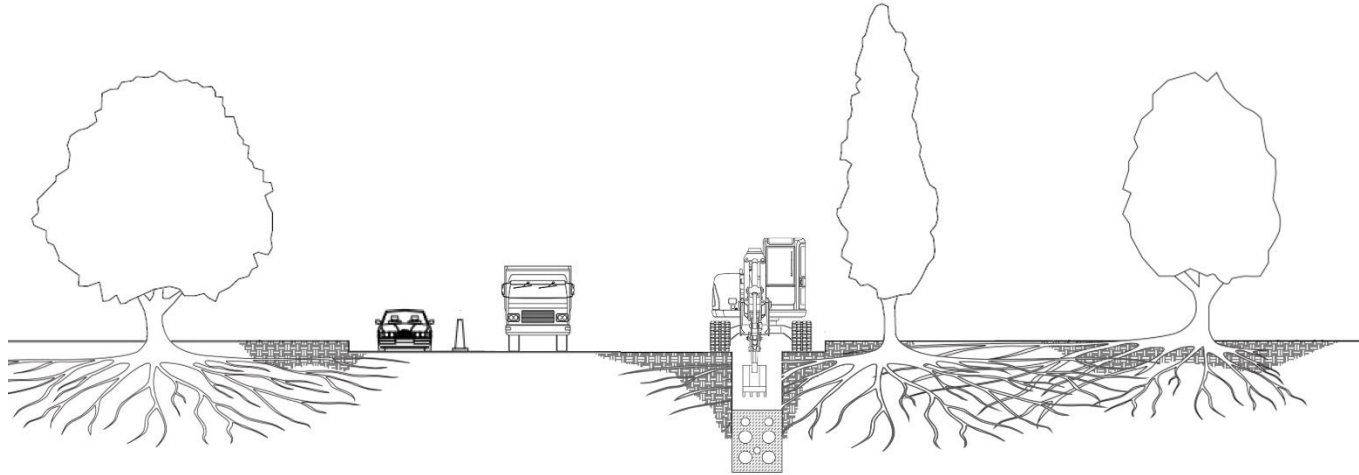
Underground lines require a cleared right-of-way for the entire length in order to trench excavation and line installation.

As compared to overhead lines, which have the ability to span areas of concern, underground transmission line construction has more direct impact to the environment.



# Environmental Impacts

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Underground lines require a cleared corridor for the entire length in order to trench and install the line. This can significantly impact environmentally sensitive areas such as wetlands and sensitive habitats.

This clearing will require vegetation removal, grading, and contouring of the ground.



# Environmental Impacts

Example of an underground transmission line during construction.



# Ongoing Corridor Maintenance

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Once constructed, the corridor will need to remain clear of vegetation (e.g., trees and shrubs) that have root systems that could damage the duct bank.



# Cost Range of Underground Transmission

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Underground construction is much more expensive than overhead construction; generally 2.5-7 times for a 115kV single circuit transmission line.

- Example: For a similar overhead line that is estimated to be \$2.5million per mile for construction, that line may cost \$5-\$17million per mile in an underground configuration.



# Cost Range of Underground Transmission (continued)

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The range reflects the large number of variables that an underground project faces; such as:

- Type of soils to be excavated
- Number of existing underground facilities that need to be protected, avoided, or relocated.
- Access constraints
- Road closure requirements
- Stream, freeway, or other crossings
- Permitting cost
- Easement costs

Together these variable can significantly influence costs. In order to determine specific costs for an underground project; the route needs to be identified and a preliminary design completed.



# “Missing link” and undergrounding

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Process for the City explore the option

- Approach PSE to discuss
- Preliminary feasibility study
- Decision to move forward



Cost sharing

- Local community to pay the cost difference between overhead and underground lines.

# Questions?

## Next steps and wrap up

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Karen Brubeck, PSE

## Next steps

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- PSE analyzing route options to determine a preliminary preferred route
- Late September, date TBD – Community info session on electromagnetic fields (EMF)
- Fall - Community Sounding Board meeting
- Preferred route announcement: anticipated late 2021

## For more information

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