

2025 ASCE Pacific Northwest Student Symposium

Water Filtration (Environmental) Competition

Acknowledgement

A large portion of these rules have been adapted from the 2019 and 2020 rules from when St. Martin's University and the University of Washington, respectively, hosted the PNW Symposium. As this is the first time in 4 years that an environmental/water filter competition has been offered at the PNW Symposium, we made the decision to not reinvent the wheel and instead build on the good work done by both of these symposium hosts.

- 2025 PNW Symposium Planning Committee

Overview/Scenario

*"When the next full-margin rupture happens, that region will suffer the worst natural disaster in the history of North America, outside of the 2010 Haiti earthquake ..."*¹

It is no secret that the Pacific Northwest is overdue for a significant Cascadia Subduction Zone (CSZ) earthquake. While engineers, emergency managers, and politicians are making progress to prioritize resilience in our infrastructure, there remain many fundamental services that will be affected by a significant CSZ seismic event.

The scenario for this competition is that a CSZ earthquake has heavily impacted the Portland Metro area and access to treated water is severely limited. To add to the direness of the situation, this scenario occurs during a drought in one of the hottest years on record, and surface water (from lakes and streams) is in low supply and widely impacted by toxic algal blooms. Access to groundwater has been limited due to the damaged electrical grid and lack of manual pumps. Remaining high-quality water sources have been prioritized for drinking water.

Many residents are planting gardens or raising small livestock (chickens, rabbits, etc.) or fish (aquaponics) to supplement their food supply, which has been drastically reduced by damage to transportation infrastructure. There is a need to provide water for these purposes, and many people look to the nearby Willamette River as a potential source. The water quality in the Willamette has been impacted by a significant amount of sediment from landslides, untreated sewage from upstream communities, and stormwater runoff from the few rain events that have occurred.

¹ Schulz, Kathryn, ["The Really Big One"](#), The New Yorker (2015)

Environmental/Water Filter Rules (rev1)

Each team must design, construct, and operate a water filter to improve the quality of water taken from the Willamette to use for crops, small livestock, and fish until water supply systems in the region can be repaired. The design should utilize commonly available, local materials and be accessible for a layperson to construct. No part of the filtration system shall be pre-designed for use as a filter, and no part of the system can rely on electricity for operation.

Contaminated Water Source

The water source for the water filtration systems will be the Willamette River in the downtown Portland vicinity. Each team will be given 9.5 liters (2.5 gallons) of this water to process in their filtration system. Prior to receiving the water, 250mL (approx. ½ cup) of dirt from a low point / wallow adjacent to (and receiving runoff from) a major roadway in the Metro area will be added and adequately mixed to simulate contamination. The parameters to be monitored include pH, turbidity, and conductivity.

Team Make-up

- Each university may enter only one team.
- Each team must consist of 2-5 members, with one designated team captain.
- Every team member must be a registered participant of the conference.
- Only one team member may be a graduate student; all other members must be undergraduates.

Students are encouraged to work closely with university faculty and local engineering professionals to create a practical and innovative method of addressing the scenario described above.

Judging

The competition will be scored based on the following categories:

CATEGORY	MAX. POINTS
Technical Paper	25
Poster	25
Filter Construction & Performance	25
Water Quality	25
TOTAL	100

Teams will be judged by a panel of Professional Engineers and EITs from local engineering firms and agencies with experience in water quality and treatment. The decisions of the judges are final. After judging is finalized, each team is responsible for disassembling their water filtration system and poster board.

Technical Paper (25pts)

The technical paper must be combined into a single PDF document and submitted by email to the 2025pnwsymposium@gmail.com prior to Friday, March 22nd, 2025 at 5:00 PM (Pacific). The paper shall not exceed 5 pages in length (not including references, appendices, and cover page) and must include a cover page which depicts: school & team name, the team members & their background, and the “trademarked” name for your water filtration system. All documents shall be single-spaced with 2.54 cm (1 inch) margins and written in 12 point Times New Roman font.

The technical paper shall convey the team’s understanding of available water/wastewater treatment concepts & processes, in general; but with an emphasis on water filtration technology. The document shall also describe how each team prepared for the competition (including design principles & considerations, constructability, operational concerns, available filtration technologies, materials of construction & cost, mobility, and operations & maintenance procedures). The paper must, at a minimum, be divided into the following labeled sections:

1. Abstract
2. Introduction
3. Technical Discussion – Include detailed information that is specific to your water filtration system
4. Fabrication/Construction – discuss materials/construction methods, tools used, and cost (not including labor)
5. Operations & Maintenance – discuss procedures for using and maintaining the filter
6. References
7. Appendices – include table of costs, construction material receipts, process flow diagram, cross-sectional diagram for inside of filter, and any calculations

All documents will be scored on: technical merit, grammar & punctuation, technical writing skills, comprehensiveness, conciseness, clarity, length, presentation of figures, creativity, and following all competition rules.

Poster Board (25pts)

Each team must prepare and display a poster board. At a minimum, each poster board must depict: school & team name, the team members and their background, the “trademarked” name for your water filtration system, cost summary, and appropriate visual aids (e.g., diagrams, pictures, equations, props, etc.). Ideally, the poster board should be a concise version of the technical paper.

Poster board dimensions shall not exceed (4 feet x 3 feet). Teams are encouraged to bring their own easel to support the poster - none will be provided at the symposium. The poster must be displayed alongside the water filtration system (once constructed). At least one team member shall be stationed near their poster and filter to answer questions from judges during the specified time.

Construction & Efficiency (25pts)

Teams will be judged on the following criteria:

CRITERIA	SCORING
Cost (before sales tax) <i>Lowest cost possible</i>	15 pts for lowest 14 pts for 2nd lowest 13 pts for 3rd lowest ... (minimum score of 0 pts)
Volume Target <i>As close to influent volume as possible</i>	$\left(\frac{\text{effluent volume}}{\text{influent volume}}\right) \cdot 10\text{pts}$

Schools with tied rank for a given criteria will receive the same score.

There is no requirement that schools build or assemble the filters during the competition; i.e., filters may be brought pre-built/pre-assembled.

Schools will be given a maximum of 60 minutes to filter the influent.

Water Quality (25pts)

Teams will be judged on the following criteria:

CRITERIA	SCORING
pH Target <i>Between 7-8</i>	7.0-8.0: 4 pts 6.5-6.9 or 8.1-9.0: 3 pts 6.0-6.4 or 9.1-9.5: 2 pts 5.5-5.9 or 9.6-10.0: 1 pts (all other pH values): 0 pts
Turbidity Target <i>Minimal NTU</i>	$\left(\frac{1}{rank}\right) \cdot 4 pts$
Electrical Conductivity Target <i>Minimal $\mu S/cm$</i>	$\left(\frac{1}{rank}\right) \cdot 4 pts$
Total Free/Available Chlorine Target <i>0.2-4 ppm after 10 minutes</i>	If target met: 4 pts
DOC Target <i>Maximum Removal</i>	$\left(\frac{1}{rank}\right) \cdot 4 pts$
Dissolved Oxygen Target <i>100% DO Saturation</i>	100% DO: 2.5 pts 90-100% DO: 2.0 pts 80-90% DO: 1.5 pts 70-80% DO: 1.0 pts 60-70% DO: 0.5 pts (all other values): 0 pts
Hydrocarbons <i>None detected</i>	$\left(\frac{1}{rank}\right) \cdot 2.5 pts$

Schools with tied rank for a given criteria will receive the same score.

Requests for Information (RFIs)

If teams have questions regarding any specific items, they are encouraged to submit a request for information (RFI) to 2025pnwsymposium@gmail.com with “[Water Filter RFI]” at the beginning of the subject line. Any response to an RFI will be forwarded to all of the teams.

Code of Conduct

Team members are expected to comport with [ASCE’s Code of Ethics](#) as well as their University’s Student Code of Conduct. Students are expected to act professionally and respectfully in regard to all aspects of this competition.

Generative AI may not be used to produce any part of the required deliverables. For example, AI may not be used to write a passage of the report or to create a figure/chart. Team members may use AI to facilitate their research; however, the veracity of any AI-generated results must be independently verified by the team.

Teams should avoid using others’ work as significant elements of their deliverables. For example, figures in the report should be created by the student, whenever possible (this may be difficult to do for photos of specific products or places, but should be achievable for graphs/charts and engineering schematics). All work that was not originally created by a team member must be properly cited and attributed.