This document is a compilation of the public commentary submitted to Ecology, with regards to the draft National Pollutant Discharge Elimination System (NPDES) Permit #WA0024490 for the City of Everett Water Pollution Control Facility located in Snohomish County, Washington. The comments are presented as follows:

- Form letter comments from Earthjustice supporters
- Comments from Earthjustice (three parts)
- Letter from the City of Everett
- Letter from the Snohomish Basin Salmon Recovery Technical Committee
- Letter from Long Live the Kings
- Letter from the Orca Network
- Comment from Washington State Department of Health
- Email from the Tulalip Tribes
- Comment from Snohomish County Indivisible
- Comments from unaffiliated individuals

The following Earthjustice form letter comments were submitted to Ecology between January 9 and January 30, 2024. The comments are in regard to the draft National Pollutant Discharge Elimination System (NPDES) Permit (No. WA0024490) for the City of Everett Water Pollution Control Facility located in Snohomish County, Washington.

Hackman, James
Port Hadlock, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Now is the time for action.

Myer, Ralph
Seattle, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   WASTEWATER TREATMENT PLANTS ARE A PRIMARY SOURCE of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that PRETREATMENT agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should SET DEADLINES for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should SET LIMITS on the levels of nitrogen (N) and phosphorous (P) that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the RENEWAL OF THIS PERMIT to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. IT IS TIME TO PRIORITIZE PLANET OVER PROFIT$.

Bendich, Arnold and Judith
Seattle, WA

We're writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Rowe, Irene
Vancouver, WA

As a resident of Washington state, I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Larson, Elizabeth
Renton, WA

As a resident of Washington, and a young person who loves this state and wants to preserve its natural beauty for future generations, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Please help preserve our beautiful state and the species that call it home.

Courtsal, Lyle
Port Townsend, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. And also duwamish toxins as well. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Reed-Jones, Carol
Bellingham, WA

I’m writing to urge you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. This is a health hazard to all life. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

German, Katherine
Bellevue, WA

I’m writing to request that you require Everett Wastewater Treatment Plant to clean up what they are discharging into Puget Sound. PBDEs, PFASs and nutrient pollution should be kept out of our waterways. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. So much effort is being put into protecting salmon and orcas so we don't lose them - this is an important step in making sure they have somewhere clean to live. There is no point in spending billions of dollars to repair culverts for salmon and protect orcas if we are just going to poison them. There is a reason PFAS are called 'forever chemicals' - they don't breakdown and there is no safe level of exposure. I have a son with autism and the incidence of this disability is increasing. We have to stop dumping chemicals into our environment thinking they are safe and then trying to clean them up later - we are all paying for this pollution even if only through higher taxes to support people who are unable to work because of disability. Please get tougher and stop the discharge of pollutants into our environment . The permit renewal to the Everett Wastewater Treatment Plant is a great place to make changes to the process. Thank you.

Ranz, Gary
Bellingham, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Dilution is NOT A SOLUTION!

Boyd, Liiza
Vancouver, WA

PLEASE...I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

christ, MLou
Seattle, WA

Humans can & should deal with all their own waste! I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Anderson, Coleen
Yakima, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Biodiversity is essential for a healthy planet. Please consider our children, grandchildren, and future generations and how this will affect them.

Garner, John
Tacoma, WA

We can no longer afford to wait to enforce water quality regulations that are needed to protect salmon in Puget Sound. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Wilham, Kathryn
Suquamish, WA

As a resident of Suquamish for whom the Salish Sea is sacred, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Conrad, Norm
Mount Vernon, WA

Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. As you know only too well, wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Demian, Dr
Seattle, WA

Hi: Regarding the the wastewater discharge permit for the Everett Wastewater Treatment Plant; Please implement strict rules in order to reduce harmful discharges of PBDEs, PFAS, and nutrient pollution. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. For PBDEs, the Department of Ecology should require that pretreatment agreements, with each of the plant's industrial users, include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. Permits should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. The permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Thank you. Dr. Demian

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marshall-mcconnell, Janet
Anacortes, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. every delay is just not right. please do your part!

Eldridge, Sara E
Seattle, WA

Please Lead efforts to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. As you all know well, wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. Please employ your authority, education, expertise and experience, with the clear science that these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. Please take responsibility to protect our people from PBDEs. Ecology must require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Okano, Pamela A
Seattle, WA

Salmon and orcas are iconic to the Pacific Northwest. That's why I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Marino, Robert
Olympia, WA

Southern Resident Orca Whales are on the verge of extinction. Do something! I'm writing to request that you implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Hall, Jerilyn
Bonney Lake, WA

When you protect our sea life--you protect us--the citizens of Washington State. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Simpson, Jennifer
Seattle, WA

Stop the forever chemicals going into our precious waters! I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Banks, Wesley
Vancouver, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution, and wondering why that has not happened already. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

McGee, Terence
Woodinville, WA

I urge you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Kinyon, Susan
Port Orchard, WA

I write to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

McClintock, Gloria
Mount Vernon, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. The Orcas are my neighbors and need protection.

Mork, Ted
Lummi Island, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Foster, Steve
Vancouver, WA

I'm writing to ask you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Nelson, Tobey
Clinton, WA

Please don't renew the wastewater discharge permit for the Everett Wastewater Treatment Plant unless stronger action is taken to prevent discharges of PBDEs, PFAS, and nutrient pollution. We must do all we can to protect the health of ourselves as well as the marine ecosystem. Please demand strong measures to stop the discharges of these chemicals. Make the permit require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. Set close-horizon deadlines for industrial users to reduce source controls to reduce and prevent both PFAS and PBDE discharges. The permit should also set low limits for the amounts of nitrogen and phosphorous that can be discharged to prevent nutrient pollution. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. Be a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Conn, Patrick
Kent, WA

I'm writing to encourage you to implement the strongest possible measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   There SHOULD BE NO EQUIVOCATION HERE! The Department of Ecology has an immediate opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Not to act now is UNCONSCIONABLE!

Ciske, Sandra
Seattle, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. As a resident, I hope our State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Brandt, Cathy
Issaquah, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity and a responsibility through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

eggers, K.
Addy, WA

BETTER HURRY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Bright, Jane
Bellingham, WA

Please prioritize the safety of our habitat for both people and the ecology that supports salmon and orcas by requiring pollutants be removed from wastewater. The technology exists. It is only a matter of exercising the authority you already have to do what is right for the public. I strongly encourage you to implement effective measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. Please put people and our habitat above profits For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Crampton, Susan
Twisp, WA

I live in eastern Washington but have come through Puget Sound area on Amtrak and visited friends in the Puget Sound area, and have been very surprised and disgusted at the things that I have seen and heard about discharge of wastewater and other pollutants into the Sound. As we all become aware of the problems with how things have been done, please take action as our responsible agency for environmental quality in Puget Sound. Please take care of a significant problem and be an example :). Thank you. I support the letter from Earthjustice below. ------------------------- I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Wahl, Ann
Bellevue, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. The science is clear on this matter – more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. (As a Washington state resident, I was so disappointed to read about this issue; it would be a great way for Gov. Inslee to conclude his service to the state by overseeing an improvement in accountability. We did not stand by when our neighbors in Victoria continued releasing untreated sewage into the Salish Sea; we should now look at improving our own behavior.)

Link-New, Virgene
Anacortes, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Thank you.

Anderson, Carrie
Spokane, WA

PLEASE implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source and have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. More must be done to prevent these waste streams from harming our communities and aquatic ecosystems. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to protect our marine environment, salmon, orcas, and people.

Brown, S.F.
Sequim, WA

PLEASE implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

martinez, priscilla
Snoqualmie, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wildlife are God's creations, we need to take better care of them, and their environment. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

McClure, Leslie
Lacey, WA

I'm writing to demand that you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Way, Janet
Shoreline, WA

Our salmon and orca are a high priority. Wastewater pollution must be better regulated and clean water must be required . You must implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Jordan, Dorothy
Lynden, WA

As an inhabitant of Washington state, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Thank you for your consideration of these comments.

Erckmann, Lynn
Kirkland, WA

I am very concerned about the presence of chemical contaminants in wastewater discharge and their effects on salmon, Southern Resident Orcas, and ultimately people. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Gregory, Linda Zapote
Bellingham, WA

I live in the region where orcas habituate and am concerned about their very critical status. For that reason, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. In the past I have heard marine biologists in my region refer to the Department of Ecology as the 'Department of Apology' because of the lack of willingness to take actions that would truly help orcas and their endangered salmon species they depend on survive and thrive.

Layden, Pat
Seatac, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. These elements can cause serious damage to sea creatures and humans. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. Please note, the science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Faste, Andrea
Seattle, WA

Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Tighter regulation of pollutants will help reduce harm to the salmon in the waters of the Salish Sea. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Becker, Vicki
Sammamish, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Stop the pollution now!!

Davis, Virginia
Woodinville, WA

I encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter. These pollutants are causing harm to threatened salmon, endangered orcas, and people, and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems. Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Rich, Chris
Shoreline, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Francis, Barbara
Bellingham, WA

C’mon!! This is ridiculous and wrong that harmful levels of pollutants are being discharged into the puget sound PLEASE, do the right thing and implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Adams, Roberta
Olympia, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Thank you.

Martel, Nicole
Yelm, WA

We must realize that the ripple effect of this is very significant. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. They are doing way more damage than we realize, and it is affecting all life on the plant in detrimental ways. We have the power to change the course of history by doing the right thing now. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Asher, Dave
Kirkland, WA

Let's keep our legacy. I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Olcsvary, Michael
Lynnwood, WA

Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Thank you for your time.

Hordon, Robin
Kingston, WA

EARTHCARE FIRST... includes PROTECTING and SAVING ALL WATERWAYS!!! Robin Hordon Kingston, WA ------------------------ I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Staley, Sheri
Shelton, WA

We can't wait any longer to do the right thing in these instances. We are truly running out of tine to save so very many species... I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Albright, Gary
Snohomish, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. This is the right thing to do. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Vick, Alun
Vashon, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.   I'm Required to maintain my septic system and have it professionally checked every two years. And if there are any problems I have to fix it. How can you get away with not doing your job and obligation.

Armstrong, Greg
Bothell, WA

I recreate in this area of Puget Sound and forage (when and where legal) for shellfish, salmon, Dungeness crab etc., and I've just been diagnosed with kidney cancer... I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Davis, Christina
Spanaway, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. MMMM....dumpling pollution into the river!!! What part of your JOB do you NOT understand??!!!!

Masri, Holly
Longview, WA

I'm writing to urge you to implement much stronger protective measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways… and Puget Sound is a particularly vulnerable area. The science is clear on this matter – these pollutants are causing harm to threatened salmon, critically endangered orcas, and people – and more MUST be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts! The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Zarter, Ellen
Bellevue, WA

I am surprised that I have to ask you to take action at the Everett Wastewater Treatment plane. You should be doing this as a matter of routine. Nevertheless, I encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Bledsoe, Bonnie
Seattle, WA

Why are we polluting Puget Sound...affecting the health of all creatures in the Sound, orcas and salmon among them? Please regulate the wastewater discharge for the Everett Wastewater Treatment Plant to reduce harmful discharges of PBDEs, PFAS, and nutrient pollution. The science is clear that these are harmful. They are found in our salmon, and we eat the salmon along with the orcas. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Muller, Alan
Seattle, WA

I’m writing to encourage you to PLEASE implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Buck, Julia
Seattle, WA

Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. It's such a big problem, even our Senator has taken action on it at the federal level. These pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. Why are we spending billions of dollars on salmon restoration and then not bothering to control this pollution entering Puget Sound? That seems extremely foolish, and also gross. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Crawte, Arly
Poulsbo, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Thank-you in Advance for caring.

Walker, Dorothy
Gig Harbor, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. These are dangerous pollutants and should not be allowed to be discharged into our waters. I assume our understanding of these chemicals has increased since the permit was last approved. Now is the time to correct a serious problem.

Benedict, Derek
Lynnwood, WA

We must protect the Puget Sound and Salish Sea at all costs in order to protect our ecological biome here in the great Pacific NW. So I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Apap, Chris
Seattle, WA

Hello, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Holder, Lehman
Vancouver, WA

What I'm writing about is flatly unacceptable. I encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Maris, Celeste
Olympia, WA

The salmon and all species need you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, DOE should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. Washington State should be a leader in these efforts, by issuing a permit that will reduce our exposure to these pollutants.

Lutwak, Mark
Seattle, WA

My wife and I are writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Dunn, Sharon
Greenbank, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Living on the east side of Whidbey Island I know our waters are impacted by what happens elsewhere in the drainage - this can be fixed!

Thomas, Cecile
Seattle, WA

I am a long time resident of the Puget Sound. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Thank you for taking care with this matter.

mcnamara, jessica
Tonasket, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. It is incredible that this pollution has been unregulated, for so long, especially since it is common knowledge that both orca and salmon populations are at a new low. Please, Ecology, take your responsibility to regulate more seriously in regard to this issue.

Brakke, Laura
Bellingham, WA

I am asking DOE to be proactive now, to stop this abuse of the Common Spaces-- I'm referring to allowing Everett treatment plant to discharge cancer causing chemicals and forever chemicals into the Sound. The frightening amount of chemicals in our water affects all life. Human, animal, fish, crustatician, plant, kelp. ellgrass..... all life now is contaminated! Once in the Salish Sea it travels everywhere. I am writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Mafford, Spike
Seattle, WA

Please help! I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Maust, Jean
Tenino, WA

Hello, As a former employee of Dept of Ecology, I know how difficult environmental improvements can be. But there is nothing more important than caring for our planet and all living systems. Now I am writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant to keep PBDEs, PFAS, and other harmful discharges out of our waters. Please make sure that the permit renewal for wastewater treatment in this part of the state protects our marine environment, salmon, orcas, and people. Lead the way to higher environmental standards as we have done before. Thank you.

Francis, John
Sultan, WA

Just do it! I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Williams, Ernie
Bainbridge Island, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. It's 2024, time to stop what we know to be dangerous. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

McNiel, Betty
Bellevue, WA

Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are achievable and will help address Puget Sound's persistent nutrient pollution problems. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. Thank you for your time and attention.

Polley, JoAnn
Poulsbo, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Sincerely, JoAnn Polley

Gallagher, Kevin
Lake Forest Park, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

D'Amico, Sharon
Kirkland, WA

I'm writing to ask that you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Please!-- for the sake of our children and theirs, the sake of our fragile environment --require a more stringent permit that would require the City of Everett plant to reduce harmful discharges of PBDEs, PFAS, and nutrient pollution into the Snohomish River and Puget Sound. Strong pollution control measures – combined with adequate monitoring – are essential to protect both people and wildlife. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Walker, Frances
Gig Harbor, WA

The Everett Wastewater Plant's dangerous pollution of PBDEs & PFAs must be stopped post haste. Please implement robust rules/laws to end this toxic pollution of our Salish Sea & Puget Sound. The salmon and whales dwindling numbers are a testament to this toxic discharge.
Sincerely, Frances Walker

Loosli, Ed
Cathlamet, WA

Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

A BARRECA, JOSEPH
Kettle Falls, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. I used to eat clams we got along the beaches of Puget Sound. Hope people can do that again some day. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Schwartz, Rhona
Seattle, WA

My family and I urge you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant, which will reduce discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and human breast milk. PFAS and nutrient pollution are pervasive locally and nationwide. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Ferm, Mary
Bainbridge Island, WA

As a resident of Puget Sound, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Moore, Erin
Bellingham, WA

I’m writing about the Everett Wastewater Treatment Plant and to encourage you to implement strong measures in the plant's wastewater discharge permit. To protect our precious salmon, orcas, and humans, the city of Everett must reduce harmful discharges of PBDEs, PFAS, and nutrient pollution. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear and forceful on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with EACH of the plant’s industrial users include: 1) Quarterly monitoring of PBDE discharges and concrete steps to reduce these discharges, 2) Deadlines for industrial users to conduct initial sampling and reporting, 3) Deadlines for industrial users to implement monitoring and pollution prevention and reduction practices, 4) EPA-recommended ongoing quarterly sampling done directly by industrial users, 5) Creation of evaluation strategies by industrial users to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. 6) Limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established nutrient pollution limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a true leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Thank you!

Pendle, Carolyn
Olympia, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems: 1. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. These PBDEs are accumulating in the bodies of juvenile Chinook salmon at levels that harm their immune systems and increase susceptibility to disease, which is causing population declines. Puget Sound Chinook salmon are listed as a threatened species under the Endangered Species Act.   2. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   3. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Maynard, Kim
Seattle, WA

I am deeply concerned about how much pollution we are creating and am invested in doing everything we can to protect our ecosystems and food webs - which ultimately protects us as well. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Fanger, Rose
Spokane, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   It is shameful that a so-called intelligent species as we humans believe we are should continue to pollute our planet which will only lead to our own destruction. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

robinson, d
Curlew, WA

I’m writing to demand you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. Dammit, it’s the twenty first century and we have to be better than that! For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology have to be required to follow best available scientific information and to listen to the experts immediately! The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants ASAP.

Hiebert, Jennifer
Seattle, WA

I write to you as a senior citizen who has worked for and been concerned about environmental issues all of my life. I live in Seattle, so the issue of pollution in the Puget Sound is particularly important to me. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Wolf, Edward
Bellingham, WA

As a resident of Washington's Salish Sea area, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, southern resident orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Elder, Paul
Bellevue, WA

As a resident of Washington State, I encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Stempf, Debbie
Spokane, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. How we can allow these sorts of discharges from one of our Washington wastewater treatment plants is beyond me. Please work to rectify this situation. Thank you.

Funk, Sarah
Shoreline, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Jacobs, Marcia
Sumner, WA

We must protect our salmon and our endangered orcas who depend on them. This is not debatable - populations of both of these signature northwest species are in decline and must be protected. We cannot force them into extinction. So, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is totally clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Fields, marjorie
Edmonds, WA

I was horrified to learn about the pollutants pouring into Puget Sound from the Everett Wastewater Treatment Plant. Strong measures must be implemented to reduce harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Rotondi, Paula
Bellingham, WA

If people alive twenty years from now are to have more than a last dying remnant of the former marine version of the Garden of Eden we must stop polluting Puget Sound now. Unfortunately generations of ignorance and inaction have brought us to the present dire situation but at least we do have solutions. I encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Burke, Sharon
Seattle, WA

You must stop the discharge of PFAS chemicals, oxygen-killing nitrogen and other toxic chemicals coming from the Everett Wastewater Treatment Plant. These harmful chemicals have been detected in much of our marine life, including our endangered salmon and orcas. They are showing up in humans as well. Stopping these dangerous discharges should be a no-brainer for the Department of Ecology. The damage that we humans have done, and are continuing to do, to the planet's biodiversity is reaching a tipping point. Even the UN recognizes that we are on the verge of a mass extinction event caused solely by human activity, so why aren't we doing more to prevent this? Between global warming and rampant chemical pollution, we seem to be on a path to annihilate life on the planet. Shame on us. I hope you will give us some hope out here and do the right thing concerning the Everett Wastewater Treatment Plant.

Gillis, Cydney
Everett, WA

I live in the Delta Neighborhood in Everett very close to the Snohomish River. It's bad enough that I live in the arsenic left by the Asarco, but we are simply losing the battle of saving the native salmon. It is imperative that you implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant to reduce harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Crawford, Wanda
Federal Way, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Please continue to take care of our environment and protect our marine wildlife.

Rooney, Sue
Seattle, WA

I realize that online campaigns are rarely considered 'direct input' from local citizens. I hope that you will take the time to note that I am deeply concerned by the untreated chemicals flowing into the Salish Sea from Everett's under-performing technology. At this point in our understanding of pervasive chemicals entering waterways, it is simply unacceptable to allow the municipality of Everett to continue discharging harmful toxins into the water. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Jackson, Sego
Clinton, WA

As a local fisherman, clammer, crabber, oyster grower, and wildlife advocate living on Whidbey Island, I am concerned about pollution entering our marine waters. As well, I am aware that water treatment utilities have not done all they could have to support legislation that would have further limited PBDE releases in the environment, so have not helped address this problem 'upstream.' I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Rockel, Uta
Seattle, WA

I’m writing to strongly encourage you to implement robust measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Allison, Paula
Olympia, WA

As a native resident of Washington, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. This is unacceptable! PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more MUST be done to prevent these waste streams from further harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. We can do this!

Hinkle, Roxanne
West Richland, WA

I am writing not just as an environmentalist but from an Alaska who lives in wa.state and utilizes those waters I kayak canoe and small boat those waters I am in that water alot I'd hate to think I'd be effected my family and grandkids and so many others ..Not only do we need to protect our realize from military sonar that kills many and beachside them but now waste water it saddens me we should be caring for the water..please please would you like your children in those waters knowing what you do I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

McElfish, Briana
Bellingham, WA

As a local who often visits, recreates, and enjoys the Puget Sound, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Wilcox, Briana
Yakima, WA

Implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Weiss, Angela
Kingston, WA

This is URGENT! I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Martin, Roger
University Place, WA

I have long been disappointed by Washington's failure to adequately regulate pollutants in the very sensitive estuarine environment of Puget Sound. Lax enforcement seems rampant in WA-based businesses. Just look at the Air Force KC-46 tanker. It has never met spec. The 737MAX8's twice- fatal flaw(s) still remain(s) unidentified to the public, and finger-pointing is just beginning for the MAX9. The radioactive leaks at Hanford still haven't been stopped. Please do your part to actually stop ongoing damage. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Pierini, Katherine
Seattle, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. It is time we stopped this archaic practice of dumping poison into our water. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Parker, Deborah
Bellingham, WA

Dear DoE, Please, urgently implement strong and effective measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will require greatly reduced discharges of dangerous PBDEs, PFAS, as well as nutrient pollution.   Wastewater treatment plants are a primary source of these harmful pollutants.   In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. This is unacceptable! PFAS and nutrient pollution are now pervasive nationwide, including in our beloved local waterways. The science is clear on this matter – these pollutants are harming threatened salmon, endangered orcas, and people – and more must be done NOW, to reduce these waste streams that are KNOWN to damage our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Townsend, Sean
Olga, WA

I'm writing to encourage you to please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Morgan, Faith
Port Townsend, WA

I live here. I made Port Townsend my home and am appalled at the toxins. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Pickard, Shannon
Kenmore, WA

I live in Kenmore, WA and the safety of the beautiful wildlife here is near and dear to my heart. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Hodis, Minerva
Sequim, WA

When my grandson took a course in Oceanography about 9 or 10 years ago, he shared his. Professor's advice not to eat seafood from Puget Sound because the heavily polluted Puget Sound produced contaminated seafood that is hazardous to our health. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Cleve, Clara Ann
Edmonds, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. I have property in Everett & therefore tenants that are affected by these pollutants. I urge you to act quickly on getting the pollutants out of Everett's drinking water. And treating the discharge water so it is not polluting the Snohomish river and the Salish Sea & Puget Sound. Sincerely, Clara Cleve 550 Elm Way #203 Edmonds, WA 98020

Roller, Henry
Walla Walla, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Please protect the health of the ecosystems that all members of the biotic community (humans included) depend on.

Nelson, M Janet
Ellensburg, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Help keep us all safe from these environmental poisons!!'

Rutherford, James
Spokane Valley, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. We eat them off our nonstick cookware, they are in our water from firefighters at the airport and Fairchild, so I’m sure SeaTac and Boeing have much the same. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Stanley, Beck
Seattle, WA

I'm writing to STRONGLY encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

underwood, kirsten
Spokane, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. I used to live on The Sound until four years ago, so this particular pod of whales is very close to my heart and I know from lived experience that when we Washingtonians diminish these whales we diminish ourselves. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Paterson, Mary Cogan
Seattle, WA

Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant, to reduce harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. These pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We need Washington State to become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Bue, Nancy
Bellevue, WA

We are counting on you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Kill, Maureen
Seattle, WA

Hello. Why are you polluting the home of our fish and our whales and all our fragile sea life? They're endangered because of your actions and only you have the power and the responsibility to change that and protect our precious marine lives. PLEASE implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Do you want your children drinking this poison? You're killing us and our sea creatures. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Honeycutt, Michael A
Shoreline, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Regards, Michael A Honeycutt

Demian, Dr.
Seattle, WA

Hi: Please take strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Please require pre-treatment agreements with each of the plant's industrial users. Please include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. Permits should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. Permits should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Permits should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. Please protect our marine environment, salmon, orcas, and people. Thank you. Dr Demian

Lindsey, JJ
Tumwater, WA

Enough is enough! Clean it up. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Douglass, Desiree
Bellingham, WA

I support Northwest Tribes, Earth Justice, and others working to protect and restore Salmon and Orcas in the Salish Sea. Earth Justice's letter, below details the problem and necessary actions by Ecology to bring the Everett Wastewater Treatment Plant into the higher standards that we need if we are going to be successful. Please review their permit closely and require the changes to protect the Salish Sea from pollutants. Sincerely, Desiree Douglass I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Hampton, Amber
Kirkland, WA

I'm writing you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Penton, Toni
Snohomish, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. I AM Toni Penton and I approved this message!

Foster, Alix
Mount Vernon, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Sincerely, Alix Foster

Mundhenk, Norm
Poulsbo, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. I am puzzled that I need to urge this action on the Department. One would think that this need would be both obvious and urgent. What is the reason for the delay?

Wichar, Den Mark
Vancouver, WA

I encourage you to implement strong measures in wastewater discharge permit for Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are one primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   Science is clear on this. These pollutants are causing harm to threatened salmon, endangered orcas, and people, and more must be done to prevent these waste streams from harming communities and aquatic ecosystems.   For PBDEs, Ecology should require that pre-treatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. Permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, permit should set limits on levels of nitrogen and phosphorous that can be discharged. Scientists have established limits that are achievable and will help address Puget Sound's persistent nutrient pollution problems. Everett and Ecology just need to listen to experts.   Ecology has opportunity through renewal of this permit to do more to protect marine environment, salmon, orcas, and people. We hope Washington State can lead in these efforts by issuing permit to reduce exposure to these pollutants.

Meador, Libby
Ocean Shores, WA

The following is worth repeating over and over: Please implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Collins, Randall
Seattle, WA

I strongly urge you to immediately implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant which is emitting harmful discharges of PBDEs, PFAS, and nutrient pollution into the Puget Sound. It has been well-known for a long time that wastewater treatment plants are a primary source of these pollutants. In Puget Sound. Alarmingly, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Leach, Darcy
Olga, WA

I live on Orcas Island, and the health of the aquatic ecosystem in the Salish Sea and Puget Sound are vitally important to our way of life in this region. I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Savidge, Lawrence
Tacoma, WA

Please know that my family and I support the strongest measures against pollution. That includes the wastewater discharge permit for the Everett Wastewater Treatment Plant.   As a resident of Ruston Point, we soak in the Puget Sound on hot summer days and do polar plunges in the winter. We see orcas sometimes from our shores. We enjoy the sanctity and purity of those waters. Please do everything in your power to reduce harmful discharges of PBDEs, PFAS, and nutrient pollution.   Here are some recommendations: -require pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges -Set deadlines for industrial users to conduct initial sampling and reporting - implement monitoring and pollution prevention and reduction practices, -Perform ongoing quarterly sampling. -Set limits on the levels of nitrogen and phosphorous discharges It's time we prioritize the health of our waters. Thank you!

Bowlby, Ed
Sequim, WA

As a retired marine wildlife biologist, I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Bledsoe, Bonnie
Seattle, WA

I am upset to find wastewater full of toxic elements (PBDEs, PFAS, and nutrient pollution) is being discharged regularly into Puget Sound. Why are we not protecting the creatures in Puget Sound from these toxins, and also us! High rates of PBDEs have been found in salmon, orcas and human breast milk! This is a serious crisis. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Rutan, Marcia
Seattle, WA

The whales and salmon are already struggling and need help! I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Lynn, Jill
Amboy, WA

I am asking you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Arnzen, Barbara
Spokane, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Sincerely, Barbara J Arnzen

Mitchell, Cheryl
Spokane, WA

I am an attorney in Spokane, Washington and I'm a former chairperson of the Washington State Bar Association's Animal Law Section. My comments are my own and do not represent the views of either the Bar Association or the Animal Law Section. My reason for writing is to ask that you to implement strong measures that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution in the wastewater discharge permit for the Everett Wastewater Treatment Plant . Wastewater treatment plants are a primary source of PBDEs and PFAS. It is scientifically established that In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. We need to minimize these pollutants to the maximum degree possible. For PBDEs, the Department of Ecology should require contractual agreements with each of the plant's industrial users which will include quarterly monitoring of PBDE discharges. The Department of Ecology should also require concrete steps to be taken in order to reduce these discharges. For PFAS contamination, permits should establish deadlines for industrial users to conduct initial sampling and reporting. There must be the implementation for monitoring of PFAS and for pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Additionally, each permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to reduce PFAS levels. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable. Using these standards will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. This should not be a political decision--it must be based on science. The Department of Ecology has an opportunity, through the renewal of this permit, to do more to protect our marine environment, salmon, orcas, and people. Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. State agencies need to work for 'the people' and NOT for Big Business interests.

Svete, Irene
Seattle, WA

I'm encouraging you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Watchie, Joanne
Seattle, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Please protect our children and grandchildren, as well as our endangered Puget Sound salmon and orcas!

Morris, Jenna
Seattle, WA

I urge you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Woestwin, Carl
Seattle, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Please keep Paige Sound as clean as possible.

Bishop, Madeline
Olympia, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Condon, Mary
Olympia, WA

I. encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter. These pollutants are causing harm to threatened salmon, endangered orcas, and people. More must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are achievable and will help address Puget Sound's persistent nutrient pollution problems. Everett and Ecology need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Ornstein, Lisa
Olympia, WA

I’m writing as a proud Washingtonian to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Caton, Karen
Olympia, WA

I’m writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant’s industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren’t sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound’s persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Holman, Melinda
Olympia, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. Sincerely, Melinda Holman Olympia WA

Lanz, Jean
Seattle, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. The science is clear on this matter – pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic environments. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Berquist, Kyle
Seattle, WA

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution.   Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways.   The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems.   For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges.   For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down.   For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts.   The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Ecology received the following comment verbatim from several commenters (list follows):

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

A, Dr
Medina, WA

A Phillips, Cheryldene
Spokane Valley, WA

A Saarinen, Tamara
Gig Harbor, WA

Abbott, G D
Olympia, WA

Abbott, Daniel
Everett, WA

Ableman, Carolyn
Seattle, WA

Ackerman, Laura
Spokane, WA

Ackerman, Laura
Spokane, WA

Adams, Amanda
Tacoma, WA

Adams, Audrey
Renton, WA

Adler, Zimyl
Seattle, WA

Ahrens, William
Burien, WA

Aispuro, Chyanne

Vancouver, WA

Aldora M Perez, Aldora
Seattle, WA

Alexander, Emily
Freeland, WA

Allen, Catherine E
Vancouver, WA

Allen, Susan
Bellevue, WA

Allen, Teresa
Bellingham, WA

Allen, Teresa
Bellingham, WA

Allred, Carolyn
Vancouver, WA

Alonso, Joyce
Spokane, WA

Ambrosius, Cindy
Woodland, WA

Anderson, Glen
Lacey, WA

anderson, seth
Westport, WA

Anderson, Judith S
Tacoma, WA

Anderson, Patricia
Cathlamet, WA

Anderson, Jessica
Seattle, WA

Anderson, Kristina
Seattle, WA

Anderson, Meghan
Ellensburg, WA

Andrews, Wesley
Kirkland, WA

Angerer, Christine
Redmond, WA

Armstrong, Deanna
Seattle, WA

Arnesen, Cathy
Olympia, WA

Arnold, Donna
Puyallup, WA

Ascalon, Donna
Bellingham, WA

Ash, Corr
Seattle, WA

Atkins, Gail
Raymond, WA

Aughtry, Kym
Sequim, WA

Austerman, Darla
Nine Mile Falls, WA

Austin, Bonny jean
Auburn, WA

Aymond, Laura
Centralia, WA

Babich, Louis
Seattle, WA

Backstrom, Pamela
Olympia, WA

Bacon, Theresa
Port Orchard, WA

Bagley, Charles and Nancy
Seattle, WA

Bahl, Judith
Vancouver, WA

Bahr, Dennis
Snohomish, WA

Bailey, Dori
Chimacum, WA

Bajwa, Ravinder
Redmond, WA

Baker, Norman
Sequim, WA

Baker, Kai
Sammamish, WA

Baker Blagg, Merna
Vancouver, WA

Baker Blagg, Merna
Vancouver, WA

Balasubramaniam, Ananya
Bothell, WA

Baldwin, Gordon Philip
Seattle, WA

Ballard, Clifford
Mattawa, WA

BALLES, KATHERIN
Bremerton, WA

Baltin, Brian
Seattle, WA

Bamford, Stephen
Seattle, WA

Barber, Pamela
Kent, WA

Barnes, Lisa
Seattle, WA

Barrett, Addison
Seattle, WA

Bartelmes, Farley
Kirkland, WA

Bartlett, Quinn
Yakima, WA

Bartlett, Vivian
Bellingham, WA

Bartlett, Rebecca
Anacortes, WA

Bartlett, Faye
Bellingham, WA

Bartlett, Tina
Chehalis, WA

Bartley, William
Redmond, WA

bartow, sally
Mercer Island, WA

Basta, Angela
Seattle, WA

Bates, Jennifer
Spokane, WA

Bates, James
Seattle, WA

Bauman, Sarah
Bellingham, WA

Bauman, Sarah
Bellingham, WA

Bauman, Tamara
Tukwila, WA

Bauman, Sarah
Bellingham, WA

Bear, Steve
Port Townsend, WA

Bein, Jeanie
Bellingham, WA

Beleny, Charles
Dayton, WA

Bell, Jordan
Olympia, WA

Bendix, Pamela
Bainbridge Island, WA

Bennehoff, Carolyn
Spokane, WA

Bennett, Paula
Seattle, WA

Benster, Jacqueline
Des Moines, WA

Bentham, Felicia
Seahurst, WA

Bentley, Kathleen
Forks, WA

Benton, Lori
Vancouver, WA

Berardo, Brian
Port Angeles, WA

Berg, Kelly
Tulalip, WA

Berg, Cathleen
Suquamish, WA

Berggren, Elizabeth
Seattle, WA

Bergman, Sandra
Puyallup, WA

Bergman, Sandra
Puyallup, WA

Berkshires, Nova
Lacey, WA

Berlin, Brenda
Kenmore, WA

Berlow, David
Seattle, WA

Bernthal, Jim
Seattle, WA

Berquist, Kyle
Seattle, WA

Bertolino Phares, Donna
Vashon, WA

Bielma, Pamela
Ritzville, WA

Bigelow, Tacy
Coupeville, WA

Biggio, Steven
Bellingham, WA

Billmaier, Michelle
Woodinville, WA

Bingaman, Shondra
Marysville, WA

Black, Jan
Olympia, WA

Black, Richard
Hansville, WA

Blair, Frances
Gig Harbor, WA

Blair, Elke
Vancouver, WA

Blanchard, Sandra
Sequim, WA

blazich, shelly
Seattle, WA

Bliss, Sara
Seattle, WA

Bluhm, Judy
Auburn, WA

Blumenthal, Robert
Seattle, WA

Bodda, Kent
Granite Falls, WA

Bogart, Sarah
Ferndale, WA

Bogie, Art
Anacortes, WA

Bolger, Dennis
Mukilteo, WA

Boni, Taiya
Bremerton, WA

Boone, Timothy
Seattle, WA

Boone, Timothy
Stanwood, WA

Bordelon, Tika
Seattle, WA

Border, Danial
Silverdale, WA

Borso, Pam
Custer, WA

Bostwick, Cindy
Seattle, WA

Boudreau, Carol
Longview, WA

Bourgea, Renee
Vancouver, WA

Bowen, Normajean
Seattle, WA

Boyd, Michael
Mercer Island, WA

Boyd, Michael
Mercer Island, WA

Bradley, Mark
Seattle, WA

Braun, Chelsea
Bellingham, WA

Brent, Patricia
Vancouver, WA

Brill, Gary
Seattle, WA

Britton, Melissa
Mill Creek, WA

Broschat, Lyle
Seattle, WA

Brouillette-Jobe, Sandra
Freeland, WA

Broussard, Kelly
Gig Harbor, WA

Brown, Robert
Tacoma, WA

brown, kimberly
Ellensburg, WA

Brown, Tina
Anacortes, WA

Brown, Kris
Renton, WA

Brownell, Wynann
Olympia, WA

Brueggeman, Mary
Mukilteo, WA

Brunell, Ron
Tacoma, WA

Brush-Hoover, Juliette
Seattle, WA

Bubelis, Wally
Seattle, WA

buchan, william
Sequim, WA

Buchanan, Brad
Eastsound, WA

Burazer, George
Lacey, WA

Burgess, Sara
Seattle, WA

Burke, Sally
Tacoma, WA

Burkhalter, Sheldon
Seattle, WA

Butler, Elsa M
Bainbridge Island, WA

Butler, John
University Place, WA

Butler, Catherine
University Place, WA

Butler, Peggy
Olympia, WA

Byrd, Karen
Everett, WA

Caggiano, Joseph
Richland, WA

Caicco, Jody
Vancouver, WA

Camaioni, Kaye
Richland, WA

Cambier, Ziadee
Seattle, WA

Campbell, Isabel
Gig Harbor, WA

Campbell, DeDe
Coupeville, WA

cane, Madeleine
Vancouver, WA

CAPEN, PETER
Tacoma, WA

Carbon, Liana
Monroe, WA

Cardiff, Jeanine
Port Angeles, WA

Carey, Naomi
Kenmore, WA

Carey, Sharon
Vancouver, WA

Carey, Barbara
Olympia, WA

CARLSON, ELIZABETH
Olympia, WA

CARLSON, CRAIG
Olympia, WA

Carodiskey-Wiebe, Jenna
Edmonds, WA

Carpenter, James
Lynnwood, WA

Carpenter, Doug
Bellingham, WA

Carrasco, Abbie
Gig Harbor, WA

Carroll, F
Olympia, WA

Carson, Katherine
Mount Vernon, WA

Cashman, Tom
Des Moines, WA

Cassato, Candice
Olympia, WA

Ceazan, Jon
Olympia, WA

Celeste, Paula
Concrete, WA

Cetina, Martha
Marysville, WA

Chabot, Christian
Seattle, WA

Chadwell, Maribeth
Seattle, WA

Chambers, Jacqueline
Olympia, WA

Chamness, Julia
Monroe, WA

CHANG, ROBERT
Seattle, WA

Chase, Brandee
Lynnwood, WA

Chenery, Mary-Faeth
Seattle, WA

Chessin, M
Seattle, WA

Chin, Andrea
Redmond, WA

Chipchase, Silke
Dupont, WA

christ, m lou
Seattle, WA

Christensen, Diane
Lynnwood, WA

Chubb, Catherine
Seattle, WA

Ciarlo, Denise
Richland, WA

Claesgens, Anthony
Darrington, WA

Clark, Roger
Bellingham, WA

Clark, Judy
Cinebar, WA

Claydon, Lisa
Seattle, WA

Cline, Catharine
Lacey, WA

Clinton, Brian
Seattle, WA

Cloner, Matthew
Seattle, WA

Cloner, Matthew
Seattle, WA

Close, Theresa
Monroe, WA

Cochran, Deirdre
Seattle, WA

Cochrane, Meg
Duvall, WA

COFFIN-GREENIG, CINDY
Seattle, WA

Cohen, Lisa
La Conner, WA

Cole, Marietta
Coupeville, WA

Collins, Jeffrey
Olympia, WA

Colony, Stephanie
Seattle, WA

Comanor, Kyle
Seattle, WA

Comstock, Benjamin
Puyallup, WA

Conlan, Mike
Redmond, WA

Conrad, Clare
Seattle, WA

Conte, Monika
Olympia, WA

cook, nena
Newport, WA

Cook, Rebecca
Friday Harbor, WA

Coon, Edwin
Mukilteo, WA

Coontz, Sharron
Olympia, WA

Cooper, Denise
Shoreline, WA

Coopershear, Glenna
Tacoma, WA

Copas, Dr
Medina, WA

Copenhefer, Roberta
Mabton, WA

Corbett, Randy
Port Ludlow, WA

Corridon, Christian
Tacoma, WA

Cottrell, Chris
Seattle, WA

Courter, Matt
Seattle, WA

Cox, Lanie
Spokane, WA

Crane, Mary
Duvall, WA

Cristina, Diana
Port Angeles, WA

Critchlow, Lisa
Lummi Island, WA

Cross, Jeffrey
Seattle, WA

Crossett, Paul
Ellensburg, WA

Crossley, Jim and Marjorie
Vancouver, WA

Crowley, Marty
Port Townsend, WA

Crowley, Marty
Port Townsend, WA

Crudo, Lynn
Vashon, WA

Crum, Alyssa
Gig Harbor, WA

Crum-Freund, Lisa
Port Townsend, WA

Culbert, Laurette
Seattle, WA

Currier, Lynette
Lynnwood, WA

Curtis, Colleen
Bellingham, WA

Czarnecki, Roberta R
Everett, WA

Dahl, Peter
Seattle, WA

Dahlman, Diana
Everett, WA

Danver, Susan
Olympia, WA

Darden, Ruth
Seattle, WA

Darling, Carolyn
Bothell, WA

Darvill-Coate, Kari
Bothell, WA

Dash, Robert
Deer Harbor, WA

Daugherty, Randall
Aberdeen, WA

David, Elaine
Seattle, WA

Davies, Margaret
Pullman, WA

Davis, Charles
Seattle, WA

Davis, Kevin
Maple Valley, WA

Davis, Christopher
Wenatchee, WA

Davis, Sharren
Vancouver, WA

Day, Robert
Seattle, WA

Day, Valerie
Bellingham, WA

Day, Kristofer
Port Hadlock, WA

De Forest, Virginia
Mercer Island, WA

De Jong, Laurie
Sumas, WA

de Jong, Laurie
Sumas, WA

de Jonge, Saskia
Seattle, WA

De Klyen, Thomas
Silver Creek, WA

De Leon, Alyssa
Bothell, WA

de Ney, Aimee
Olympia, WA

Deal, Brandie
Bothell, WA

Dean, Phillip
Sumner, WA

Decker, Mallory
Sammamish, WA

Declements, Mari
Everett, WA

DeGrandchamp, Jan
Vancouver, WA

DeMarsh, Judith
Kenmore, WA

Demorest, Jan
Ellensburg, WA

DeRooy, Constance
Seattle, WA

Derrick, Benjames
Spokane, WA

Desmarais, Janean
Everett, WA

Desmarais, Janean
Everett, WA

Desmond, Francesca
Seattle, WA

Determan, Timothy
Shelton, WA

Devi, Achala
Woodinville, WA

devine, venita
Washougal, WA

DeWees, Kathryn
Spokane, WA

Di Lauro, Lisa
Sammamish, WA

Dick, Norman
Longview, WA

dicken, don
Ellensburg, WA

Dickinson, Amanda
Yakima, WA

Dietrich, Naomi
Everett, WA

Disheroon, Carla
Bellingham, WA

Dix, Teresa
Mount Vernon, WA

Dixon, Angie
Clinton, WA

Dodson, Linda
Seattle, WA

Dong, L
Woodinville, WA

Dong, L
Woodinville, WA

Donovan, Charlene
Vancouver, WA

DORSEY, PATRICIA
Oak Harbor, WA

douma, barbara
Greenbank, WA

Downes, Linda M
Friday Harbor, WA

Downing, Nancy
Bellingham, WA

Drake, Barb
Seattle, WA

Drayovitch, Kaley
Olympia, WA

Dubble, Dinah
Port Orchard, WA

DuBois, John
Renton, WA

Dubois, Christina
Vashon, WA

Duggan, Gretchen
Tacoma, WA

Duhring, Frederick
Seattle, WA

Duncan, Suzanne
Sammamish, WA

Dunn, John
Vashon, WA

Dyck, Karen Schweppe
Bothell, WA

East, Christopher
Tacoma, WA

Eben, Barry
Seattle, WA

Eberly, Claudia
Bothell, WA

Edgar, Sandra
Spokane, WA

Edlund, Elizabeth
Seattle, WA

Edwards, Richard
East Wenatchee, WA

Edwards, Ola
Seattle, WA

Edwards, Genine
Yakima, WA

Edwards, Dorelle
Tumwater, WA

Egger, Mark
Seattle, WA

Ehler, Noah
Carnation, WA

Ehrenfreund, Janet
Mineral, WA

Ehrlich, Jeremy
Seattle, WA

Eigen, Tobias
Bainbridge Island, WA

Eisenbeis, Beth
Kenmore, WA

Ekstrand, Mary
Poulsbo, WA

Eldridge, Sheryl
Lynnwood, WA

Elizabeth, Laureen
Kingston, WA

Elkins, Anne
Anacortes, WA

Elliott, Allen
La Conner, WA

Ellis, John
Bellingham, WA

Ellis, Lisa
Mount Vernon, WA

Ellsworth, Linda
Eastsound, WA

Elnan-Derse, Hannah
Freeland, WA

Enerson, Hal
Port Angeles, WA

Englehart, Catherine
Seattle, WA

Engler, Pamela
Langley, WA

Englund, Klaudia
Anacortes, WA

Erben, John
Kennewick, WA

Erbs, Lori
Acme, WA

Erickson, Pamela
Seattle, WA

Ericson, Hilarie
Mill Creek, WA

Ervin, Cecile
Walla Walla, WA

Espe, Greg
Seattle, WA

Esquivel, Lewellyn
Auburn, WA

Evans, Bronwen
Seattle, WA

Evans, Rebecca
Seattle, WA

Evans, Rebecca
Seattle, WA

Ewers, Tana
Friday Harbor, WA

F, K
Seattle, WA

Fabian, Dagmar
Bellingham, WA

Fadden, Delmar
Preston, WA

Fahrenwald, Gill
Olympia, WA

Fails, Annette
Arlington, WA

Fails, Fails
Arlington, WA

Fairchild, Jennifer
Bainbridge Island, WA

Fairchild, Jane
Seattle, WA

Faletti, Dianne
Silverdale, WA

Fankhauser, Marcia
Edmonds, WA

Feliciano Jr, Vincent J
Bellingham, WA

Felizola, James
Olympia, WA

Feller, J
Olympia, WA

Fellows, Eric
Tacoma, WA

Felts, Martine
Anacortes, WA

Fetter, Sharon
Puyallup, WA

Fiddes, Colin
Spokane, WA

Finkelstein, Laura
Seattle, WA

Finley, Susan
Marysville, WA

Fisher, Jini
Issaquah, WA

Fisher, Jini
Issaquah, WA

Fisher, Sue
Bellingham, WA

Fisher, Jini
Issaquah, WA

Fitzpatrick, Kristin
Seattle, WA

Flanagan, Lucile B.
Seattle, WA

Flank, Joel
Seattle, WA

Flaten, Carolee
Hansville, WA

Forsberg, Victoria
Langley, WA

Fortier, Karen
Monroe, WA

Foulke, Chuck
Ridgefield, WA

Fox, Teri
Seattle, WA

Fox, Annabelle
Anacortes, WA

Frank, Rebecca
Malaga, WA

Franks, Larry
Issaquah, WA

Frawley, Joy
Spokane, WA

Frazer, Jane
Tacoma, WA

Freehill, Maureen
Langley, WA

Freels, Jeff
Lacey, WA

Frese, Glenda
Eatonville, WA

Frey, Mark
Yelm, WA

Friedman, Yoni
Redmond, WA

Fries, Diana
Covington, WA

Fritz, Nathan
Burien, WA

fulcher hepburn, carol
Shelton, WA

Fuller, Deena
Seattle, WA

Gaffney, Kristine
Omak, WA

GANDOLFO, DEBORAH
Kirkland, WA

Gardner, Alicia
Seattle, WA

Garfinkel, Sha'ari
Seattle, WA

Gaul, Michael
Ravensdale, WA

Gazori, Shirley
Mill Creek, WA

Gee, Michael
Seattle, WA

Gentz, Marylin
Olympia, WA

Gerecke, Harry
Vashon, WA

Gese, Sandy
Ione, WA

Gibbons, Terralene
Olympia, WA

Gibbs, Alison
Port Angeles, WA

Gilbert, Matthew
Eastsound, WA

Gill, Gary
Everett, WA

gill, jezzalie
Everett, WA

Gillenwater, Michael
Seattle, WA

Gilmore, Nan
Vancouver, WA

Giltzow, Sheila
Lynnwood, WA

Given, Curt
Everett, WA

Glass, Rebecca
Shoreline, WA

Gleeson, Valerie
Seattle, WA

Glennon, Shelly
Bellevue, WA

glover, enid
Kalama, WA

GODWIN, ROBERT
Olympia, WA

Gogic, Laurie
Kirkland, WA

Golbuff, Graham
Seattle, WA

Goldman, Ginger
Bellevue, WA

Goldschmidt, Melissa
Tulalip, WA

golic, kathy
North Bend, WA

Golic, Kathy
North Bend, WA

Gonnella, Carol
Nordland, WA

Goodhope, Victoria
Bellingham, WA

Goodwin, Greg
Seattle, WA

GOODWIN, NANCY
Sequim, WA

Goot, Yvette
Colville, WA

Goverman, Joan
Mercer Island, WA

Graham, Salliue
Blaine, WA

Graham, Lynn
Bellingham, WA

Graham, Gianina
Cle Elum, WA

graham, molly
Bellevue, WA

Graham, Brian
Everett, WA

Grajczyk, Joyce
Kent, WA

Granberg, Amanda
Seattle, WA

Grannis, Christopher
Bellingham, WA

Gray, Todd
Seattle, WA

Greef, Fred
White Salmon, WA

Green, Steve
Burlington, WA

Green, Elaine
Bellingham, WA

Greene, Steven
Camano Island, WA

Greer, Dale
Seattle, WA

Gregory, William
Sedro Woolley, WA

greig, gregor
Silverdale, WA

Grelock-Yusem, David
Langley, WA

Griffith, John
Sequim, WA

Grindle, Russell
Long Beach, WA

Grise, Erin
Seattle, WA

gruenhagen, Todd
Kingston, WA

Guard, Mary
Friday Harbor, WA

Guillory, Chris
Port Angeles, WA

Gulledge, Kathleen
Spokane Valley, WA

Gulley, Kim
Vancouver, WA

Gullickson, Anna
Cashmere, WA

Gundersen, Bruce
Poulsbo, WA

Guobis, Thomas
Port Angeles, WA

Guren, David
Seattle, WA

Gurnett, Greg
College Place, WA

guros, john
Montesano, WA

Gusch, Linda
Newport, WA

Gusdal, Margaret
Everett, WA

Gush, Joseph
Vancouver, WA

Guthrie, Randy
Snohomish, WA

Gylland, Kathleen
Seattle, WA

Gyncild, Brie
Seattle, WA

H, Carole
Port Townsend, WA

H Chinn, Phyllis
Kenmore, WA

Hackman, James
Port Hadlock, WA

Hailey, Kari Ann
Sammamish, WA

Haller, Keith
Olympia, WA

Hallowitz, Joanne
Liberty Lake, WA

Hamilton, Donna
Maple Valley, WA

Hamilton, Melanie
Silverdale, WA

Hampel, Susan
Eastsound, WA

Hampton, Reed
Seattle, WA

haniger, Marianna
Lopez Island, WA

Hanke, Susan
Port Townsend, WA

Hansen, Shawn
Seattle, WA

Hapke, peter
Seattle, WA

Hare, Ed
Snohomish, WA

Harmon, Susan
Bellingham, WA

Harper, Elena
Seattle, WA

Harrington, Julia
Vashon, WA

Harris, Lisa
Seattle, WA

Harris, Shirlee
Seattle, WA

Harrison, Jim and Bea
Cheney, WA

Harrod, Mariah
Seattle, WA

Harrowe, David
University Place, WA

Hartman, Jonathan
Camas, WA

Hartmann, Lorraine
Seattle, WA

Harty, Florence
White Salmon, WA

Harvey, Jo
Pacific, WA

Hasbrook, David
Bellevue, WA

Hassel, Alice
Camano Island, WA

Hatch, Kelli
Renton, WA

Hatfield, Phyllis
Seattle, WA

Haver, Virginia M.
Seattle, WA

Hawkins, Lee
Everett, WA

Hayden, Nancy
Spokane, WA

Hayek, Carolyn
Kirkland, WA

Hayes, John
Otis Orchards, WA

He, Nadine
Renton, WA

Heffernan, Sandra
Coupeville, WA

Heine, Carole
Port Ludlow, WA

Held-Rude, Astrid
Shoreline, WA

Hemenway, Shauna
Veradale, WA

Hemness, Stephani
Olympia, WA

Hemness, Stephani
Olympia, WA

HENLING, DANIEL
Seattle, WA

Heydet, Sharon
Vancouver, WA

Heywood, Susan
Tacoma, WA

Higgins, Alfred
Wenatchee, WA

hill, cheri
White Salmon, WA

Hilton, Margaret
Shelton, WA

hines, whitney
Medina, WA

Hinton, Colleen May
Burien, WA

Hipp, James
Bellingham, WA

Hirst, Eric
Bellingham, WA

Hitchko, E. Bruce
Burlington, WA

Hobbs, Jana
Kirkland, WA

Hochendoner, Kelly
White Salmon, WA

Hodack, Deborah
Port Orchard, WA

Hodson, Sally
Olga, WA

Hoerlein, Sara
Bellingham, WA

Hoey, Daniel
Seattle, WA

Hoff, S. M.
Bow, WA

Hoffman, Michael
Kirkland, WA

Hokonson, Suzi
Spokane, WA

Holland, Valerie
Vancouver, WA

Holman, Victoria
Renton, WA

Holstein, John
Bellingham, WA

Holtz, Eric
Kirkland, WA

Holtzman, Julie
Snohomish, WA

Hoover, Lana
Seattle, WA

Horn, Diane
Seattle, WA

Howe, jon
Friday Harbor, WA

Howe, Jared
Seattle, WA

Hoyt, Spencer
Battle Ground, WA

Hubbard, Shaun
Friday Harbor, WA

Hubbard, Glen
Olympia, WA

Hubenthal, D
Spokane, WA

Huber, Michael
Anacortes, WA

Huddlestone, Laura
Seattle, WA

Hudson, Dorothy
Tacoma, WA

Hulick, Stephen and Kathleen
Brush Prairie, WA

Hungerford, Chasity
Kirkland, WA

Hunter, Alma
Seattle, WA

Huntting, Sarah
Seattle, WA

Hunziker, Kristi
Yakima, WA

Hurley, Justine
Seattle, WA

Hurst, Sally
Seattle, WA

Hurst, Darcia
Arlington, WA

Huskinson, John
Seattle, WA

Hyldahl, Yausen
Seattle, WA

ichikawa, jeri
Battle Ground, WA

Ionina, Kateryna
Redmond, WA

Ionina, Kateryna
Redmond, WA

Isgrigg, Celina
Tacoma, WA

Ishitani, Jack Ishitani
Spokane, WA

J, Joseph
Ferndale, WA

Jacobs, Marianne
Steilacoom, WA

Jacobson, Linda
Arlington, WA

Jacobson, Addie
Bellingham, WA

Jacobson, Addie
Bellingham, WA

Jaeger, Anna
Everett, WA

Jamieson, Robert
Edmonds, WA

Jamison, Vanessa
Marysville, WA

Jamison, Vanessa
Marysville, WA

jenkins, jim
Spokane, WA

Jensen, Valerie
Hobart, WA

Jerskey, Paul
Port Orchard, WA

Jerskey, Paul
Port Orchard, WA

Jezerinac, Shawn
Ellensburg, WA

Johansen, Penelope
Montesano, WA

Johnson, Richard
Bellingham, WA

Johnson, Nancy
Port Orchard, WA

Johnson, Lee
Renton, WA

Johnson, Darcy
Kittitas, WA

Johnson, Elizabeth
Stevenson, WA

JOHNSON, Lucy
Seattle, WA

Johnson, WendyRae
Port Angeles, WA

Johnson, Monica
Seattle, WA

Johnson, Erin
Lakewood, WA

Johnston, Beverly
Puyallup, WA

Jones, Clayton
Tukwila, WA

Jones, Lois
Seattle, WA

Jones, Katie
Friday Harbor, WA

Jones, Chris
Stanwood, WA

Jones, Linda L.
Tulalip, WA

Jones, Darin
Seattle, WA

Jordan, Janet
Olympia, WA

Jordan, Sarah
Bremerton, WA

Jordan, Theresa
Pullman, WA

Joyce, CJ
Vancouver, WA

Jurus, Nicholas
Vashon, WA

Justis, William
Olympia, WA

Justis, William
Olympia, WA

k, k
Seattle, WA

Kahler, Paula
Seattle, WA

Kaiser, Robert
Olympia, WA

Kalahan, Deb
Renton, WA

Kalahan, Deb
Renton, WA

Kane, Tracy
Mount Vernon, WA

Kaplan, Eliot
Seattle, WA

Karpenko, Broehe
Seattle, WA

Kavage, Sarah
Seattle, WA

Kaye, Deborah
Blaine, WA

Kaylen, Sharon
Bainbridge Island, WA

Keating, Michelle
Vancouver, WA

Keefer, Kelly
University Place, WA

Keeler, Mary
Seattle, WA

Keeley, James
Vancouver, WA

Keiser, John
Tacoma, WA

Kellems, liisa
Seattle, WA

Keller, Sophia
Seattle, WA

Kelly, Gary W
Bothell, WA

KELLY, JOANNE
Olympia, WA

kelly, sheryl
Mukilteo, WA

Kelsberg, Jane
Greenbank, WA

Kemp, Kindra
Port Townsend, WA

KENNEDY, JENNIFER
Maple Valley, WA

Kenny, Patricia
Vancouver, WA

Kerbow, Devon
Covington, WA

KERR, LAURIE
Battle Ground, WA

Kessinger, Jerry
Lynnwood, WA

Key, Chloe
Tukwila, WA

Keyes, Jeannie
Renton, WA

Khemani, Victoria
Seattle, WA

Kiba, Amy
Vancouver, WA

Kilbourne, Lynn
Seattle, WA

Kilham, Nina
Everett, WA

Kim, Ji-Young
Bothell, WA

Kim, Grace
Lynnwood, WA

King, Amy
Bothell, WA

King, Theodore
Seattle, WA

King, Ruth
Lacey, WA

Kingston, Susan
Gig Harbor, WA

Kirk, Anna
Seattle, WA

Kitson, Jamie
Granite Falls, WA

Kjaer, Lisa
Seattle, WA

Klauk, Amanda
Colbert, WA

Klein, McKenna
Sedro Woolley, WA

Klinski, Janice
Olympia, WA

Klitz, Pam
Federal Way, WA

Klunder, Christine
Bellingham, WA

Klyn, Charles
Seattle, WA

Knowles, Lorelette
Everett, WA

Knudson, Linda
Bainbridge Island, WA

Knudson, Arnie
Lynnwood, WA

Knudson, Dorothy
Walla Walla, WA

Knutzen, Steve
Anacortes, WA

Koenig, Ron
Kirkland, WA

Koepp, Stephen
Mukilteo, WA

Koerner, Sheila
Nine Mile Falls, WA

KOLB, JAMES
Indianola, WA

Koloini, Kyle
Duvall, WA

Kolva, Jessica
Tacoma, WA

Korn, Meryle A.
Bellingham, WA

Korneliussen, Vivian
Shoreline, WA

Kostal, Kate
Kirkland, WA

Krause, Fayette
Port Townsend, WA

Krause, Ben
Spokane, WA

Kraushaar, Sunday
Washougal, WA

Krebsbach, Tom
Brier, WA

Krehbiel, Beth
Port Townsend, WA

Kreider, Janice
Anacortes, WA

Kronenberg, Esther
Olympia, WA

Kronenberger, Eliza
Bellingham, WA

Krumboltz, Ann
Seattle, WA

Kuehne, Clarice
Grand Coulee, WA

Kunz, Cheri
Woodinville, WA

Lachance, Cynthia
Renton, WA

Lackland, Edie
Seattle, WA

LaGasse M.D., Jeffrey
Freeland, WA

Lagerloef, Marcia
Bainbridge Island, WA

Lagerquist, Melinda
Hansville, WA

Lague, Rich
Seattle, WA

Lambros, Kathryn
Seattle, WA

Lampi, Michael
Bellevue, WA

Landry, Joanne
Vancouver, WA

Langhans, Judith
Olympia, WA

Lankford, Clayann
Olympia, WA

Lapite, Arthur
Seattle, WA

Larsen, Julia
Seattle, WA

Larsen, Jennifer
Seattle, WA

Larson, R. A.
Mount Vernon, WA

LaRue, Erik
Burlington, WA

Lauzon, Charlene
Lynnwood, WA

Lawrence, Christopher
Spokane, WA

Leathers, Kathy
Bellingham, WA

Ledden, Dennis
Sequim, WA

Lee, Elizabeth
Langley, WA

Lee, Kathleen
Lacey, WA

Leeper, Kimberly
Seattle, WA

LeFort, Andrew
Port Angeles, WA

Lehner, Lora
Port Orchard, WA

Leifker, Karen
Nine Mile Falls, WA

Leigh, Steve
Seattle, WA

Leighton, Shannon
Seattle, WA

Leitch, Kathy
Woodinville, WA

Lemoine, Evelyn
Seattle, WA

Lengel, Elizabeth
Anacortes, WA

Leow, Millicent
Burlington, WA

Levan, Patricia
Port Orchard, WA

Levin, jessica
Seattle, WA

LeVine, Sharon
Seattle, WA

Lewis, Nancy
Seattle, WA

Lewis, Shannon
Puyallup, WA

Lewis, Christine
Ridgefield, WA

Lewis, Lindsey
Everett, WA

Lewis, Nancy
Seattle, WA

Lichtenstein, Joan
Maple Falls, WA

Lippert, Aunna
Oak Harbor, WA

Lisafeld, Monica
Vashon, WA

Liu, Hannah
Vancouver, WA

Loeffler, Karen
Nine Mile Falls, WA

Loeser, Karen
Mercer Island, WA

Lofton, Saab
Seattle, WA

Logan, Kerry
Wenatchee, WA

Lokken, Fred
Seattle, WA

Long, Karol
Spokane, WA

Loomis, Susan
Renton, WA

Lopez, Josefina
Kent, WA

Loucks, Jonathan
Everett, WA

Lovejoy, Valerie
Bellingham, WA

Loveless, Scott
Seattle, WA

Lowney, Kathleen
Sammamish, WA

Lucas, Jennifer
Eatonville, WA

Lufkin, Thom
Olympia, WA

Lunceford, Kate
Bothell, WA

Lund, Cynthia
Lopez Island, WA

Lund, Kristen
Seattle, WA

Lundheim, Vanassa
Everett, WA

Luxem, David
Burien, WA

Lyman, Michael
Colville, WA

Lyon, Jen
Mercer Island, WA

Lyon, Carrie
Edmonds, WA

M, Tom
Bellingham, WA

M, Sarah
Seattle, WA

Mabel, Joseph
Seattle, WA

MacArthur, June
Port Orchard, WA

MacDonald, Susan
Poulsbo, WA

Macdonald, John
Edmonds, WA

MacDonald, Mark
Seattle, WA

MacGregor, Susie
Redmond, WA

Mack, Kim
Shelton, WA

Madole, Catherine
Walla Walla, WA

Maghakian, Michael
Blaine, WA

Magliola, Lawrence
Sequim, WA

Magner, Millie
Seattle, WA

Magnotto, Dennis
Bainbridge Island, WA

Mahaffa, Michael
Brush Prairie, WA

Mahder, Debbie
Battle Ground, WA

Mahder, Debbie
Battle Ground, WA

Mahlis, Larry
Seattle, WA

Main, Christine
Maple Falls, WA

major, joyce
Lakebay, WA

Majsterek, Shelley
Ellensburg, WA

Malone, Dawn
Des Moines, WA

mandeville, pete
Spokane, WA

Mansfield, Mary Ann
Langley, WA

Maravilla, Maria
Pullman, WA

Marceron, Dennis
Seattle, WA

Markley, Shannon
Shoreline, WA

Marks, Diane
Port Angeles, WA

Martin, Kathleen Peter
Langley, WA

Martin, Elizabeth
Seattle, WA

Martinez, Jami
Sedro Woolley, WA

Martinson, Julie
Everett, WA

Martinson, Julianne
Everett, WA

Marx, Laura
Seattle, WA

Masbaum, Judy
North Bend, WA

mashayekh, Niousha
Seattle, WA

Mason, Troy
Tacoma, WA

Mass, Ursula
La Conner, WA

Mathew, Joseph
Maple Valley, WA

Mathews, Holger
Seattle, WA

Mathieu, Stephanie
Olympia, WA

Mathison, Bruce
Diamond, WA

Matinjussi, Valarie
Bellingham, WA

Mattes, Katherine
Sammamish, WA

May, Ann
Milton, WA

Mayers, Marilyn
Bellevue, WA

McAllister, Patrick
Gig Harbor, WA

McClellan, Lois
Seattle, WA

McCluskey, Sharon
Manchester, WA

McColl, William
Blaine, WA

McConaughy, Jeffery
Bellingham, WA

Mcconnell, Cathleen
Tacoma, WA

McCoy, Sean
Shoreline, WA

McCoy, Alan
Spokane, WA

McDonough, Gail
Wenatchee, WA

McGill, John
Sequim, WA

McKee, Patrick
Mercer Island, WA

McLeod-Pacheaco, Nicole
Bellingham, WA

McNeely, Tom
Bellingham, WA

Meehan, Toni
Brinnon, WA

Meijer, Marijke
Sequim, WA

Mendiola, Michael
Mukilteo, WA

Mendoza, Jean
White Swan, WA

Messinger, Lisa
Port Townsend, WA

Mest, Rita
Redmond, WA

Methe, Leslie
Arlington, WA

Metzger, Alexander
Lynnwood, WA

Meyer, Marilee
Port Angeles, WA

Meyer, Carol
Vancouver, WA

Meyer, Jacob
North Bonneville, WA

Meyer, Dr. Sabine
Seattle, WA

Michaels, Brenda
Port Townsend, WA

Michaels-Tyner, Michelle
Ridgefield, WA

Middleton, David
Seattle, WA

Milam, Kevin
Seattle, WA

MILLARD, JANET
Leavenworth, WA

Miller, Bonnie
Seattle, WA

Miller, Toby
Bainbridge Island, WA

Miller, Robin
Spokane, WA

Millner, Marjorie
Vancouver, WA

Mincks, Janine
Renton, WA

Mincks, Janine
Renton, WA

Mintun, Linda
Spokane, WA

Mintz Kavas, Lisa M.
Lynnwood, WA

Misek, Jolie
Lacey, WA

mller, donald
Clinton, WA

Modian, Esta
Seattle, WA

Molesh, Kathy
Hansville, WA

monahan, sean
Bellingham, WA

Monahan, Steven
Kenmore, WA

Monk, Jeffrey
Bellingham, WA

Moon, Alison
Seatac, WA

Moore, Rosemary
Mercer Island, WA

Moore, Ben
Mountlake Terrace, WA

MOORE, Jenny
Stanwood, WA

Moralez, Cheryl
Spokane Valley, WA

Morgan, Kay
Carlton, WA

Morgan, Kay
Carlton, WA

Morgan, Dan
Lynnwood, WA

Mork, Stuart
Seattle, WA

Morkill, Barbara
Spokane, WA

Morris, Eleanor
Grapeview, WA

Morris, Nancy
Shoreline, WA

Mortinson, Shelley
Marysville, WA

Mott-Smith, Margot
Bothell, WA

Mower, Amy
Maple Falls, WA

Moylan, Jessica
Sammamish, WA

Moylan, Julie
Tacoma, WA

Moylan, Jessica
Sammamish, WA

Mueller, Marcia
Spokane, WA

Mulcare, James
Clarkston, WA

Mullie, Christine
Winthrop, WA

Murawski, Heather
Renton, WA

Murdock, Robert
Olympia, WA

Murray, Susanne
Pullman, WA

n, mary
Vancouver, WA

N, Mary
Vancouver, WA

Nabeel, Myra
Kent, WA

Nagyfy, Desiree
Deer Park, WA

Nagyfy, Desiree
Deer Park, WA

Nehring, Paul
Seattle, WA

Nelson, Jennifer
Seattle, WA

Nelson, Nancy
Spokane, WA

Nelson, Katherine
Kent, WA

Nelson, Thora
Kingston, WA

Nelson, Nancy
Spokane, WA

Nemeth, Lisa
Spokane, WA

Nevins, Suzanne
Chimacum, WA

New, Val
Renton, WA

Newkirk, Mary
Arlington, WA

Niblack, Natalie
Mount Vernon, WA

Nicholls, Jeff
Seattle, WA

Nicholson, Alice
Seattle, WA

Nickols, Neil
Seattle, WA

Nielsen, Joan
Mount Vernon, WA

Nielsen, Michael
Sequim, WA

Nikfar, Shahrokh
Spokane, WA

Nimmons, Rebecca
Bellevue, WA

Nimmons, Rebecca
Bellevue, WA

Nimmons, Rebecca
Bellevue, WA

Nolte, Gwen
Lakewood, WA

Nonnast, Kimmons
Seattle, WA

Nystrom, Roger
Edmonds, WA

OBrien, Kathleen
Bothell, WA

OBrien, Kate
Seattle, WA

OConnell, Mary Margaret
Olympia, WA

Odonnell, J
Seattle, WA

Okada, Toni
Mercer Island, WA

O'Keefe, Suzanne
Vancouver, WA

Ollom, Kolten
Arlington, WA

Olsen, Kristine
Aberdeen, WA

Olsen, Debra
Tacoma, WA

Olson, Carole
Marysville, WA

Omenn, Larkin
Seattle, WA

ONeill, Lenora
Toledo, WA

ONeill, Lenora
Toledo, WA

ONeill, Lenora
Toledo, WA

ONeill, Lenora
Toledo, WA

ONeill, Lenora
Toledo, WA

Oranges, Elizabeth
Acme, WA

Oranges, Elizabeth
Acme, WA

Orosco, Ally
Tacoma, WA

Orrange, Mary K
Sedro Woolley, WA

Osmer, William
Issaquah, WA

Osnes, Libby
Lake Stevens, WA

Ostrander, Lucy
Bainbridge Island, WA

OSTRANDER, BARBARA
University Place, WA

Ostrow, Robert
Kettle Falls, WA

O'Toole, Christina
Olympia, WA

Ouellette, Tracy
Bow, WA

Oulman, Lynne
Bellingham, WA

Owen, Sandra
Snoqualmie, WA

P, Cece
Seattle, WA

Packard, Elaine
Seattle, WA

Padelford, Grace
Kirkland, WA

Padelford, Grace
Kirkland, WA

Page, Peggy
Stanwood, WA

Palmer, Judy
Tonasket, WA

Pare, Nancy
Tacoma, WA

Parker, Tracey
La Conner, WA

Parker, Barry
Vancouver, WA

Parrett, Julianne
Ridgefield, WA

Parshall, Dorothy
Langley, WA

Parshall, Sharon
Fall City, WA

Parsley, Adina
Stanwood, WA

Patterson, Joy
Bellingham, WA

Pauley, Jean
Seattle, WA

Paulsen, Julia
Seattle, WA

Peace, Stephanie
Lynnwood, WA

Pearl-Thomas, Dina
Bellingham, WA

Pearson, Pat
Port Ludlow, WA

Peck, Glenda
Vancouver, WA

Pederson, D
Tacoma, WA

Pennington, Sherry
Kent, WA

Percy, M
Bellingham, WA

Perez, Aldora
Seattle, WA

Perfrement, Eileen
Shelton, WA

Perrin, Miriam
Seattle, WA

Petach, Paul
Gig Harbor, WA

Peters., Nancy
Kirkland, WA

Petersen, Art
Anacortes, WA

Peterson, Kristina
Mill Creek, WA

Peterson, Lauren
Seattle, WA

Petrova, Alla
Shoreline, WA

Phelps, Kathy
Lakewood, WA

Phillips, Sally
Seattle, WA

Phillips, S
Edmonds, WA

Phipps, Claude
Lacey, WA

Pickard, Drew
Kenmore, WA

PICKERING, PATRICIA
Woodinville, WA

Pilger, Carrie
Lynnwood, WA

Pinkston, Pamela
Lakewood, WA

Pinson, Luan
Vancouver, WA

Plancich, Richard
Shoreline, WA

Platt, Sylvia
Port Townsend, WA

Plischke Jr, Bob
Tacoma, WA

Plut, Marin
Seattle, WA

Pollack, Michael
Bainbridge Island, WA

Pope, Betsy and Chris
Friday Harbor, WA

Post, Frances
Port Townsend, WA

Potts, Paul
Raymond, WA

Potts, Paul
Raymond, WA

Powers, Melinda
Seattle, WA

Pratt, Debbi
Seattle, WA

PRESTON, JAMES
Seattle, WA

Price, Denise
Bellingham, WA

Princing, McKenna
North Bend, WA

Proctor, Steve
Seattle, WA

Propp, Leslie
Olympia, WA

Provost, Lin
Seattle, WA

Pum, Wendy
Spanaway, WA

Pursley, Paula
Concrete, WA

PYLES, ROBERT
Sequim, WA

R, Pr
Sequim, WA

Radford, Lemoine
Sammamish, WA

Ramage, Janath
Kent, WA

Ramon, Laura
Woodinville, WA

Randall, Kirsten
Tacoma, WA

RANDLES, Jean
Arlington, WA

Ranganathan, Senthil
Bothell, WA

Ranstrom, Patricia
Vashon, WA

Rasmussen Ranz, Lauren
Bellingham, WA

Rayl, Taylor
Bellingham, WA

Raymond, Charles
Seattle, WA

Reagel, Peter
Burien, WA

Reback, Mark
Battle Ground, WA

Redmond, Penny
Olympia, WA

Redmond, Mark
Seattle, WA

Reed, Miho
Sammamish, WA

Rei, Carla
Kirkland, WA

reichley, nancy
Seattle, WA

Reifschneider, Jill
Vashon, WA

Reitz, Eowyn
Mukilteo, WA

Relyea, Sandra
Port Angeles, WA

Rhyder, Zanne
Vashon, WA

Richard, Barbara
Cheney, WA

Richards, Geoffrey
Poulsbo, WA

Riddle, Carolyn
Vancouver, WA

Ridgley, Katheryn
Tacoma, WA

Riggs, Judith
Lakebay, WA

Rimbos, Peter
Maple Valley, WA

Ring, Susan
Seattle, WA

Ringler, Diane
Port Ludlow, WA

Ringler, Diane
Port Ludlow, WA

Riordan, Janet
Snohomish, WA

Ritchie, Daniel
Mount Vernon, WA

Ritter, Phil and Lynn
Sammamish, WA

Roberts, Jim and Nancy
Kirkland, WA

Roberts, Melissa
Tacoma, WA

Roberts, Paul
Seattle, WA

robinson, d
Curlew, WA

Robinson, Devin
Marysville, WA

Rodgers, Julie
Kirkland, WA

Rodriguez- Sero, Graciela
Olympia, WA

Rodriguez- Sero, Graciela
Olympia, WA

Rodriguez- Sero, Juan
Olympia, WA

Rogers, James
Bremerton, WA

Rolland, Janna
Seattle, WA

Rose, Diane
Kirkland, WA

Rosen, Michael
Mercer Island, WA

Rosenfeld, Daniel
Renton, WA

Rossen, Christine
Seattle, WA

Rossum, Deborah
Seattle, WA

Roth, Arlene
Seattle, WA

Roth, Maximilian
Edmonds, WA

Rowe, Debbie
Auburn, WA

Rudolph, Judith
Port Townsend, WA

Rummerfield, Mike
Onalaska, WA

Russell, Dave
Issaquah, WA

Russell, Sandra
Pullman, WA

Russell, Wanda
Aberdeen, WA

Ryan, Terrance
Quilcene, WA

S, Tisha
Lake Stevens, WA

Saarinen, Tamara
Gig Harbor, WA

Safaie, Noushin
Seattle, WA

Sampson, Paul
Seattle, WA

Sanborn, Barbara
Seattle, WA

Sand, Gretchen
Kennewick, WA

sandberg, annette
Kent, WA

SANDERS, HILLARY
Bothell, WA

Sandvig, Daniel
Monroe, WA

Sandwell, Susan
Olympia, WA

Sanford, Bryan
Bonney Lake, WA

Santelli, Jake
Seattle, WA

Santelli, Jake
Seattle, WA

Santi, Ron
Medina, WA

Santoro, James
Vancouver, WA

Sargent, Jean
Bainbridge Island, WA

Saunders, Patricia
Snohomish, WA

Scavezze, Barbara
Woodinville, WA

Schautz, Jane
Seattle, WA

Scheide, Kirsten
Seattle, WA

Schellberg, Marta
Seabeck, WA

Scherrer, Katie
Seattle, WA

Scheunemann, Anita
Rochester, WA

Schmidt, Sarah
Coupeville, WA

Schmidt, Moriah
Seattle, WA

Schneider, Steve
Seattle, WA

Schneider, Sari Rose
Mercer Island, WA

Schneider, Erik
Graham, WA

Schneider, Dan
Seattle, WA

Schoonover, Richard
Tacoma, WA

Schreiber, Arwen
Seattle, WA

Schroeder, Val
Camano Island, WA

Schroeder, Val
Camano Island, WA

Schubert, Daria
Redmond, WA

SCHULLER, MARK
Newman Lake, WA

Schulz, Laura
Puyallup, WA

Schweitzer, Michelle
Seattle, WA

Schwendemann, Harry
Burien, WA

Schwinberg, Jean
Seattle, WA

Scott, Susan
Vancouver, WA

Scott, Katelyn
Wellpinit, WA

Scranton, Liz
Lopez Island, WA

Scribner, Denee
Nine Mile Falls, WA

Seater, Kimberly
Seattle, WA

Sebek, Mary
Seattle, WA

Sewell, Lauren
Seattle, WA

Shaffer, Renay
Blaine, WA

Shafransky, Paula
Sedro Woolley, WA

Shank, Genevieve
Bellingham, WA

Shannon, John T.
Anacortes, WA

Shannon, John T.
Anacortes, WA

Sharp, C.B.
Lakewood, WA

Sheck, Sally
Tacoma, WA

Sherwood, Trina
Wapato, WA

Shocki, Jeannene
Marysville, WA

Shokenu, David
Tacoma, WA

Shore, Patricia
Vancouver, WA

Shouse, Susan
Everett, WA

Shrewsbury, George
Deming, WA

shubert, stephen
Friday Harbor, WA

Shuler, Heidi
Vancouver, WA

Silver, Margaret
Seattle, WA

Simcox, Shelley
Bremerton, WA

Simpson, Kristina
Longview, WA

Sing, Hailey
Issaquah, WA

Sing, Hailey
Issaquah, WA

Sisson, Kathleen
Kennewick, WA

Sites, Sherry
Gig Harbor, WA

Skager, Theresa
Lakewood, WA

Skeels, Vicki
Lacey, WA

Skerlec, Ernetta
Lakewood, WA

Slack, Kelley
Bellingham, WA

SMALL, LORRAINE
Poulsbo, WA

Smartlowit, Rodney
Wapato, WA

Smith, D
Olympia, WA

Smith, Stu
Wenatchee, WA

Smith, Barbara
Arlington, WA

Snapp, Seth
Bellingham, WA

Snow, Michael
Bellingham, WA

Snow, Donna
Olympia, WA

Solon, Jeri
Stanwood, WA

Sovran, Vivian
Seattle, WA

Sparling, Sheryl
Lynden, WA

Spear, Valerie
Yakima, WA

spears, sandy
Bainbridge Island, WA

Speed, Andrea
Tacoma, WA

Spencer, Bob
Auburn, WA

Springborn, Graciela
Port Angeles, WA

Springer, Aleta
Lake Stevens, WA

Spurling, Sherry
Sultan, WA

Spurling, Leslie
Seattle, WA

St Marie, Valarie
Vancouver, WA

Staats, Alycia
Seattle, WA

Star, Sam
Seattle, WA

Stark, Alexis
Gig Harbor, WA

Steadman, Jane
Seattle, WA

Stefano, Lori
Yelm, WA

Sterling, Laurie
Port Orchard, WA

Stevens, Carol
Spanaway, WA

Stevenson, Karen
Port Orchard, WA

Stewart, Kristin S
Olympia, WA

Stiglich, Lynn
Vancouver, WA

Stocker, Rebecca
Tacoma, WA

Street, Kergan
Seattle, WA

Streiffert, Dan
Kent, WA

Strickland, Stacy
Seattle, WA

Stromberg, Terri
Redmond, WA

Stuart, Barbara
Edmonds, WA

Sturt, Debbie
Olympia, WA

Stutheit, Don
Edmonds, WA

Subala, Marilyn
Redmond, WA

suggs, gaila
Bellingham, WA

Sullivan, Diane
Oak Harbor, WA

Sullivan, Terry
Vashon, WA

Sullivan, Barb
Blakely Island, WA

Sutor, Molly
Spokane, WA

Swan, Linda
Snohomish, WA

Swihart, Janet
Long Beach, WA

Swihart, Janet
Long Beach, WA

Sydnor, Giles
Seattle, WA

Szumlas, Nick
Seattle, WA

T, Dr
Medina, WA

Tallman, Scott
Seattle, WA

Tanaka, Kathleen
Shelton, WA

Tanler, Ben
Seattle, WA

Tatsumi, Garrett
Olympia, WA

Tatum Jr, James
Kennewick, WA

Taylor, Vicky
Kirkland, WA

Taylor, Karla
Olympia, WA

Taylor, Ricky
Everett, WA

Taylor, Caren
Gig Harbor, WA

Taylor, Polly
Olympia, WA

Teed, Cornelia
Bellingham, WA

Teesdale, Mary
Bellingham, WA

Teraberry, Kimberly
Seattle, WA

Tharp, Rod
Olympia, WA

Tharp, Rod
Olympia, WA

Thayer, Margaret
Bothell, WA

Therrell, Charles
Port Orchard, WA

Thierry, Judy
University Place, WA

Thirloway, Melissa
Kirkland, WA

thomas, kat
Seattle, WA

Thomas, Vicki
Bellingham, WA

Thomas, Anne
Seattle, WA

Thomas, Peter
Shoreline, WA

Thompsen, Linda
Redmond, WA

Thompson, Michael
Shelton, WA

Thompson, Gay
Selah, WA

Thompson, Jennifer
Olympia, WA

Thornsbury, Jean
Federal Way, WA

Tierson, Tina
Vancouver, WA

Tjersland, Tory
Olympia, WA

Todnem, David
Port Angeles, WA

Tomasek, Teresa
Everett, WA

Tomlinson, Richard
Seattle, WA

Tompkins, Sarah
Seattle, WA

TOSDALE, KIM
Bainbridge Island, WA

Townsend-Tyers, Dorothy
Langley, WA

Tracy, Kathleen
Seattle, WA

Tracy, Kathleen
Seattle, WA

TRAVERS, mary
Seattle, WA

Trimble, Nathan
Port Townsend, WA

Trosper, Michelle
Battle Ground, WA

Turlo, Joy
Bonney Lake, WA

Turnell, Amelia
Seattle, WA

Turner, Robert
Seattle, WA

Turner, Kathy
Seattle, WA

Turner, Bobbi
Winlock, WA

Turnidge, Carol
Kent, WA

Turnoy, David
Eastsound, WA

Tuthill, Shawn
Mountlake Terrace, WA

Tylor, Ronaye
Blaine, WA

Udovich, Adam
Olympia, WA

Underwood, Dennis
Tacoma, WA

Ungar, Jill
Ellensburg, WA

Unruh, Amy
Seattle, WA

Unruh, Amy
Seattle, WA

Unruh, Amy
Seattle, WA

Unruh, Amy
Seattle, WA

Uyenishi, Steven
Seattle, WA

Uzuner, Selim
Carnation, WA

Valentine, Vanessa
Blaine, WA

Vandegrift, Debra
Seattle, WA

Vanderbilt, Linda
Tacoma, WA

Vanderkamp, Robert
Battle Ground, WA

varley, will
Stanwood, WA

Vavrek, Jean
Stehekin, WA

veenendaal, katherina
Marysville, WA

Venable, Brian
Seattle, WA

Vennerholm, Susan
Leavenworth, WA

Villeneuve, Kiel
Yelm, WA

Villeneuve, Phyllis
Olympia, WA

Vincent, Gail
Tacoma, WA

Viniko, J L
Langley, WA

Voget, Richard
Seattle, WA

Voigt, Lynda
Seattle, WA

Voli, Carlo
Edmonds, WA

Volkirch, Terence
Issaquah, WA

Von Dohlen, Lindy
Pasco, WA

von Sacher-Masoch, Michael
Everett, WA

Vos, Andrea
Everett, WA

Vossler, Susan
Kirkland, WA

Vralsted-Thomas, Nora
Medical Lake, WA

Vu, Tien
Renton, WA

Wachob, Carrie
Edmonds, WA

Wagner, Rebecca
Edmonds, WA

wagner, gary
Burien, WA

waitkevich, cheryl
Olympia, WA

Wakefield, Cameron
Seattle, WA

wallace, nadine
Tacoma, WA

Wallesz, Barbara and David
Bellingham, WA

Walseth, David
Vancouver, WA

Walseth, David
Vancouver, WA

Walter, Amy
Seattle, WA

Wang, Tracy
Seattle, WA

Warburton, Jen
Port Ludlow, WA

Ward, Benjamyn
Seattle, WA

watermam, Susan
Port Townsend, WA

watermam, Susan
Port Townsend, WA

Weatherly, Joan
Bremerton, WA

Wechsler, Roger
Bow, WA

Weedman, Ruth
Longview, WA

Wehner, Ronald
Port Angeles, WA

Weinberger, Diane
Greenbank, WA

Weinstein, Elyette
Olympia, WA

Weir, Kristi
Bellevue, WA

Weir, Kristi
Bellevue, WA

Weis, Karen
Bellingham, WA

Wells, Christine
Olympia, WA

Westerlund, Trina
Bellevue, WA

Weyer, Dora
Everett, WA

Wheeler, Kathleen
Deer Park, WA

Wheeler, Gene
Darrington, WA

White, Nancy
Spokane Valley, WA

White, Bruce
Kirkland, WA

White, Bruce
Kirkland, WA

Whitney, Calista
Spokane, WA

Whittle, Kati
Puyallup, WA

whorton, adrian
Seattle, WA

Wiederspan, Evan
Seattle, WA

Wiese, Katherine
Ridgefield, WA

Wight, Dean
Bellingham, WA

Wight, Barbara
Edmonds, WA

Wilbur, Robert
Coupeville, WA

Wilfing, Janice
Port Angeles, WA

Wilkins, MaryJo
Kennewick, WA

Williams, Kendra
Seattle, WA

Williams, Steve
Tacoma, WA

Williams, Judi
Tacoma, WA

Williams, Ali
Bothell, WA

Williams, Sandy
Elma, WA

Wilson, Beth
Olalla, WA

Wilson, Lauren
Seattle, WA

Winkel, Marguerite
Spokane, WA

Winnard, James
Seattle, WA

Winters, Lisa
Black Diamond, WA

WITT, LUCAS
Battle Ground, WA

Woestwin, Carl
Seattle, WA

Woll, Margaret
Bellingham, WA

Woll, Margaret
Bellingham, WA

Wood, Gordon
Seattle, WA

Wood, Emma
Spokane, WA

Woodbridge, Jennifer
Shaw Island, WA

Woods, Victor
Olympia, WA

woods, michael
Snohomish, WA

Woodward, Caryn
Shoreline, WA

Woolpert, Steven
White Salmon, WA

Wynne, Janet
Bellingham, WA

Yalowicki, Dayna
Bothell, WA

Yogev, Yonit
Olympia, WA

York, Traci
Port Ludlow, WA

Young, William
Bellingham, WA

Young, Joseph
Port Townsend, WA

Yuen, Karen
Redmond, WA

Z, Alexis
Shelton, WA

zeldenrust, karen
Arlington, WA

Zerr, Laura
Auburn, WA

Zinck, Z
Olympia, WA

Zizza, Hannah
Seattle, WA

Zontek, Ken
Yakima, WA

Zontek, Ken
Yakima, WA

No Last Name Given, Adele
Everett, WA

No Last Name Given, Kathryn
Vashon, WA

Earthjustice

Please see attached comment letter submitted by Earthjustice with attachments, part 1 of 3.

EARTHJUSTICE

January 31, 2024

Tricia Miller, Permit Administrator
WA State Dept of Ecology – NWRO
PO Box 330316
Shoreline, WA 98133-9716

**Re: City of Everett Water Pollution Control Facility
National Pollutant Discharge Elimination System (NPDES) Wastewater Discharge Permit**

Dear Ms. Miller:

I. INTRODUCTION AND SUMMARY

The undersigned submit these comments on the draft National Pollutant Discharge Elimination System (NPDES) Permit (No. WA0024490) for the City of Everett Water Pollution Control Facility located in Snohomish County, Washington. In renewing an NPDES permit, the Department of Ecology (Ecology) must address violations of water quality standards and the harm such violations cause to people, water, and aquatic life. In this permit cycle, it is imperative that the permit have measures that will eliminate or significantly reduce discharges of persistent bio-accumulating toxic chemicals and nutrients.

At a minimum, the permit must contain effluent limits and other controls to address three pollution streams:

(1) the permit must eliminate discharges of PBDEs (polybrominated diphenyl ethers) that are causing a hot spot in the Lower Snohomish River, where concentrations in juvenile Chinook salmon are above levels that suppress the immune system and impede survival;

(2) the Everett Wastewater Treatment Plant must require testing of industrial user discharges for PFAS chemicals and impose pollution prevention measures or treatment requirements on the sources of these toxic pollutants; and

(3) the permit must impose effluent limits to prevent harmful nutrient discharges from the Plant, which is a major source of nutrient pollution into Puget Sound, with compliance deadlines that ensure the limits will be fully met in this permit cycle.

Before addressing each of these waste streams, we note that the draft permit suffers from Ecology's consistent failure to conduct the required analysis of all known, available, and reasonable treatment methods (AKART) for each of these waste streams in order to establish technology-based limits. Nor did Ecology set limits to prevent ongoing violations of water quality standards from the Plant's discharges. These analyses and limits are imperative in order to inform pretreatment agreements with industrial users to reduce toxic pollutants at the source, as well as to address additional efforts the Plant must undertake.

Below is a summary of our recommendations for each pollutant stream.

A. The Permit Must Eliminate PBDE Discharges That Are Harming Juvenile Chinook Salmon In Violation Of Water Quality Standards.

The Everett Plant's discharges of persistent, bioaccumulative, and toxic PBDEs are causing a hot spot in the lower Snohomish River. Juvenile Chinook salmon in the area — listed as threatened under the Endangered Species Act — have PBDE concentrations in their tissues associated with increased disease susceptibility and mortalities. Ecology identified the PBDE hot spot as long ago as 2010. Subsequent studies by WDFW and NOAA Fisheries systematically eliminated stormwater or other wastewater treatment plants as the cause of the hot spot, circling in on the Everett Plant as the cause of the harmful levels of PBDEs in juvenile Chinook salmon.

Alarmingly, PBDE concentrations in juvenile Chinook in the lower Snohomish River have increased in recent years. Sampling in 2021 found that the proportion of juvenile Chinook with PBDEs concentrations at levels that harm the immune system rose to 80% (up from 73% in 2016 sampling). This is in contrast to elsewhere in Puget Sound where PBDE concentrations in fish and other marine species have declined as production of most PBDEs has been phased out. The aerospace industry, however, has had an exemption from the state ban on PBDEs as well as an exemption from the new federal ban on decaBDE, which allows production and use of decaBDE for replacement parts for aerospace vehicles over the next 30-40 years. Since the large Boeing facility discharges into the Everett Plant, this exemption may lead to the Snohomish River hot spot persisting for decades unless the plant is required to carry out strong pollution reduction measures, including identifying and using safer alternatives to PBDEs.

The Snohomish estuary is crucial to Chinook survival and recovery, providing vital rearing habitat to juveniles as they feed and undertake the physiological transformation in preparation for their migration to the marine environment. The juveniles are vulnerable to the PBDEs that currently inundate the water in which they reside and that bioaccumulate and bioconcentrate through the local food web, including the prey on which they depend. The Chinook are prey for endangered Southern Resident Killer Whales, whose numbers are precariously low in large part due to food scarcity. Additionally, Chinook are an essential treaty-protected resource for Northwest Tribes. The Plant's PBDE discharges ae harming this treaty resource and Tribal rights.

PBDEs also harm human health. PBDEs are passed onto children in utero and through breastfeeding. Studies have found that children with higher levels of PBDEs have lower IQs:

about a five-point deficit is associated with a tenfold higher PBDE level. Tribal members are more highly exposed to PBDEs in fish than the general population because of higher fish consumption rates.

The State of Washington does not have a numeric water quality standard for PBDEs. However, permits must meet narrative water quality standards, which require that discharges of toxics be below levels that adversely affect designated uses, like supporting salmon, and below levels that individually or cumulatively cause acute or chronic toxicity to fish. The current PBDE discharges from the Everett Plant violate these standards. The permit must contain measures to end these violations.

We were pleased that the draft permit recognizes the imperative of addressing PBDE contamination from the Everett Plant and that it features pretreatment agreements and pollution reduction as a key control strategy. Reducing PBDE pollution at the source is the best strategy, given the persistence and bioaccumulating properties of PBDEs. Source control also avoids saddling ratepayers with the costs of treating the pollution generated by the industries. The draft permit, however, does far too little, given the severity of the violations of water quality standards and harm to Chinook salmon. The permit must be strengthened in the following ways.

1. Baseline and Effectiveness Monitoring

The permit must call for a monitoring program that is sufficiently comprehensive, reliable, and frequent to establish credible baselines for the Plant and industrial users and to assess the effectiveness of permit limits and other pollution reduction measures. The permit must require testing by each industrial user of its pretreated wastewater, as well as testing by Everett of total influent into and effluent from the Plant. During the permit's first year, each industrial user must be required to conduct quarterly sampling of its pretreated wastewater using the most sensitive test method to establish IU-specific PBDE baselines. Such sampling must be conducted every odd-numbered year thereafter to provide a basis for assessing the efficacy of pollution reduction measures. The permit must also require that Everett conduct semi-annual monitoring of total influent into and effluent out of the Plant with one sampling event coinciding with high flow conditions. The sampling results must be reported by IUs to Everett and by Everett to Ecology and must be made available to the public.

2. The Permit Must Have Stringent Controls to Reduce PBDE Discharges.

The permit must be strengthened to eliminate the serious water quality standard violations from the Everett Plant's PBDE discharges. It must set limits to stop PBDE discharges that will cause or contribute to harmful PBDE concentrations in fish tissues, yet the draft permit has no effluent limits for PBDE. Ecology undertook no review of available methods for treating PBDEs as a predicate for establishing technology-based limits, as it is legally required to do. Ecology must go back to the drawing board to develop more stringent permit limits that will meet its legal obligation to eliminate the pervasive and severe water quality standard violations.

Ecology should also require that the Plant route its discharges through the deep-water Port Gardner outfall into Puget Sound during the juvenile salmon outmigration season. PBDE concentrations are lower at the Port Gardner outfall and likely will cause less harm to juvenile salmon than discharges into the Snohomish River where juvenile Chinook salmon feed during the spring outmigration and rearing season. In pursuing this operational modification, the permit should require monitoring of PBDEs in sediments, invertebrates, and salmon impacted by releases through the Port Gardner outfall to assess the impacts of rerouting the discharges through that outfall and make appropriate adjustments if the monitoring documents harm to aquatic resources from Port Gardner releases.

3. The Permit Must Direct Everett to Establish Pretreatment Requirements That Mandate Pollution Reduction or Effective Treatment Methods.

The draft permit calls for modifications of pretreatment permits to require that each IU evaluate and propose a plan to reduce or eliminate PBDE discharges, without requiring that the IUs take any specific actions during this permit cycle. Instead, the permit must require modification of pretreatment permits to achieve substantial PBDE reductions by all IUs that discharge PBDEs to the Everett Plant. In the first year under the permit, Everett must impose such pretreatment requirements on the industrial laundry and landfill that have been shown through monitoring to discharge substantial PBDE volumes and concentrations into the Everett Plant and on the Boeing facility that almost certainly discharges high volumes and concentrations of PBDEs, in light of the use of decaBDE in aerospace vehicles and replacement parts, which is permitted to continue under the aviation exemption from the federal deca-BDE phase-out. In the second year, Everett must impose such pretreatment requirements on other IUs shown through the baseline monitoring to discharge PBDEs into the plant. The pretreatment permits must establish technology-based limits or more stringent water-quality based limits to ensure the IUs will not discharge PBDEs that lead the Plant to cause or contribute to water quality standard violations and specifically to violations of the permit's effluent limits.

4. Everett Must Submit and Obtain Ecology Approval of a Toxics Reduction Plan and Update that Plan Annually.

The permit must require that Everett adopt a toxics reduction plan, with Ecology's approval, to reduce PBDE concentrations in fish tissues below levels that impair immunity and meet the permit's effluent limits. Modeled on the Spokane Riverside Park Water Reclamation Facility permit, this plan must, at a minimum, contain specific actions with implementation deadlines to achieve quantified PBDE reduction targets. Based on monitoring by IUs and the Everett Plant sampling and on fish tissue sampling by WDFW, Everett must develop annual updates to the toxics reduction plan, subject to Ecology approval, to ratchet up pollution prevention measures if the demonstrated performance falls short of achieving the targets and the overall goal of reducing PBDE concentrations in juvenile Chinook salmon to below harmful levels and meeting the permit's effluent limits.

5. *Halt the application of sludge/biosolids until sampling and pretreatment measures are in place.*

The permit, as drafted, allows PBDE-contaminated biosolids to be spread on agricultural lands. Ecology should halt land application of biosolids until they are sampled for PBDEs and PFAS, notification can be provided to entities receiving the wastes, and Ecology and Everett explore applying greater restrictions on disposal of biosolids containing high concentrations or quantities of persistent bioaccumulating toxics.

B. <u>The Permit Must Identify and Limit PFAS Pollution.</u>

The Everett Plant is a likely source of PFAS contamination in the Snohomish River and Puget Sound, and therefore the permit must contain concrete and effective measures to assess and reduce the level of PFAS discharge.

PFAS, sometimes called "forever chemicals," are a class of persistent, bioaccumulating toxics linked to cancer and harm to the liver, thyroid, immune system, and fetal development in animals and humans. Wastewater treatment plants have been identified as a primary source of PFAS releases, due in part to receiving PFAS-laden wastewaters from industrial users and landfills and in part to standard wastewater treatment methods that inadvertently transform PFAS precursors into PFAS compounds. Additionally, sampling data from various categories of industrial users in Washington demonstrates that these industries may discharge large concentrations of PFAS into wastewater.

Spurred by the nationwide crisis created by PFAS pollution from wastewater treatment plants, the U.S. Environmental Protection Agency ("EPA") recently issued guidance urging states to modify wastewater treatment permits to include requirements for monitoring discharges from industries associated with PFAS releases and the development of pollution prevention plans. The Everett permit must require testing to identify the industrial sources of PFAS discharges into the Plant and pollution controls to reduce or eliminate discharges to avoid violations of Washington's water quality standards.

The permit provisions must be strengthened to meaningfully address PFAS pollution. We applaud that the draft permit includes the recognition of PFAS as a concern and requires an industrial user inventory update, and new or updated pretreatment agreements that include requirements for those sources to evaluate pollution prevention and source reduction measures. However, the current draft permit includes ambiguous and weak provisions that the Plant will "evaluate" and "encourage" other best management practices and pollution prevention strategies for dischargers. The permit must include technology-based or water-quality based effluent limits, sampling specific to each industrial user, pretreatment pollution reduction requirements with implementation deadlines, and an adaptive management approach that sets targets for reductions in PFAS discharge and updates strategies and targets as needed.

The permit must be strengthened with the following provisions:

1. *Establish effluent limits in the permit.*

Ecology must, as it is legally obligated, evaluate AKART for PFAS. That analysis can, in turn, inform the establishment of technology-based effluent limits. Ecology must also determine whether a more stringent, water quality-based effluent limit is necessary to prevent PFAS discharges that have the potential to adversely affect designated water body uses or protected fish.

2. *Clearly define PFAS in the permit.*

We support incorporating Washington's definition at RCW 70A.350.010 to ensure that attention is paid to the broad range of existing and new compounds within this chemical class.

3. *Expand the categories of users "suspected or known" to discharge PFAS to include aerospace and aircraft modification, industrial laundries, industrial gas manufacturing, and inorganic chemical manufacturing.*

The draft permit currently lists several industries considered to be known or suspected dischargers of PFAS, but it is underinclusive. Ecology sampling shows that aerospace and aircraft modification and industrial laundries are some of the highest contributors to PFOS (one PFAS compound of particular health concern) in wastewater; these industries should be considered for the expanded IU inventory. Furthermore, national research has shown that industrial gas manufacturing and inorganic chemical manufacturing are significant sources of PFAS nationwide; these industries should also be included in the expanded IU inventory.

4. *Require source-specific sampling of influent from IUs and sampling of total Plant influent and treated effluent.*

The draft permit contains no sampling or monitoring measures to assess the discharge of industrial dischargers of PFAS, the efficacy of source reduction strategies, or the severity of Everett's current or future contributions to PFAS pollution in the affected waterways. The permit should require that IUs conduct initial sampling to determine PFAS discharge quantities and concentrations, and then require quarterly sampling for the IUs found to discharge PFAS. The permit should also require that Everett determine a sampling schedule that enables it to assess relative contributions from IUs and non-regulated sources of wastewater (such as domestic wastewater), as well as to assess whether PFAS volumes or concentrations increase during treatment at the Plant.[1] Sampling data should be disclosed to the Plant and Ecology and made available to the public.

[1] As discussed in the PFAS section below, conventional wastewater treatment may cause some PFAS precursors to transform into PFAS compounds, inadvertently worsening the pollution problem.

5. Strengthen requirements for industrial users discharging PFAS.

The permit should specify that Everett and its IUs must not only evaluate potential source reduction (such as product substitution) and operational changes to reduce PFAS, but that they must also consider treatment technologies to remove PFAS from wastewater before it is sent to Everett. The latter is particularly important for industrial users with relatively little ability to prevent toxic pollutants from entering their waste streams, such as landfills.

6. Specify implementation timelines for sampling and pollution prevention or pollution treatment practices.

The permit must include implementation deadlines to ensure timely establishment of sampling schedules and implementation of source reduction and treatment practices as needed. The initial screening of industrial users for PFAS discharges and setting baselines for those found to discharge should be completed within a year of the effective date of the permit. Implementation plans should be completed by the second year, and phased-in implementation should begin in the third year. Installation of waste treatment, particularly for those with few opportunities for source reduction, should be completed within the five-year permit cycle.

7. Halt the application of sludge/biosolids until sampling and pretreatment measures are in place.

PFAS-contaminated biosolids present a high risk of contaminating soil, air, surface water, and groundwater, as well as food grown on agricultural land. Ecology should halt land application of biosolids until they are sampled for PFAS—and other bioaccumulating persistent toxics, like PBDEs—so that, at the very least, users of the waste can be notified of the presence and concentration of PFAS in the biosolids. Ecology should otherwise consider whether to apply more restrictions on biosolid use if they contain high concentrations of PFAS or PBDEs.

C. <u>The Permit Must Limit Nutrient Pollution.</u>

The draft permit contains no provisions to control nutrient pollution, despite the Everett Plant being one of the largest point sources of nutrient pollution into Puget Sound. Nutrient pollution can cause increases in algal growth, which results in reduced levels of dissolved oxygen, toxic algae blooms, and harm to aquatic life. Nutrient pollution from wastewater treatment plants is a major contributor to violations of Washington's dissolved oxygen water quality standards, including in Puget Sound at Port Gardner. The permit fails to include provisions on nutrients ostensibly because there is a general nutrient permit for Puget Sound, but that general permit also fails to set nutrient limits based on AKART or water quality for dischargers such as Everett. Even if the general permit addressed these concerns, it is being litigated and is indefinitely stayed, in part, indicating a serious need for specific and actionable provisions in this permit.

The permit must have effluent limits on key sources of nutrient pollution: nitrogen and phosphorous. Based on available technologies widely used elsewhere, the limits should be 3 micrograms/liter (mg/L) nitrogen and 0.3 mg/L phosphorous. To achieve these limits, the Everett plant will need to make long-overdue upgrades to its treatment technologies. The permit must establish stringent compliance deadlines for Everett to adopt and implement upgraded treatment technologies to achieve the effluent limits during this permit cycle.

II. LEGAL REQUIREMENTS UNDER THE CLEAN WATER ACT AND STATE LAW.

Congress passed the federal Clean Water Act (CWA) with the intent to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). Toward that end, the discharge of pollutants from a point source into navigable water is prohibited unless the discharge occurs in accord with a National Pollutant Discharge Elimination System (NPDES) permit. 33 U.S.C. § 1311(a); 33 U.S.C. § 1362. The Environmental Protection Agency (EPA) has delegated authority to issue and enforce NPDES permits to the Washington Department of Ecology. Both federal and state statutory and regulatory requirements apply to Ecology's issuance of this permit.

A. Federal Requirements.

Federal regulations prohibit the issuance of an NPDES permit when the permit's conditions do not ensure compliance with all applicable requirements of the Clean Water Act and its implementing regulations, or when the imposition of conditions cannot ensure compliance with water quality standards. 40 C.F.R. §§ 122.4(a), (d). Under federal requirements, wastewater treatment plants must implement effluent limits; meet water quality standards; and avoid degradation of water quality.

Federal regulations require that each NPDES permit include technology-based effluent limits (TBELs) and such other more stringent effluent limits (*e.g.*, water quality-based effluent limits, or WQBELs) necessary to achieve water quality standards, including any state narrative criteria. 40 C.F.R. § 122.44(a), (d). Effluent limits must control all pollutants or pollutant parameters which will cause or contribute to (or have the potential to cause or contribute to) an exceedance of any water quality standard, including narrative criteria. 40 C.F.R. § 122.44(d)(1)(i).

When developing effluent limitations, as required by these provisions, Ecology must ensure that the level of water quality achieved through the permit's limits will meet water quality standards. 40 C.F.R. § 122.44(d)(1)(vii). Permit effluent limits for publicly owned treatment works must be stated as average weekly and average monthly discharge limitations. 40 C.F.R. § 122.45(d).

Finally, permits must address pollution that could cause the water quality of the receiving waters to degrade. This requirement is part of statewide antidegradation policy which mandates that "[e]xisting instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." 40 C.F.R. § 131.12(a)(1); *see also* 40 C.F.R. § 131.12(a)(2) ("Where the quality of the waters exceeds levels necessary to support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State makes specific findings through an elaborate intergovernmental coordination and public participation process).

B. State Requirements.

Ecology is required by state statute and the agency's own regulations to ensure the highest level of protection for all Washington waters through technology-based limits, permit conditions that ensure compliance with water quality standards, and the antidegradation policy.

When issuing a waste discharge general permit, Ecology must ensure that the permit conditions "apply and insure compliance" with "[t]echnology-based effluent limitations" that reflect "all known, available, and reasonable methods of prevention, treatment, and control," or "AKART." RCW 90.48.010; RCW 90.48.520; RCW 90.54.020; WAC 173-220-130(1)(a); *see also Wash. State Dairy Fed'n v. State of Wash.*, 18 Wn. App. 2d 259, 275–76 (Wash. Ct. App. 2021). AKART involves use of "the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge." WAC 173-201A-020. AKART is required regardless of the quality of the receiving water. RCW 90.48.520; RCW 90.54.020(b). That is, AKART is the minimum standard that must be applied to all discharges to ensure clean water stays clean and pollutants are controlled.

AKART is implemented using effluent limitations. WAC 173-220-130. The phrase "effluent limitation" refers broadly to "any restriction established by the state or the administrator on quantities, rates, and concentrations of [discharges] from point sources into surface waters of the state." WAC 173-220-030(9); *see also* 33 U.S.C. § 1362(11) (defining effluent limitation under the CWA).

In addition to AKART, state law dictates that no permit may be issued that causes or contributes to the violation of any water quality standard, whether in narrative or numeric form. RCW 90.48.520; WAC 173-201A-510(1). Washington's water quality standards are designed to protect existing water quality and preserve beneficial uses of Washington's surface waters. WAC 173-201A-510. Therefore, a permit may be required to incorporate water quality-based effluent limits where, for instance, technology-based limits would be insufficient to protect water quality standards.

While Ecology has adopted numeric standards for certain pollutants in order to protect aquatic life, recreation, and human health, it also has narrative criteria to protect the specific designated uses of the state's fresh and marine waters. WAC 173-201A-210; WAC 173-201A -200; *see also PUD No. 1 of Jefferson County v. Wash. Dep't of Ecology*, 511 U.S. 700 (1994) (upholding Washington's use of broad narrative criteria in addition to numeric standards). The Snohomish River is designated for protection of salmonid spawning, rearing, and migration, among other uses. WAC 173-201A-600.

In addition to protecting designated uses, narrative criteria limit toxic or deleterious discharges to levels below those that have the potential to adversely affect designated water uses or cause acute or chronic toxicity to biota. WAC 173-201A-240(1) ("Toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department"). To implement this prohibition, Ecology "shall employ or require chemical testing, acute and chronic toxicity testing, and biological assessments, as appropriate, to evaluate compliance with subsection (1) of this section and to ensure that aquatic communities and the existing and designated uses of waters are being fully protected." WAC 173-201A-240(2). Water quality-based effluent limits must control all pollutants that "are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion of state ground or surface water quality standards." WAC 173-226-070(2)(b); *see also Wash. State Dairy Fed'n*, 18 Wn. App. 2d at 289.

As required, Washington has adopted an antidegradation policy. RCW 90.54.020(3)(b). State regulations also require that there shall be no degradation of water quality. WAC 173-201A-300; WAC 173-201A-310. The purpose of the antidegradation policy is to: (a) Restore and maintain the highest possible quality of the surface waters of Washington; (b) Describe situations under which water quality may be lowered from its current condition; (c) Apply to human activities that are likely to have an impact on the water quality of a surface water; and (d) Ensure that all human activities that are likely to contribute to a lowering of water quality, at a minimum, apply AKART. WAC 173-201A-300. Under the antidegradation policy as applied to the Snohomish River and estuary, no degradation may be allowed that would interfere with, or become injurious to, existing or designated uses and Ecology must take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards where the waters do not protect existing or designated uses. WAC 173-201A-310(1), (2).

While the rules at both federal and state levels provide that a permitting agency may use compliance plans to allow a polluter time to come into compliance with new permit requirements, 40 C.F.R. § 131.15; WAC 173-220-140; WAC 173-201A-510(4)(a), compliance plans do not excuse or negate the requirements described above: that limits be explicitly stated in the permit and that the permitting agency determine those limits will ensure compliance with water quality standards. Finally, any compliance plan, to the extent it is allowed, must include strict and enforceable progress deadlines within the terms of the permit itself, and should not extend compliance deadlines for meeting effluent limits beyond the term of the permit.

C. Pretreatment Requirements

In addition to direct discharges from a wastewater treatment plant, the Clean Water Act established a regulatory program to address discharges that originate from industrial and commercial users and are sent to publicly owned treatment works (POTWs). This National Pretreatment Program requires such dischargers, dubbed "industrial users," to obtain permits for discharge or otherwise control discharge. The pretreatment program covers toxic, conventional, and non-conventional pollutants. Under the program, industrial users can be required to pretreat or implement management practices that enable them to meet an effluent quality specified in the permit.

Source control through pretreatment requirements is designed to ensure that pollutants will not be discharged into receiving waters or end up in sludge that may be land applied. Pretreatment requirements also ensure that the polluter pays the cost of treating harmful discharges instead of ratepayers. Control at the source, through both pollution reduction and treatment, can also mean the costs of treatment will be lower because the industry can prevent pollution load and treat only its wastewater, whereas the POTW would need to treat the entire influent entering the plant. *See* RCW 90.48.465(1), (3).

Federal pretreatment regulations require POTWs meeting certain criteria, including the Everett WWTP, to establish local pretreatment programs that enforce national standards as well as any additional local requirements. *See* 40 C.F.R. § 403.8; Everett Mun. Code Ch. 14.40 (Everett pretreatment regulations). Local pretreatment programs include minimum requirements to identify and locate possible IUs, characterize discharges, receive reports, and sample and analyze IU effluent. 40 C.F.R. § 403.8(f). The POTW has authority to deny or condition IU discharges to the POTW, require pretreatment requirement compliance – including by establishing compliance schedules to bring IU discharges into compliance, and to inspect and monitor IUs. POTWs can use categorical limits, numeric case-by-case discharge limits, or best management practices. As described by EPA, "local limits should correct existing problems, prevent potential problems, protect the receiving waters, [and] improve sludge use options."[2]

All IUs are prohibited from introducing pollutants to a POTW that cause pass through of pollutants in quantities or concentrations that, alone or in conjunction with discharges from other sources, causes violation of the POTW's NPDES permit.[3] 40 C.F.R. § 403.5. Additionally, EPA has identified certain categories of industries that are major sources of pollutants; it has over time investigated and initiated rulemakings to establish technology-based effluent limit guidelines for various industry categories. 40 C.F.R. §§ 405-471. These guidelines and standards can be concentration-based, mass limits, prohibitions of a discharge entirely, or required use of best management practices. EPA has not yet established effluent guidelines for industrial discharges of PBDEs and PFAS, but the pretreatment requirements to prevent pass through apply to all pollutants that can pass through POTWs, and Everett can establish effluent limits regardless of whether EPA has promulgated guidelines for the particular pollutant.

As summarized in EPA guidance, federal regulations require that control mechanisms imposed by a POTW in its pretreatment agreements be enforceable and contain the following minimum provisions (selected for relevance to these comments):

- Effluent limits, including BMPs, that are based on applicable standards
- Self-monitoring, sampling, reporting, notification, and record-keeping requirements
- An identification of the pollutants to be monitored
  […]
- Sampling location, sampling frequency, and sample type
  […]

[2] EPA Pretreatment Program Guidance at 3-8.

[3] "The term *Pass Through* means a Discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation)." 40 C.F.R. § 403.3(p).

- A schedule of compliance (where appropriate).[4]

Everett can impose more stringent standards and requirements on discharges to the POTW than those imposed under federal or state law. 40 C.F.R. § 403.4; EMC 14.40.100. Everett's program requires that IUs "shall" provide AKART as required to comply with its pretreatment standards and requirements, and authorizes the director of the City of Everett Public Works Department to establish BMPs for particular groups of users. EMC 14.40.130.

General Pretreatment Regulations require significant IUs to self-monitor *at least* semiannually, and POTWs must monitor each significant IU at least annually.[5] IUs with greater potential to cause pass through or interference, contaminate sewage sludge, or violate standards are typically required to sample and report more often.

For an IU that is not in compliance with applicable standards, POTWs must develop and impose a compliance schedule for that IU to install technology or modify its practices to attain compliance. 40 C.F.R. § 403.12. These schedules must include progress points (with maximum time frames of 9 months per event) for major actions to install a pretreatment system or otherwise modify IU processes, along with progress reports at each increment. *Id.* If IUs do not meet the schedule, a POTW may take corrective enforcement action.

All information submitted to the POTW or the state must be available to the public, with the exception of confidential business information. 40 C.F.R. § 403.14. POTWs are also subject to reporting requirements; they must submit annual reports to the relevant approval authority (here, Ecology) documenting that year's program status and activities performed. 40 C.F.R. § 403.12(i).

III. THE PERMIT MUST BE STRENGTHENED TO REDUCE HARMFUL PBDE DISCHARGES FROM THE EVERETT PLANT.

A. PBDEs Harm Salmon, Orcas, and People

PBDEs (polybrominated diphenyl ethers) are a class of flame retardants developed using the element bromine. PBDEs were once used extensively, including in airplanes, electronics, insulation, vehicles, upholstery, and textiles. They were widely used in furniture throughout the U.S. due to a California mandate that was rescinded when the scientific basis for it was called into question and evidence of the health and environmental harms from PBDEs mounted. They are highly toxic, persistent organic pollutants.

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[4] EPA Pretreatment guidance at 4-3 to 4-4 (referencing 40 C.F.R. § 403.8).

[5] Significant IUs are those subject to categorical pretreatment standards, that discharge above certain levels, or that are designated by the POTW as having the potential to cause adverse effects or violate pretreatment requirements. 40 C.F.R. § 403.3(v). Categorical users that are not "significant" IUs, are often subject to less frequent monitoring requirements. *See* 40 C.F.R. § 403.12 (reporting requirements). Of note, a POTW can charge an IU a fee for, among other activities, monitoring, inspection, surveillance, and enforcement procedures. *See* EMC 14.40.790.

PBDEs bioaccumulate and bioconcentrate in the aquatic food chain, ultimately finding their way into salmon, Southern Resident Killer Whales or orcas, and people. As explained below, juvenile Chinook salmon impacted by discharges from the Everett Plant have PBDE concentrations in their tissues at levels associated with immune suppression and altered thyroid hormone levels. Southern Resident orcas have PBDE concentrations substantially higher than levels associated with altered thyroid hormone levels in other marine mammals. Mongillo, 2016.[6] In fact, one juvenile killer whale had concentrations of PBDEs in its blubber that were 10 times greater than those associated with endocrine disruption in grey whales. Krahn, 2007.[7]

In people, PBDEs are associated with serious health effects. DecaBDE is an endocrine disrupting chemical, adversely affecting thyroid hormone levels.[8] It also has been correlated with developmental neurological effects and reproductive toxicity, even at low environmental levels.[9] Higher levels of PBDEs in children have been correlated with lower IQs: a roughly five-point deficit is associated with a tenfold higher PBDE level.[10] PBDEs are ubiquitous in the environment due to their persistence and their previous widespread use. Virtually everyone has PBDEs in their bodies. By way of example, PBDEs have been widely detected in breast milk, posing health risks for breastfeeding infants. Schreder, 2023.[11] Infants and toddlers have the

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[6] Teresa M. Mongillo, *et al., Exposure to a Mixture of Toxic Chemicals: Implications for the Health of Endangered Southern Resident Killer Whales*: NOAA Technical Memorandum NMFS-NWFSC-135 (Nov. 2016), at https://www.webapps.nwfsc.noaa.gov/assets/25/8314_11302016_111957_TechMemo135.pdf.

[7] Margaret M. Krahn, *et al*., *Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales*, Marine Pollution Bulletin, Volume 54, Issue 12, (December 2007), Pages 1903-1911, at https://www.sciencedirect.com/science/article/abs/pii/S0025326X07002846

[8] EPA, *Environmental and Human Health Hazards of Five Persistent Bioaccumulating Chemicals* (June 2018), at https://www.epa.gov/sites/default/files/2018-06/documents/environmental_human_health_hazard_summary_five_pbts.pdf.

[9] *Id*.; U.N. Env't Programme Stockholm Convention on POPs, *Risk Profile on Decabromodiphenyl Ether* at 25, 27–28 (2015) at file http://chm.pops.int/Portals/0/download.aspx?d=UNEP-POPS-POPRC.11-INF-7.English.pdf; *see also* EPA, *Toxicological Review of Decabromodiphenyl Ether (BDE-209), In Support of Summary Information on the Integrated Risk Information System* (June 2008), at https://iris.epa.gov/static/pdfs/0035tr.pdf; Consumer Product Safety Comm'n, Guidance Document on Hazardous Additive, Non-Polymeric Organohalogen Flame Retardants in Certain Consumer Products, 82 Fed. Reg. 45,268, 45,269 (Sept. 28, 2017).

[10] Juleen Lam, *Developmental PBDE Exposure and IQ/ADHD in Childhood: A Systematic Review and Meta-analysis*, Environmental Health Perspectives, 086001-1 (Aug. 3, 2017), at https://doi.org/10.1289/EHP1632.

[11] Erika Schreder, *Brominated flame retardants in breast milk from the United States: First detection of bromophenols in U.S. breast milk, Environmental Pollution*, Environmental

highest PBDE body burdens.[12] PBDEs have been listed as persistent organic pollutants under the Stockholm Convention. United Nations, Stockholm Convention Annex A.[13]

PBDEs differ in the number and location of bromines with 209 possible congeners. PBDEs with fewer bromines – *e.g.*, BDE-47 (four bromines) – are smaller and more readily biologically available and therefore more toxic to aquatic life. PBDEs with more bromines – *e.g.*, BDE-209 (ten bromines or decaBDE) – are highly toxic and can be converted through various processes to the lower-brominated congeners. Thus, the ongoing release of decaBDEs can contribute to the presence of not only BDE-209, but also BDE-47, BDE-99, and other congeners in the water, sediments, and biota.

Fortunately, use of PBDEs is declining. Two major commercial formulations, pentaBDE and octaBDE, have not been manufactured in or imported into the United States for nearly 20 years. Washington banned decaBDE, the remaining major commercial formulation, in some uses (such as TVs, computer monitors, residential upholstered furniture), effective in 2011, being the first state to do so. RCW 70A.405.030. The U.S. EPA is phasing out many uses of decaBDE, but with some exceptions, including for use in new aerospace vehicles until 2024 and for aviation replacement parts for the service lives of the aerospace vehicles. 86 Fed. Reg. 880 (Jan. 6, 2021) (manufacture, distribution, processing, and import); *see* 88 Fed. Reg. 82,287 (Nov. 24, 2023) (proposed revisions). The exception for the service life of aerospace vehicles means decaBDE may be in use for years to come, since, according to the Aerospace Industries Association, "[m]any aerospace products are designed for a lifespan of 30 or 40 years or more."[14] Because a vast quantity of products containing PBDEs have long service lives, PBDEs will continue to enter the environment for years to come.

B. Scientific Evidence Shows that the Everett Wastewater Treatment Plant is Discharging PBDEs in Amounts that Impair Juvenile Chinook Salmon Health and Survival.

While significant amounts of PBDEs enter aquatic environments via atmospheric deposition and stormwater runoff, discharges from wastewater treatment plants have been

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Pollution Volume 334, 1 (October 2023), 122028, at https://www.sciencedirect.com/science/article/abs/pii/S0269749123010308.

[12] Lucio G. Costa, *Polybrominated Diphenyl Ether (PBDE) Flame Retardants: Environmental Contamination, Human Body Burden and Potential Adverse Health Effects*, Acta Biomed, 2008 Dec;79(3):172-83 (Dec. 2008), at https://pubmed.ncbi.nlm.nih.gov/19260376/.

[13] United Nations, *Stockholm Convention Annex A* at https://chm.pops.int/Implementation/Alternatives/AlternativestoPOPs/ChemicalslistedinAnnexA/tabid/5837/Default.aspx (calling for elimination of major commercial congeners in products, but with some exemptions).

[14] Aerospace Industries Association, *Comment Letter to TSCA Rulemaking,* Docket EPA-HQ-OPPT-2019-0080 (Oct. 26, 2019).

identified as a major source of PBDEs in the Puget Sound, particularly in the Whidbey Basin into which the Snohomish River empties. Osterberg & Pelletier, 2015.[15]

Two studies released in 2010 identified a potential link between PBDEs in wastewater from the Everett Plant and high levels of PBDEs in outmigrating juvenile Chinook salmon in the Snohomish River. NOAA Fisheries researchers found PBDE concentrations in juvenile Chinook gathered from the lower Snohomish River at a site "adjacent to a sewage treatment plant" to be higher than found in fish from other locations in the Puget Sound, even in more-urbanized locations. Sloan, 2010.[16] In a study of effluent discharges from major wastewater treatment plants in Puget Sound, Ecology found the highest PBDE concentrations at the Everett Plant's Outfall 100, which discharges into Port Gardner Bay, over two times higher than from other plants. Ecology & Herrera, 2010.[17] The Snohomish hotspot spurred additional monitoring and research by state and federal agencies, as well as by the City of Everett.

In 2013, scientists with the Washington Department of Fish and Wildlife (WDFW) and NOAA Fisheries sampled juvenile Chinook salmon from various locations around Puget Sound, and found 100% of the samples collected in the lower Snohomish River had PBDEs at levels associated with increased disease susceptibility. O'Neill, 2015.[18] Moreover, 75% of the Snohomish River estuary fish had PBDE levels at the higher concentrations associated with altered thyroid functioning. O'Neill, 2015; *see* Arkoosh, 2010 (identifying concentrations that cause immune suppression and alter thyroid functioning in juvenile Chinook salmon).[19] The study noted concern because "the health and ultimately the marine survival of juveniles migrating from freshwater into Puget Sound in route to the Pacific Ocean are more likely to be reduced by contaminant exposure as this [i.e., juvenile] life stage also undergoes tremendous physiological stress associated with smolting" and because juvenile Chinook, in particular, "are especially vulnerable to contaminant exposure because they spend considerably more time than

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[15] Wash. Dep't of Ecology (David Osterberg and G. Pelletier), *Puget Sound Regional Toxics Model: Evaluation of PCBs, PBDEs, PAHs, Copper, Lead, and Zinc* (Aug. 2015), https://apps.ecology.wa.gov/publications/SummaryPages/1503025.html.

[16] Catherine A. Sloan, *et al.*, *PBDES in Outmigrant Juvenile Chinook Salmon from the Lower Columbia River Estuary and Puget Sound, Washington*, Arch Environ, Contam. Toxicol. (Feb. 2010) (58:403-414), at https://pubmed.ncbi.nlm.nih.gov/19771462/.

[17] Wash. Dep't of Ecology and Herrera Environmental Consultants Inc., *Control of Toxic Chemicals in Puget Sound* (Dec. 2010), https://apps.ecology.wa.gov/publications/documents/1010057.pdf

[18] This study refers to the Snohomish River sampling sites as "freshwater," while subsequent studies call the same sites "estuary" or "lower mainstem." WDFW Sandra M. O'Neill, *et al., Toxic contaminants in juvenile Chinook salmon (Oncorhynchus tshawytscha) migrating through estuary, nearshore and offshore habitats of Puget Sound,* 58, Wash. Dep't of Fish and Wildlife (Oct. 2015), at https://wdfw.wa.gov/sites/default/files/publications/01796/wdfw01796.pdf.

[19] Mary R. Arkoosh, *et al.*, *Disease susceptibility of salmon exposed to polybrominated diphenyl ethers (PBDEs)* (Feb. 2010), Aquat. Toxicol. 98, 51-59, at https://pubmed.ncbi.nlm.nih.gov/20207027/.

other salmonid species feeding in estuaries … where contaminant inputs may be quite high." Carey, 2017.[20]

These findings prompted the researchers to broaden the geographic scope of their Snohomish sampling sites in 2016 to include the "distributary channels," the "lower mainstem," and the "upper mainstem." They analyzed three lines of evidence to identify the source of the elevated PBDE levels in the juvenile Chinook and pointed to the Everett Plant as the cause of the hot spot. O'Neill, 2020.[21]

First, they found that 73% of the juvenile Chinook samples taken in 2016 had PBDE concentrations at levels high enough to alter their immune systems, and 4–10 times higher than those found in juvenile Chinook salmon in the other locations. Arkoosh, 2010; Arkoosh, 2018.[22] They noted that immune suppression increases susceptibility to naturally occurring infectious and parasitic diseases that cause direct mortality or increase risks of predation. The 2016 WDFW studies found higher PBDE concentrations in natural-origin salmon than hatchery-origin salmon, which are larger when they are released into the river and move through the Snohomish estuary more rapidly than natural-origin salmon. The lower PBDE concentrations found in the hatchery-origin salmon strengthened the conclusion that no upriver source is the primary cause of the PBDE exposures. O'Neill, 2019.[23]

The graphic below identifies the lower mainstem sampling sites with blue triangles and the Everett Plant's Outfalls 015 and 100 with yellow stars. While Outfall 015 is downstream of a key sampling site, significant tidal influences move effluent discharged at Outfall 015

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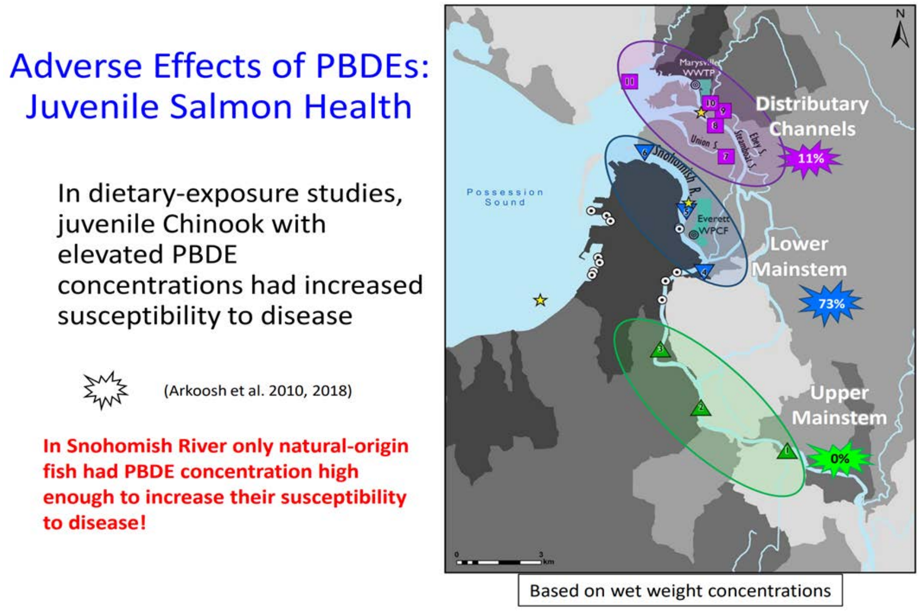
[20] Andrea Carey, *et al.*, *Toxic contaminants pose a threat to early marine survival of Chinook salmon from Puget Sound," in* Puget Sound Ecosystem Monitoring Program*, 2016 Salish Sea Toxics Monitoring Review: A Selection of Research* 15 (2017), at https://www.eopugetsound.org/sites/default/files/features/resources/PSEMP_2016_ToxicsSynthesis%202017.05.09.pdf.

[21] Sandra M. O'Neill, *et al.*, *Chemical tracers guide identification of the location and source of persistent organic pollutants in juvenile Chinook salmon (Oncorhynchus tshawytscha), migrating seaward through an estuary with multiple contaminant inputs*, Science of the Total Environment 712 (Apr. 10, 2020), at https://www.sciencedirect.com/science/article/pii/S004896971935510X.

[22] Mary R. Arkoosh, *et al.*, *Dietary exposure to a binary mixture of polybrominated diphenyl ethers alters innate immunity and disease susceptibility in juvenile Chinook salmon,* (Nov. 15, 2018), Ecotoxicol. Environ. Saf. 163, 96-103, at https://pubmed.ncbi.nlm.nih.gov/30041130/.

[23] O'Neill, Sandra M. *et al*., *Source of PBDEs in juvenile Chinook salmon along their out-migrant pathway through the Snohomish River, WA* (2019), *PowerPoint Presentation to Snohomish Basin Salmon Recovery Forum* (Feb. 17, 2019), available at https://snohomishcountywa.gov/DocumentCenter/View/61874/2719_Oneill-ppt.

upstream to this location. Carey, 2018.[24]



Second, the study found that the composition of the persistent organic pollutants ("POPs") in the juvenile Chinook salmon in the lower Snohomish indicated they were exposed to PBDEs from wastewater, rather than from stormwater runoff. These natural-origin Chinook juveniles "had a distinct pattern from other region and origin samples, with a much higher proportion of the sum of 11 PBDE congeners in the total Persistent Organic Pollutant (POP) concentration," indicating wastewater as the likely contaminant source. O'Neill, 2020.

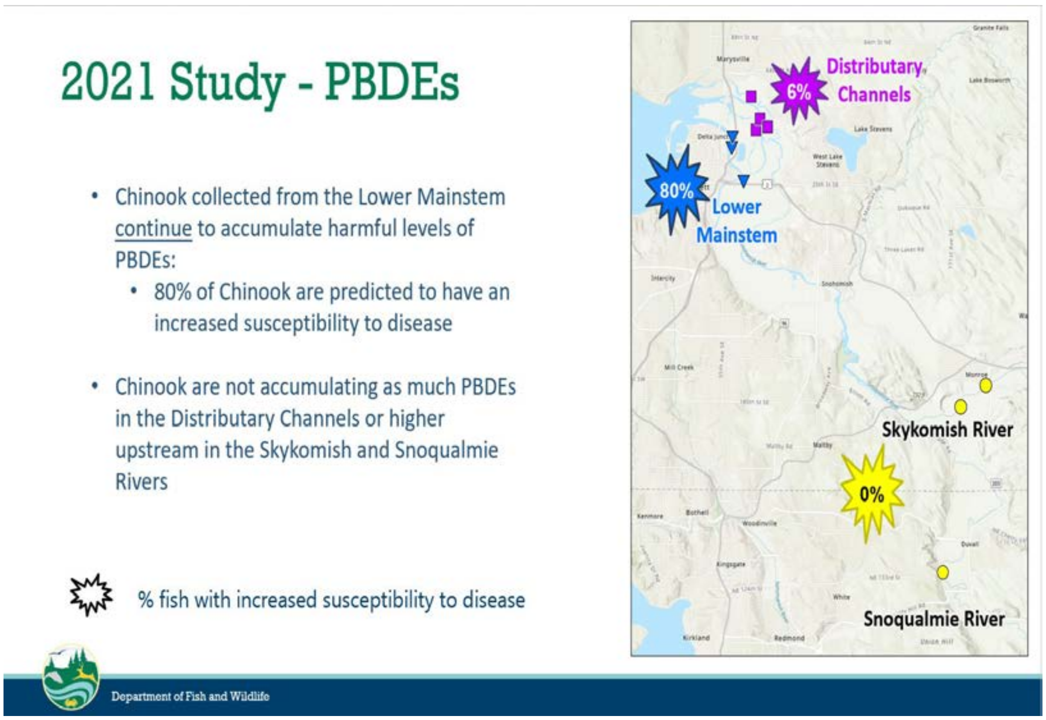
Third, the study found that stable nitrogen isotopes, which are incorporated into the aquatic food web through the uptake of wastewater with high nutrient concentrations, indicated that wastewater, rather than stormwater, is the source of PBDEs in the lower Snohomish juvenile Chinook. Scientists found a depleted nitrogen signal typical of that associated with "secondary treated sewage with insufficient nutrient removal," such as the Everett Plant, which has "a higher proportion of ammonium compared to nitrates and nitrites." The depleted nitrogen isotope tracers and POP fingerprints "suggested a common source for both the high PBDEs exposure and the depleted nitrogen isotopic signal." O'Neill, 2020.

This study, sometimes called "the smoking gun" study, correlated discharges from the Everett Plant with the Snohomish PBDE hot spot. It spurred further studies by WDFW and the Department of Ecology's Environmental Assessment Program (EAP), which provided further

[24] Andrea J. Carey, *et al.*, Input of PBDE exposure in juvenile Chinook salmon along their out-migrant pathway through the Snohomish River, WA (2018). Presentation to Salish Sea Ecosystem Conference (May 18, 2018), PowerPoint available at https://cedar.wwu.edu/ssec/2018ssec/allsessions/355/?utm_source=cedar.wwu.edu%2Fssec%2F2018ssec%2Fallsessions%2F355&utm_medium=PDF&utm_campaign=PDFCoverPages

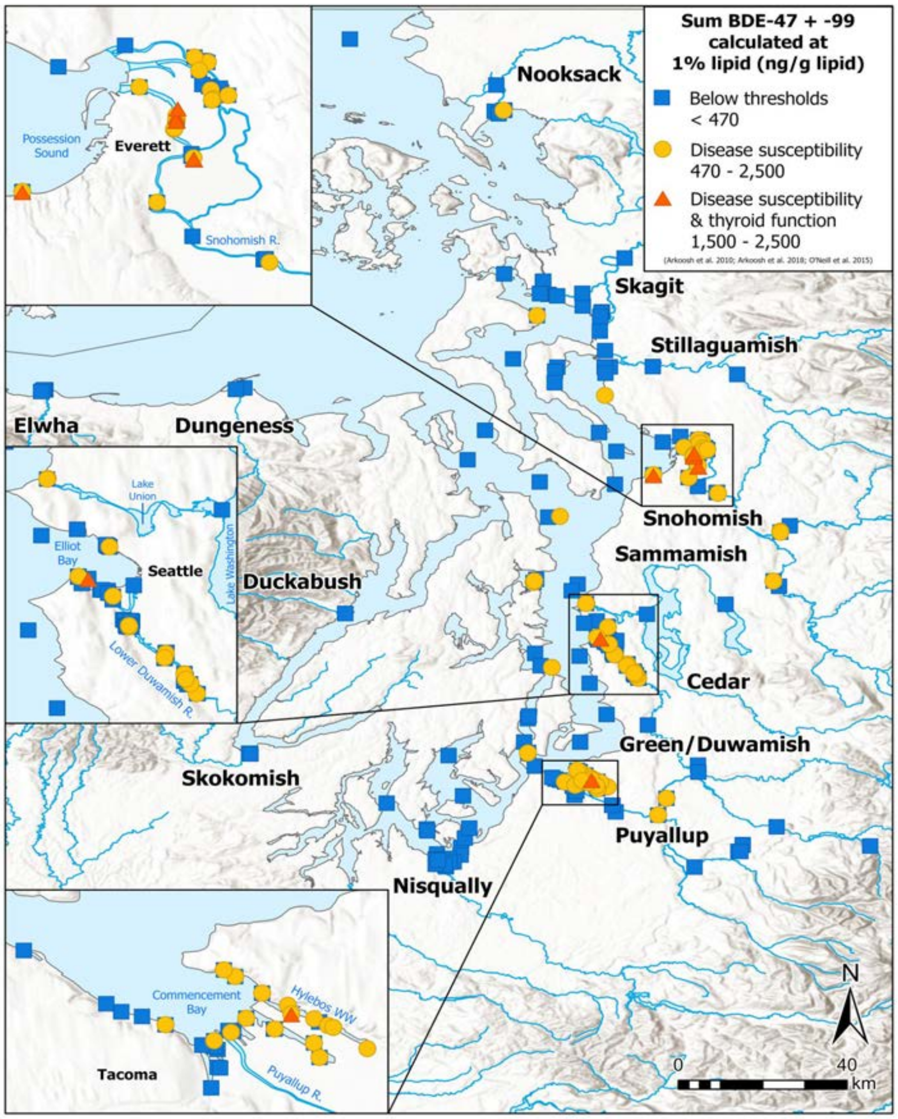
evidence that Everett's discharges are causing harmful PBDE concentrations in juvenile Chinook.

In 2021, WDFW scientists sampled juvenile Chinook in the Skykomish, Snoqualmie, and Snohomish Rivers, adding a site that is closer to Everett's Outfall 015 than the other Snohomish sites. The study found that 80% of juvenile Chinook from the lower Snohomish had PBDE concentrations at levels that increase their susceptibility to disease, making them more likely to die and ultimately affecting "their marine survival." Carey, 2023.[25] This percentage is even more dire than the 73% figure found in previous studies. Juvenile Chinook from the Skykomish and Snoqualmie Rivers did not have harmful PBDE concentrations.



[25] Carey & O'Neill, *An Update on PBDEs in Juvenile Chinook from the Snohomish River* (Nov. 30, 2023) PowerPoint, Slide 17.

Some of the 2021 samples had PBDE concentrations at the higher levels also associated with impaired thyroid function. On the WDFW map below, which portrays the results of samples gathered over the 2013-2021 timeframe, these higher levels are denoted by orange triangles.[26] The locations where juvenile Chinook had PBDEs at levels associated with impaired immune function are marked by the yellow circles on this map.



Data collected over the 15-year period from 2006 to 2021 showed that PBDE concentrations in lower Snohomish juvenile Chinook are not declining, in contrast to

[26] WDFW, Calculations of Sum BDE-47 and -99 (ng/g lipid calculated at 1% lipids) Measured in Juvenile Chinook Salmon in Various Habitats of Puget Sound River Systems in 2013-2021 (Jan. 2024).

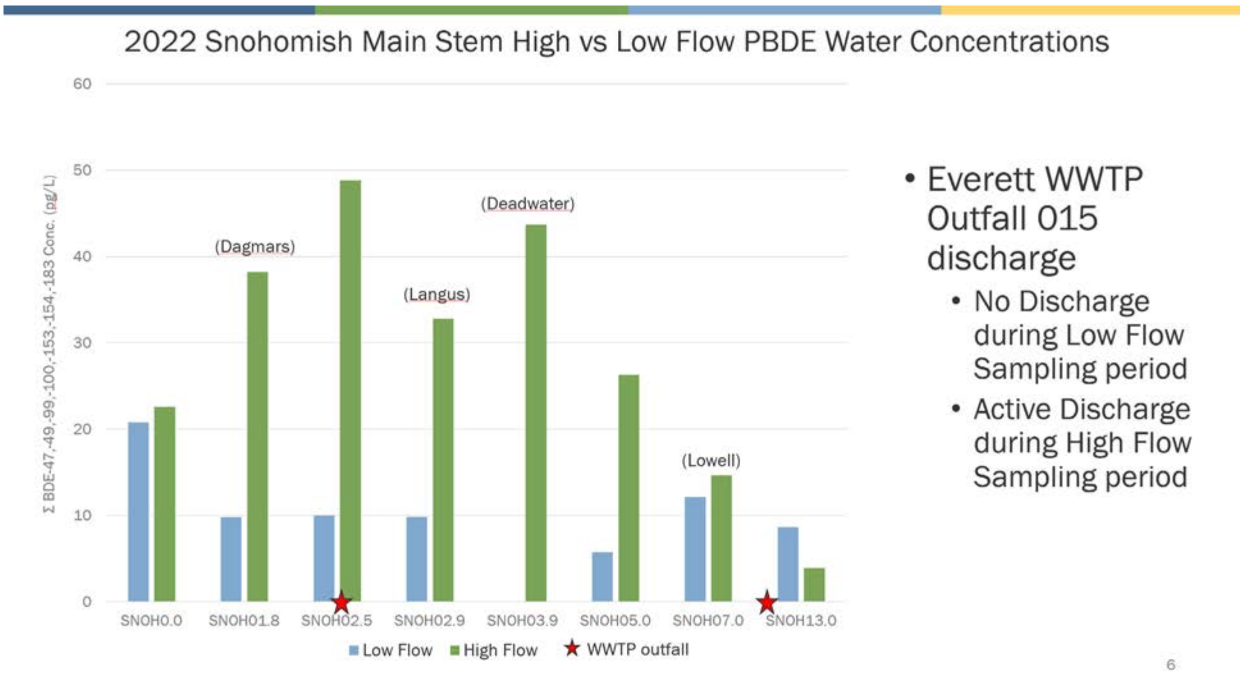
improvements elsewhere in Puget Sound. Juvenile Chinook in close proximity to the Everett Outfall 015 continued to have PBDE body burdens at harmful levels. Carey, 2023, Slides 178.

In 2021, WDFW sampled stomach contents from juvenile Chinook, which confirmed that "juvenile Chinook are getting large amounts of PBDEs from their diet." The PBDE concentrations found in their stomachs correspond to the PBDE concentrations in the aquatic invertebrates that are a source of prey for juvenile Chinook. Carey, 2023, Slide 15.

Sampling by the Department of Ecology's Environmental Assessment Program in 2019, 2021, and 2022 demonstrated the connection between the Everett facility and elevated PBDE levels in the lower Snohomish. Beginning in 2019, Ecology's EAP sampled surface water, suspended and bottom sediments, algae/biofilm, and aquatic macroinvertebrates at several locations upstream and downstream of the Everett Plant in low flow and high flow conditions. Ecology Quality Assurance Project Plan, 2019.[27] EAP found elevated PBDE levels in surface water in the vicinity of effluent discharges from wastewater treatment plants. The concentrations in the vicinity of the Everett Plant generally dwarfed those measured elsewhere and diminished significantly with distance from the source. Additionally, EAP's 2022 sampling compared water concentrations during a period in which the Everett Plant was *not* actively discharging through Outfall 015 (green bars) with a period in which it was actively discharging through this outfall (blue bars), as shown in the bar graph below. The location of the Everett outfall is indicated by the leftmost red star. The data showed markedly greater concentrations of PBDEs present in the waters influenced by the Everett Plant during periods in which it is actively discharging effluent to the lower mainstem. Gipe, 2023.[28] While most of the concern focuses on bioaccumulation of PBDEs in the food chain, juvenile Chinook rearing in these waters take in some amount of the PBDEs in the water over their gills.

[27] Wash. Dep't of Ecology, *Quality Assurance Project Plan: Assessing Sources of Toxic Chemicals Impacting Juvenile Chinook Salmon* (Aug. 2019), Pub. No. 19-03-110, at https://apps.ecology.wa.gov/publications/documents/1903110.pdf.

[28] Gipe, EAP, *Source Assessment of PBDEs Impacting Juvenile Chinook in the Snohomish River System* (Nov. 30, 2023), PowerPoint, Slides 12-13.



EAP's sampling of aquatic invertebrates, which included species known to be prey for juvenile Chinook, found higher PBDE concentrations in invertebrates from the vicinity of the Everett Plant compared to those collected elsewhere. Gipe, 2023. The invertebrates also had higher PBDE concentrations in the spring, which coincides with the period when juvenile Chinook feed and rear in the lower Snohomish. The invertebrates sampled during 2022 and 2021, when the Everett Plant was actively discharging to the Snohomish through Outfall 015, had significantly higher PBDE concentrations than those gathered in 2019, during a time when the Everett Plant was not actively discharging – indeed, seven times greater. Gipe, 2023.

EAP sampling in the lower Snohomish across multiple years and flow conditions found PBDEs in every medium studied: receiving water, suspended and bottom sediments, biofilms, and invertebrates. EAP's data, combined with the City of Everett's sampling of PBDEs in the Everett Plant's effluent through Outfall 015 and WDFW's sampling of PBDEs in juvenile Chinook, demonstrate the bioaccumulation of PBDEs through the food web. PBDE concentrations in invertebrates were greater than in the sediments – 4-8 times greater (2,000-8,000 parts per trillion (ppt)) – and PBDE concentrations in juvenile Chinook were 2-4 times higher than in invertebrates (4,000-33,000 ppt) as of 2019.[29]

The graphic below illustrates increasing concentrations of PBDEs as they move through the water, sediments, and biota in the Snohomish. PBDE concentrations in suspended sediments, bottom sediments, and biofilm were orders of magnitude greater than those in water.

[29] Gipe, *et al.*, *Assessing Sources of Polybrominated Diphenyl Ether (PBDE) Flame Retardants Impacting Juvenile Chinook Salmon in the Snohomish River Watershed, in PSEMP, 2022 Salish Sea toxics monitoring synthesis: A selection of research 20-23* (Sept. 2023), at https://www.eopugetsound.org/articles/2022-salish-sea-toxics-monitoring-synthesis-selection-research.

Note that this graphic reflects data gathered through 2019; if the more recent (2021 & 2022) invertebrate data were included, the invertebrate figure would be 2,000-10,000 ppt. Gipe, 2023.

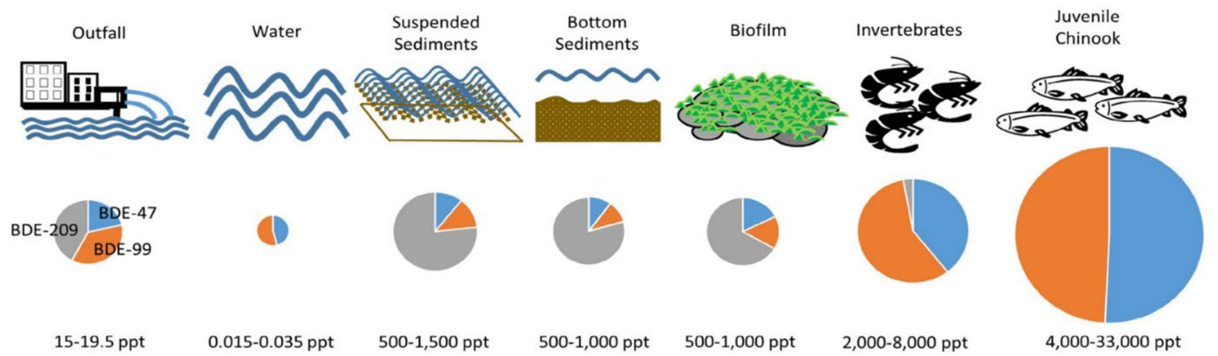


Figure 1. Concentrations of PBDE congeners BDE-209 (Gray), BDE-99 (Orange), and BDE-47 (Blue) in wastewater treatment plant effluent, ambient water, suspended sediments, bottom sediments, biofilms, invertebrates, and juvenile chinook from the lower Snohomish mainstem. ppt= part per trillion. Preliminary wastewater treatment plant outfall concentrations provided by City of Everett Public Works. Juvenile Chinook PBDE tissue concentrations provided by WDFW.

C. <u>City of Everett and EAP monitoring of wastewater influent and effluent.</u>

In 2020-2022, the City of Everett tested influent into and effluent out of the Everett Plant (at both Outfall 100 and Outfall 015), with five samples, covering all four quarters of the year. The City measured PBDEs in the total influent without measuring contributions from particular industrial users discharging to the Plant. Kerlee, 2023.[30] The City of Everett's monitoring revealed lower PBDE discharges through Outfall 100, which discharges into deeper receiving waters in the Sound, than from Outfall 015, which discharges into the lower Snohomish. By way of example, during the third quarter of 2022, PBDE concentrations at Outfall 100 were less than half those at Outfall 015. *Id.*

In 2020, Ecology's EAP began sampling pretreated wastewater from nine industrial users (IUs) that discharge into four wastewater treatment plants in Puget Sound, including the Everett Plant, and found PBDEs in the wastewater of all nine IUs. Ecology (Wong), 2020.[31] Ecology kept the specific identities of the facilities anonymous, describing them only by the general type of industry, *e.g.*, food processing, metal finishing, steel foundry, landfill, industrial laundry, and ship building and repair. The study authors disclosed that the industrial laundry and landfill discharge into the Everett Plant, but did not indicate which of the two industrial laundries and two landfills that meet this description were subject to influent testing. The industrial laundry had the highest PBDE concentrations (an order of magnitude higher than the other sites) and highest total load of PBDEs. *Id.*; Wong PowerPoint (2022).[32] The landfill had

[30] Kerlee & Sinclair, City of Everett, *Everett Water Pollution Control Facility, PowerPoint* (Nov. 30, 2023).

[31] S. Wong, *Chemicals of Emerging Concern in Pretreated Industrial Wastewater in Northwestern Washington State: Screening Study Results, 2021* (Aug. 2022), at https://apps.ecology.wa.gov/publications/documents/2203013.pdf;

[32] S. Wong, *Sampling of Pretreated Industrial Wastewater in NW Washington*, PowerPoint Slides 6-9 (2022).

the third highest PBDE concentrations and second highest total load of PBDEs. One of the aerospace/aircraft modification facilities (which does not discharge to Everett) had the second highest PBDE concentrations and fourth highest total load of PBDEs.[33]

D. PBDE Discharges from the Everett WWTP are Causing Serious Water Quality Standard Violations.

While Ecology has yet to set numeric criteria for PBDEs, its narrative standards make salmon spawning, rearing, and migration a designated use of the Snohomish River and require that toxic discharges be below levels that individually or cumulatively cause acute or chronic toxicity to the most sensitive of the biota dependent on these waters. Scientists with NOAA Fisheries, the federal expert agency with jurisdiction over Chinook salmon, have established concentration levels for PBDEs associated with adverse effects levels in juvenile Chinook, *i.e.,* that suppress immunity, thereby increasing susceptibility to disease, and that alter thyroid functioning. Arkoosh, 2010; Arkoosh, 2018. Where discharges lead or contribute to documented PBDE levels in salmon above these toxicity thresholds, they violate the narrative standards that prohibit discharges that individually or cumulatively cause toxicity to salmon and thereby impair the ability of the Snohomish River to support salmon rearing.

To ensure aquatic life is being fully protected, Ecology regulations direct Ecology to employ chemical testing, acute and chronic toxicity testing, and biological assessments. In *A Primer on Using Biological Assessments to Support Water Quality Management* at 7-8, 50-52 (2011), EPA indicates biological assessments can be used for NPDES permitting to assess whether discharges are leading to violations of water quality standards.[34] If a biological assessment shows that the applicable water quality standards are not being attained, it would trigger reopening and modifying the permit. While biological assessments generally are tied to numeric water quality standards, here the smoking gun and other studies show that Everett's discharges are leading to PBDE concentrations in fish tissues that NOAA Fisheries scientists have correlated with immune suppression and impaired thyroid functioning. The studies provide irrefutable evidence that the Everett Plant is causing or contributing to violations of water quality standards.

The monitoring conducted by Ecology shows that the Everett Plant is discharging PBDEs into the lower Snohomish and that PBDE concentrations increased markedly in surface waters influenced by the Everett Plant when it was actively discharging. Monitoring by Ecology and WDFW documented the bioaccumulation of PBDEs in sediments, biofilms, invertebrates that are prey for juvenile Chinook salmon, and ultimately the juvenile Chinook. The 2021 sampling of juvenile Chinook stomach contents identified diet as the key route of exposure, correlating the PBDE levels in the juveniles with PBDE bioaccumulation in the

[33] While two of the facilities are categorized as aerospace/aircraft modification engaged in "chemical metal finishing, aircraft cleaning and painting," we understand that neither one is the Boeing facility that discharges into the Everett Plant.

[34] EPA, *A Primer on Using Biological Assessments to Support Water Quality Management*, (Oct. 2011) at https://www.epa.gov/sites/default/files/2018-10/documents/primer-using-biological-assessments.pdf

Snohomish biota. And the smoking gun study correlated the PBDE discharges from the Everett Plant with the Snohomish hot spot.

WDFW has consistently found PBDE concentrations in juvenile Chinook salmon at levels associated with suppressed immune functioning and in some samples, even at the higher levels associated with impaired thyroid functioning. The proportion of lower Snohomish juvenile Chinook with PBDE concentrations at harmful levels is increasing, rather than decreasing. In 2016, WDFW found PBDE concentrations in 73% of the juvenile Chinook salmon at levels that increase susceptibility to disease and reduce Chinook survival rates, while that proportion rose to 80% in 2021, and the PBDE concentrations also rose to exceed the higher thresholds associated with impaired thyroid functioning. Carey, PowerPoint Slides # 8, 15, 2023. Juvenile Chinook are particularly vulnerable to contaminant exposure at the sensitive life stage when they rear in the lower Snohomish as they are undergoing the physiological stresses and demands of smolting in preparation for their transition to the marine environment.

The adverse health impacts to the Chinook are likely even greater than suggested by considering PBDEs alone, as there are likely additive or synergistic effects from exposure to contaminant mixtures such as those found in urbanized Puget Sound systems. In particular, exposure to both PBDEs and PCBs has been found to enhance adverse neurobehavioral effects and to compound reductions in learning and memory. Mongillo, 2016, at 58-60, 70; Carey, PowerPoint Slide #19, 2023.[35] It is noteworthy that WDFW monitoring has documented PCB concentrations in juvenile Chinook salmon at levels associated with adverse health effects.[36]

In sum, extensive data gathered and analyzed by expert agency scientists demonstrates that the Plant's PBDE discharges not only have a "reasonable potential" to cause or contribute to violations of water quality standards, but they are actually causing violations with pervasive and serious harm to juvenile Chinook salmon. The discharges are causing or contributing to PBDE levels that harm juvenile Chinook salmon in violation of the prohibition on causing acute or chronic toxicity to biota. The discharges are thereby impairing the lower Snohomish River mainstem's ability to support salmon rearing and migration – a designated use for this waterbody.

E. It Is Imperative to Eliminate the PBDE Hot Spot Given the Harm the Discharges Are Causing to ESA-Listed Puget Sound Chinook Salmon.

Puget Sound Chinook Salmon have suffered such precipitous declines that they were listed as threatened under the federal Endangered Species Act ("ESA") in 1999. 64 Fed. Reg. 14,308 (March 24, 1999). Preventing further declines and moving toward recovery of Puget

[35] *See also* ESA Biological Opinion, *Reissuance of National Pollutant Discharge Elimination System (NPDES) permit (#CA0107409) for the Point Loma Wastewater Treatment Plant and Ocean Outfall*, NMFS Consultation Number: WCRO-2021-03010, at 88 (March 2022) at https://repository.library.noaa.gov/view/noaa/37544 (non-linear dose response curves thyroid hormone impacts from PBDEs and other POPs).

[36] WDFW, Calculations of Total PCBs (ng/g lipid calculated at 1% lipids) Measured in Juvenile Chinook Salmon in Various Habitats of Puget Sound River Systems in 2013-2021 (Jan. 2024).

Sound Chinook is also imperative because Chinook salmon are the preferred prey for Southern Resident Killer Whales, which are listed as endangered and whose total population is less than 75 individuals. 70 Fed. Reg. 66,903 (Nov. 18, 2005) (endangered listing of Southern Resident Killer Whales). The orca recovery plan identifies pollution and toxic contamination as a major threat and specifically identifies PBDEs. Recovery Plan for Southern Resident Killer Whales at 100-01, 106-08, 113-16 (2008).[37] To address this threat, NOAA Fisheries and the federal EPA have convened technical workshops on the effects of PBDEs on orcas and on ways to remove PBDEs from wastewater.

Once a species is on the endangered species list, the statute imposes legal obligations on the federal government to avoid taking actions that jeopardize the species' survival and to work toward recovery of the species to the point that it no longer needs the ESA's protections to be viable. 16 U.S.C. §§ 1532(3), 1533(f), 1536(a)(2). The ESA also prohibits any entity, including state and local governments, from causing a take of members of the species unless it has obtained a permit from NOAA Fisheries constraining and authorizing the take. 16 U.S.C. §§ 1536(b)(4), 1538(a)(1)(B); *see* 50 C.F.R. § 223.203 (take prohibition applicable to listed salmon). Take includes significant habitat modification that impairs essential behavioral functions, including rearing and migrating, that actually injures or kills members of the listed species. 50 C.F.R. § 222.102; *see Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon*, 515 U.S. 687 (1995) (upholding this regulatory definition of "harm"). In listing Puget Sound Chinook Salmon, NOAA Fisheries identified discharges of toxics into salmon habitat among the activities likely to violate the take prohibition. 64 Fed. Reg. at 14,326.

In carrying out their ESA obligation to ensure their actions avoid jeopardizing listed species' recovery, federal agencies must consult with the expert fish and wildlife agency, NOAA Fisheries for salmon and orcas. While this obligation is inapplicable to Ecology's issuance of this NPDES permit because it is a state agency not the federal government that is issuing the permit, it did apply to EPA's issuance of an analogous permit for the Fort Lewis (Joint Base Lewis McChord) (JBLM) Wastewater Treatment Facility at Solo Point, which authorized discharges of PBDEs, among other pollutants, into Puget Sound. NOAA Fisheries found that the PBDE discharges are likely to adversely affect Puget Sound Chinook and Southern Resident Killer Whales and will cause incidental take of Puget Sound Chinook.[38] The Biological Opinion noted the need to reduce PBDE discharges due to the harmful effects of PBDEs on both Chinook salmon and orcas, but ultimately determined that the PBDE discharges over the 5-year life of the permit would not be likely to jeopardize either species' survival, although the conclusion might be different if PBDE discharges are not reduced over the long-term. *Id*. at 84-86, 111-14, 123, 127-29.

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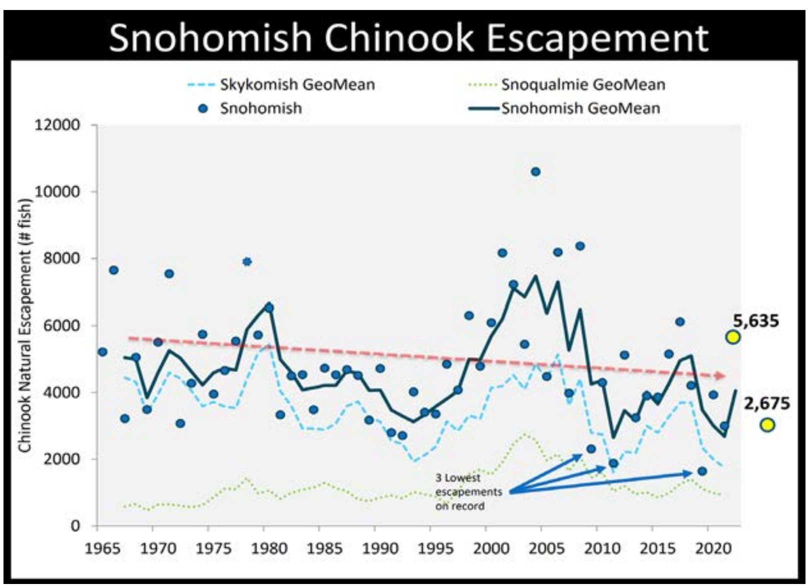
[37] NMFS, *Recovery Plan for Southern Resident Killer Whales (Orcinus orca)* (2008), https://repository.library.noaa.gov/view/noaa/15975.

[38] NOAA Fisheries, *Biological Opinion on Reissuance of the Fort Lewis (Joint Base Lewis McChord) Wastewater Treatment Facility NPDES Permit* (WA-002195-4), NMFS Consultation Number: 2009/03531 (2012), at file: I75R5GWY/BiOp%20NOAA_JBLM_NPDES_2-06-2012FinalTR_1_.pdf.

In contrast to the wealth of monitoring of PBDE discharges from the Everett Plant, no monitoring had been conducted for the Solo Point Plant. NOAA Fisheries' no-jeopardy determination hinged, in part, on this lack of information, but it required monitoring to fill this data gap during the life of the permit. Because the PBDE discharges are likely to cause the incidental take of thousands of Puget Sound Chinook, *id*. at 131-32, NOAA Fisheries issued an incidental take statement, authorizing the take, conditioned on monitoring of PBDEs in influent and effluent and on the monitored PBDE concentrations in fish tissues staying below adverse biological effects thresholds in fish. *Id*. at 11, 134. JBLM also had to consider treatment technologies for PBDEs and rerouting discharges to deeper water as the base planned for an upgrade at Solo Point. *Id*. at 12, 129,134.

The body of scientific evidence correlating Everett's PBDE discharges with harmful PBDE levels in juvenile Chinook salmon supports a finding that the Plant is causing the take of listed Chinook. Ecology must construct permit conditions that will stop discharges that injure and even kill juvenile Chinook. To do so, Ecology should draw from the Solo Point biological opinion to minimize the take of Puget Sound Chinook and harm to orcas. Specifically, it should mandate comprehensive monitoring of PBDEs in influent and effluent, require that PBDE concentrations in fish tissues not exceed adverse biological effect levels, direct Everett to consider treatment technologies for PBDEs, and require rerouting discharges to deeper waters. Proposed permit conditions that would meet these goals are described further below.

The Snohomish River is the second largest producer of Puget Sound Chinook, but its Chinook population is at less than10% of historic levels. The 2023 numbers – just 2,675 returning adults – fall far short of recovery goals, which range from 14,000-64,000. [39]



[39] Matt Pouley, *Tulalip Tribes Natural Resources, Fish In, Fish Out (2023) (annual update of Snohomish salmon data and trends. Snohomish Basin Salmon Recovery Technical Committee, PowerPoint* (Dec 5, 2023), at https://snohomishcountywa.gov/3826/Technical-Committee

Chinook numbers have declined markedly in the last 20 years. *Id*. The PBDE hot spot with concentrations in juvenile Chinook at levels associated with adverse effects in natural-origin juvenile Chinook poses a serious threat to the population's recovery.

Persistent PBDE contamination that causes salmon mortalities imposes significant societal costs. Millions of dollars are being spent on salmon recovery, including on improving Snohomish freshwater, estuary, and nearshore habitat for Chinook. To cite one metric, between 2005-2017, the Snohomish River Basin received $127,578,772 in restoration funding.[40]

The ESA listings underscore the critical importance of ensuring that this permit will stop PBDE discharges that are harming Chinook salmon. Urgent actions are needed to reduce this serious threat to Chinook salmon and the orcas.

F. The Permit Must Contain Measures to Stop These Serious Water Quality Standard Violations.

This permit must be strengthened to contain effective measures to stop discharges causing or contributing to this harm expeditiously, given the imperiled condition of this Chinook salmon population. As written, the draft permit focuses on modifying pretreatment requirements to reduce PBDE discharges by IUs into the Plant. We applaud this approach because source control and pollution reduction are the ultimate solutions to limiting the entry of persistent PBDEs into the Snohomish River and Puget Sound. IU discharges of PBDEs into the Everett Plant simply moves the pollutants around with their re-release via sludge, landfill leachate, or incinerator emissions. Reducing pollution at the source also avoids saddling the City of Everett and ultimately ratepayers with the costs of limiting PBDE pollution that is sent to the Plant by the IUs it serves. We are particularly concerned that imposing such costs on Everett and its ratepayers would impose burdens on those least able to bear the costs.

While Ecology's fact sheet represents (at 38) that the draft permit "requires" Everett to "take actions to identify and control" sources of PBDEs, the draft permit's provisions fall far short. The permit must include at least the following measures to reduce PBDE discharges expeditiously: (1) effective monitoring; (2) effluent limits and other requirements to reduce PBDE discharges from the Plant that cause or contribute to water quality standard violations; (3) pollution reduction requirements in pretreatment permits; and (4) adoption and implementation of a toxics reduction plan to reduce PBDEs..

1. Establish An Effective Monitoring Program, Including of Each IU's Pretreated Wastewater.

The draft permit lacks sufficient monitoring requirements to establish a credible baseline and assess the efficacy of pollution reduction measures. Ecology seems to recognize the importance of establishing a baseline, but it proposes to do so in an ineffectual way. It proposes

[40] Snohomish County, *Snohomish River Basin Salmon Conservation Plan Status and Trends* (Dec. 2019), at https://www.snohomishcountywa.gov/DocumentCenter/View/71060/SnohomishBasin10YearReport_2019-12-30_reduced

to begin gathering baseline data by requiring that Everett revise its inventory of IUs by April 2025 to indicate which ones currently discharge or historically have discharged PBDEs. Draft Permit S6.E(1). Ecology indicated at the January 11, 2024, public hearing that Everett will satisfy this requirement by canvassing its industrial users to obtain this information. In other words, through a survey, the industrial users will tell Everett whether they discharge or have discharged PBDEs. The result will be a list of current or past PBDE dischargers. Later, in 2026 and 2027, the draft permit would require semi-annual monitoring of aggregate PBDE concentrations in the total influent into the Plant. Draft Permit S6.E(4).

Inexplicably, the permit would not require that Everett either conduct or require its IUs to conduct monitoring of the pretreated wastewater each IU discharges into the Everett Plant. Other permits, like the City of Spokane's permit for the Riverside Park Water Reclamation Facility,[41] require this type of IU-specific monitoring, and EPA is recommending quarterly IU-specific monitoring for PFAS. *See infra* at 44. The permit must require monitoring of each IU's pretreated wastewater both to establish a baseline and to evaluate the effectiveness of the permit's pollution reduction measures. Only with monitoring of each IU's pretreated wastewater, coupled with monitoring of the Plant's total influent and effluent, will Everett be able to identify which IUs are contributing the greatest amounts and concentrations of PBDEs. Furthermore, both IU-specific sampling and sampling of total influent and effluent are needed for Everett (and Ecology and the public) to be able to assess the efficacy of pollution reduction measures.

The permit must require monitoring of PBDE concentrations and volumes in total influent and effluent at the Everett Plant on a semi-annual basis, with one sample coinciding with high-flow conditions. The monitoring must use a testing method that is sufficiently sensitive to detect total PBDEs and individual PBDE congeners in order to provide the necessary quantitative data about the nature and sources of the PBDE contamination in the influent and the effluent. Specifically, the permit must require that total influent and effluent from both Outfalls 100 and 015 be sampled quarterly (by 24-hour composite sample), using the most sensitive method capable of distinguishing the congeners, EPA Method 1614, expressing the results in picograms/liter (pg/L) units. This is the test method required in the City of Spokane's monitoring program.[42]

The permit must also require that Everett establish pretreatment requirements for each IU to undertake quarterly monitoring of total PBDEs and individual PBDE congeners in its pretreated wastewater. The monitoring must be done quarterly in keeping with EPA's guidance as to the frequency of PFAS monitoring by IUs. It also should require 24-hour composite samples and use of the EPA test Method 1614, expressing the results in pg/L units. The initial year of monitoring will establish a baseline for each IU. The monitoring should be undertaken

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[41] NPDES *Waste Discharge for City of Spokane Riverside Park Water Reclamation Facility (RPWRF) and Combined Sewer Overflows (CSOs)* Permit No. WA0024473 (July 27, 2022), at file: [WA0024473 Spokane Riverside Park Water Reclamation Facility Permit 2022-09-01 (spokanecity.org)].

[42] City of Spokane, *Quality Assurance Project Plan: PCB and PBDE Wastewater Monitoring* (Sept. 2023)

thereafter in every odd numbered year to allow assessments of the extent to which the permit and pretreatment requirements are reducing PBDE discharges. The IU-specific monitoring should be undertaken to coincide with Everett's monitoring of total influent into the Plant to facilitate an understanding of each IU's contribution to total influent.

The permit must require that all results of this sampling be submitted by IUs to Everett and by Everett to Ecology within three months, including all lab sheets, raw data, and analyses, paralleling the requirements in the Spokane Permit. The sampling results must also be made available to the public, preferably automatically by being posted on available websites.

2. The Draft Permit Must Limit PBDE Discharges.

The draft permit has no effluent limits for PBDEs, even though there is no question that Everett's PBDE discharges have the potential to cause or contribute to water quality violations. Indeed, they are already causing pervasive violations. As noted above, NOAA Fisheries scientists have identified PBDE concentration levels that suppress immunity, thereby increasing susceptibility to disease, and that alter thyroid functioning in juvenile Chinook salmon. Arkoosh, 2010; Arkoosh, 2018. WDFW studies have consistently found PBDE concentrations in juvenile Chinook tissues at levels that cause immune suppression, and some studies have also found concentrations above the higher threshold for impaired thyroid functioning. Numerous studies, most particularly the smoking gun study, have correlated the PBDE hot spot with discharges from the Everett Plant. Despite this evidence that the Everett Plant is causing violations of water quality standards, Ecology has made no attempt to develop limits on PBDEs in Everett's effluent to prevent fish tissue concentrations that cause these adverse effects.

In establishing effluent limits, Ecology typically conducts an AKART analysis to establish technology-based water quality limits. Only when a more protective standard is needed to avoid causing or contributing to violations of water quality standards does Ecology generally establish water quality based effluent limits. Here, however, the WDFW and Ecology studies show that Everett's PBDE discharges are harming salmon in violation of water quality standards. While PBDE concentrations are declining in fish and marine life throughout Puget Sound,[43] they are 4-10 times higher in juvenile Chinook salmon in the Snohomish River region that receives Everett's discharges. And the percentage of juvenile Chinook with harmful PBDE levels increased from 73% to 80% between 2016-2021. Ecology must establish limits on PBDE discharges to enforce the narrative water quality standards by prohibiting PBDE discharges that will cause or contribute to harmful PBDE concentrations in fish tissues. By way of analogy, the biological opinion for the Solo Point NPDES permit used adverse biological effects levels in Chinook salmon as an indicator of the prohibited effects of that Plant's PBDE discharges.[44] Since Ecology must "ensure" that water quality meeting effluent limits will meet water quality standards, it must prohibit PBDE discharges that contribute to harmful fish tissues. The effluent

[43] Mongillo, 2016, at 20.

[44] Biological Opinion at 131-32. While the Solo Point biological opinion used thresholds associated with other adverse biological effects, the NOAA Fisheries studies and WDFW monitoring use well-settled thresholds for impaired immune suppression and thyroid functioning.

limit should be zero or no detect, unless Ecology can establish a different limit that will meet its obligations.

We acknowledge that the Everett Plant will not be able to meet the PBDE effluent limit on day one of the permit. Accordingly, the permit can contain a compliance plan with benchmarks that must be met over time. Given the severity of the water quality standard violations and serious impacts on listed Chinook, the compliance plan should require a substantial % reduction in PBDE discharges by year three (we recommend 50%) and additional reductions annually in each subsequent year (we recommend an additional 10% reduction each year).[45]

Unless Ecology establishes water-quality based PBDE limits, as it should, it must conduct an AKART analysis to establish technology-based PBDE effluent limits. To date, it has failed to conduct an AKART analysis for PBDEs. There are many emerging treatment processes and technologies capable of removing a wide range of pollutants from wastewater. Ecology should survey the available technologies and determine which will best address PBDEs and the other pollutants of concern discharged by Everett. One available technology is granular activated carbon filters that work through adsorption, a process by which a solid holds molecules of a gas or liquid as a thin film. Activated carbon can function either as a single intervention or a step in a larger pre-treatment process.[46] Studies show that activated carbon is effective at removing many PBDEs.[47] Other treatments use membrane systems, including reverse osmosis and nanofiltration, that drive wastewater at high pressure through a membrane to separate out pollutants. Membrane separation technologies have shown promise at efficiently removing many emerging contaminants not removed by conventional wastewater treatment

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[45] Ecology also failed to consider imposing more stringent limits on total suspended solids (TSS). PBDEs bind to solids, and studies have found correlations between reduced PBDE concentrations and TSS removal. M. Kim, *et al.*, *Parameters Affecting the Occurrence and Removal of PBDES in Twenty Canadian Wastewater Treatment Plants, Water Research* 47 (May 1, 2013), 2213-2221, at https://pubmed.ncbi.nlm.nih.gov/23466032/. In a lagoon system, like that at Everett's North Plant that discharges through Outfall 015, more stringent TSS limits would lower PBDE concentrations in the effluent.

[46] *E.g.*, Rabia Amen, et al., *A Critical Review on PFAS Removal from Water: Removal Mechanism and Future Challenges*, Sustainability 2023 (Nov. 21, 2023), https://doi.org/10.3390/su152316173.

[47] Yao Ma, et al., *Treatment of PBDEs from Soil-Washing Effluent by Granular-Activated Carbon: Adsorption Behavior, Influencing Factors and Density Functional Theory Calculation* (2022), https://www.mdpi.com/2227-9717/10/9/1815 (finding that granular activated carbon can effectively reduce bioavailability of BDE-15 in sediment, with a maximum adsorption capacity of 623.19 μmol/g); Gia, Fang et al., Comparing black carbon types in sequestering polybrominated diphenyl ethers (PBDEs) in sediments, 184 Env'tl Pollution at 131 (Jan. 2014), https://doi.org/10.1016/j.envpol.2013.08.009 (finding that activated carbon displayed a substantially greater sequestration capacity than biochar or charcoal).

processes.[48] Hybrid technologies that combine multiple processes—such as membrane bioreactors, which combine activated sludge and membrane separation processes—have also shown promise in addressing emerging contaminants.[49] Because PBDEs are persistent and can break down into more toxic PBDE congeners, scientists have observed that effectively removing PBDEs from water and soil is likely to require a combination of technologies.[50]

Ecology should also consider the impacts of upgraded treatment systems at Solo Point and Spokane. The Solo Point wastewater treatment plant upgraded its treatment technology to utilize pressure membrane filtration and UV disinfection in 2016. PBDE monitoring showed that PBDE concentrations discharged by the Solo Point Plant were considerably reduced (*i.e.,* by roughly an order of magnitude) in effluent as compared to influent for several congeners of concern to Chinook and orcas.[51]

The City of Spokane upgraded its treatment technology at the Riverside Park Water Reclamation Facility in 2021 to incorporate a new membrane filtration system to address nutrient pollution issues. In 2022, Spokane reported that the new system removed PBDEs, but

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[48] *E.g.,* Wash. Dep't of Ecology, *Contaminants of Emerging Concern and Wastewater Treatment* (June 2021), https://apps.ecology.wa.gov/publications/documents/2110006.pdf (finding that reverse osmosis efficiently removed four studied contaminants of emerging concern as well as nutrient pollution); Suhas P. Dharupaneedi et al., *Membrane-based separation of potential emerging pollutants*, (Feb. 8, 2019), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7592717/ (finding that membrane-based separation processes including microfiltration, ultrafiltration, nanofiltration, reverse osmosis, and forward osmosis, as well as hybrid technologies that combine processes, are more effective than conventional wastewater treatment techniques at removing emerging pollutants).

49 E.g., Arijit Sungupta, et al., *Removal of Emerging Contaminants from Wastewater Streams Using Membrane Bioreactors: A Review*, 12 Membranes at 60, https://doi.org/10.3390/membranes12010060. For an example of a membrane bioreactor wastewater treatment system in Washington, Ecology can look to King County's Brightwater Plant. *See*, *e.g.*, King County, *Treatment Process at Brightwater*, https://kingcounty.gov/es-es/dept/dnrp/waste-services/wastewater-treatment/facilities/brightwater/treatment-process/.

[50] Bin Yao, et al., *Current progress in degradation and removal methods of polybrominated diphenyl ethers from water and soil: A review*, 403 Journal of Hazardous Materials 123674 (Feb. 2021), https://doi.org/10.1016/j.jhazmat.2020.123674 (noting that removing PBDEs likely requires a combination of technologies because of the recalcitrant nature of PBDEs and the toxic intermediate compounds that can be formed during breakdown of some PBDE congeners).

[51] EPA, *NPDES Permit for Joint Base Lewis-McChord Solo Point Wastewater Treatment Plant in Washington* (April 1, 2012) https://www.epa.gov/npdes-permits/npdes-permit-joint-base-lewis-mcchord-solo-point-wastewater-treatment-plant; NPDES 2018 Solo Point Monitoring Report; NPDES 2016 Solo Point Monitoring Report.

even with this improved removal rate, the new Spokane permit requires a toxics reduction plan to reduce PBDE concentrations further.[52]

Ecology should have considered evidence about the efficacy of treatment technologies for PBDEs and other pollutants discharged from the Plant. Yet Ecology failed to conduct an AKART analysis of available treatment technologies to establish a technology-based PBDE limit, nor did it set a limit to prevent continuation of the demonstrated water quality standard violations.

3. Rerouting Discharges Through Outfall 100 During the Juvenile Chinook Outmigration

The permit should also require Everett to reroute discharges through Outfall 100 into the Puget Sound rather than Outfall 015 into the Snohomish River during juvenile Chinook outmigration season. Doing so would reduce the amount of PBDEs entering Snohomish waters that serve as primary juvenile rearing habitat during the outmigration period.

Because PBDE discharges are lower through Outfall 100, this operational measure would reduce PBDE discharges at the Everett Plant. Everett's data show that effluent discharged through Outfall 100 has lower PBDE concentrations than effluent discharged through Outfall 015. The third quarter data for 2022, for example, showed a total PBDE concentration of 15,500.7 pg/L at Outfall 100 and a total PBDE concentration of 37,975.8 pg/L at Outfall 015. In other words, routing discharges through Outfall 100 results in lower PBDE discharges from the Plant.[53]

Between 2020 and 2023, Everett minimized discharges through Outfall 015 to some extent during the juvenile Chinook salmon outmigration to lessen the interaction of the juvenile salmon with PBDEs. The permit should require that Everett continue this operational measure. Doing so is consistent with the biological opinion for the Solo Point permit, which encouraged relocating the outfall to deeper water. Solo Point BiOp at 135.

This rerouting requirement should be accompanied by a sampling program to assess the impacts of PBDE discharges into the Sound through Outfall 100. The monitoring should be modeled on that conducted by Ecology and WDFW to determine PBDE levels in sediments, biofilm, invertebrates, and aquatic species. Everett should either conduct the sampling or fund other government agencies to do so.

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[52] Spokane, 2023 *Toxics Reduction Best Management Practices Plan (BMPs Plan) for PCBs and PBDEs* at 21 (Aug. 2022), https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=454985.

[53] The Everett Plant's discharge monitoring reports show that Outfall 100 consistently meets more stringent TSS standards than Outfall 015, confirming the correlation between TSS and PBDEs.

4. Pretreatment Permit Requirements to Reduce PBDE Discharges

The draft permit fails to include adequate measures to prevent IUs from discharging PBDEs in their pretreated wastewater that will pass through the Everett Plant and cause or contribute to water quality standard violations. It fails to require that Everett seek immediate toxic reductions from sources that are "known or suspected sources of PBDEs." Instead, it only requires Everett to "begin" by July 1, 2025, "the process of modifying pretreatment permits for IUs identified as known or suspected sources of PBDEs to include a requirement to complete a PBDE pollution prevention/source reduction evaluation." Draft Permit S6.E(2). This evaluation "must assess whether the facility uses or has historically used any products containing PBDEs, whether use of those products or legacy contamination reasonably can be reduced or eliminated, and include a plan to take action on those findings." *Id*. This direction is vague and would not capture sources like industrial laundries and landfills whose PBDE discharges are not associated with the use of products containing those chemicals or their legacy. It also mandates no specific outcomes. Everett must merely "begin the process" of modifying the agreements and the industrial users must "include a plan to take action," without requiring that any particular actions will be undertaken. *Id*.

The draft permit also requires that, by July 1, 2025, Everett must evaluate other best management practices and pollution prevention strategies that it could include in pretreatment permits to control PBDE discharges. Such control methods may include "encouraging pollution prevention, product substitution, and good housekeeping practices." Draft Permit S6.E(3). Again, the draft permit compels no pollution reduction actions. Everett would simply identify pollution prevention strategies that "it could include in pretreatment permits."

These evaluation and planning requirements are logical first steps, but they fall short of ensuring compliance with water quality standards. The permit must mandate pretreatment requirements that will reduce PBDE discharges to levels that will no longer lead to concentrations in juvenile Chinook salmon that exceed adverse effect levels.

While the IU-specific monitoring will identify the largest industrial PBDE sources, Ecology has sufficient information now to identify industrial sectors that are key sources and that need to be subject to immediate pollution reduction measures. Ecology's monitoring found that an industrial laundry that discharges into the Everett Plant had the highest PBDEs measured in terms of both PBDE concentrations in wastewater and as total volumes discharged. The monitoring also documented high PBDE concentrations and volumes from a landfill that discharges into the Everett Plant. Ecology (Wong), 2022. In light of this evidence, the permit should direct Everett in year one to impose pretreatment requirements on these facilities, including, at a minimum, effluent limits based on AKART, to achieve the limits in Everett's permit with compliance deadlines that require measurable reductions on an annual basis and compliance with the limits by the permit's end.

The Ecology monitoring also found high PBDE discharges from aircraft modification facilities that send their pretreated wastewater to other wastewater treatment plants. While Ecology did not sample influent from the Boeing facility or other aircraft facilities that discharge into the Everett Plant, Boeing is also certainly a major source of PBDEs, given that the federal phase out of decaBDE has an exemption for replacement parts for the service lives of aerospace vehicles. 86 Fed. Reg. 880 (Jan. 6, 2021). The permit should direct Everett to modify the pretreatment permits for these aircraft industries to have effluent limits based, at a minimum, on AKART with compliance deadlines calling for measurable reductions annually and meeting the limits by the end of the permit.[54]

Once the baseline monitoring identifies which IUs are discharging PBDEs and in what amounts, Everett's permit must require modification of pretreatment permits for all IUs discharging PBDEs to incorporate pollution reduction measures. Accordingly, in the permit's second year, the IUs should be required to identify the product substitution, AKART, and pollution reduction measures that would eliminate or substantially reduce their PBDE discharges, and Everett must modify the pretreatment permits with industrial users who discharge PBDEs into the Everett Plant to incorporate effluent limits based, at a minimum, on AKART, and other pollution reduction measures to reduce the PBDE discharges below levels that cause harm to juvenile Chinook salmon.

In addition, as part of its pretreatment program requirements, the permit should require that Everett reevaluate its local limits, within one year, in consultation with Ecology, to determine whether these local limits need to be strengthened to reduce PBDEs and prevent pass through PDBE pollution.

5. Toxics Reduction Plan

The severity of the harm to salmon from the PBDE hot spot necessitates immediate actions to reduce PBDE concentrations in fish tissues to below adverse effects levels and effluent limitations set in the permit. The draft plan acknowledges this need, but merely directs Everett to evaluate best management practices and pollution prevention strategies, without requiring implementation of such practices and strategies. Draft Permit S6.E(3). Because the Everett Plant is causing water quality violations, not just showing a reasonable potential to do so, a toxics reduction plan will help ensure that the Plant will meet the permit's effluent limits and compliance deadlines.

Toward that end, the permit should require that Everett adopt and implement a toxics reduction plan modeled on the recent NPDES permit for the City of Spokane's Riverside Park

[54] EPA recently proposed an amendment to its decaBDE rule that would prohibit releases of decaBDE to water "during the manufacturing, processing, and distribution in commerce of decaBDE [and] decaBDE-containing products." 88 Fed. Reg. 82,287, 82,298 (Nov. 24, 2023). Any processing of decaBDE by Boeing or other IUs to manufacture replacement parts would be subject to this ban. Further, public comments from Earthjustice and others urged EPA to expand this prohibition to apply to facilities that manufacture, process, distribute, or dispose of "articles" (basically durable products) that contain decaBDE. Ecology should either incorporate the final federal prohibition into this permit or require Everett to do so. https://www.regulations.gov/comment/EPA-HQ-OPPT-2023-0376-0313.

Water Reclamation Facility.[55] Spokane must obtain Ecology approval for its plan and annual updates that, at a minimum: (1) specify pollution reduction actions to be taken; (2) set timelines for implementing of the actions; (3) quantify pollution reduction targets to be achieved by the actions; (4) have methods for assessing effectiveness using the most sensitive methods; and (5) include additional measures in the annual updates, if the actions fall short of achieving the reduction targets.

Building on this precedent, the permit must require that Everett adopt, and obtain Ecology approval of, a toxics reduction program to reduce PBDE discharges to below levels that lead to harmful concentrations in juvenile Chinook salmon and to conform to the permit's effluent limits. The plan must, at a minimum, set forth quantified PBDE reduction targets, specify actions that will be taken to achieve those reductions and timelines for implementing them, include a method for assessing the efficacy of the identified actions, and quantify toxic reductions resulting from the actions.

The permit, like the Spokane permit, must require that Everett submit annual updates for Ecology approval. In developing the updates, Everett must be required to evaluate all PBDE sampling data, including the influent/effluent data from the Everett Plant and the pretreated wastewater testing data for the individual IUs, WDFW's ongoing monitoring of PBDE concentrations in juvenile Chinook salmon, and the efficacy of the pollution reduction measures in the pretreatment permits and implemented through the toxics reduction plan. If the pretreatment requirements and the toxics reduction plan are not achieving pollution reduction targets that reduce PBDE concentrations in fish tissues below harmful levels and the permit's effluent limits, the annual updates must include additional measures to achieve the targets. The annual updates to Everett's toxics reduction plan would incorporate an adaptive management approach in which Everett updates its plans to respond to new sampling data and other new information, employing all additional PBDE-reduction measures that the evidence indicates are necessary to meet the effluent limits in accordance with the permit's compliance deadlines.

The permit must require that the toxics reduction plan, updates, and Everett's evaluations be made public.

6. *Testing of Biosolids and Restrictions on Disposal*

The draft permit allows biosolids to be spread on agricultural lands, but this could allow PBDEs to re-enter the environment through air deposition, runoff, or migration into groundwater. The permit should require testing of biosolids before allowing them to be spread on agricultural lands, as discussed below for PFAS, and should require Everett to pursue more effective disposal of PBDE-laden sludge.

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[55] Spokane NPDES Permit; *see also* City of Spokane, *Toxics Reduction Best Management Practices Plan (BMPs Plan) for PCBs and PBDEs* (Sept. 2023), at https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=45498; Spokane *2023 Monitoring Quality Assurance Project Plan* at https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=455049.

IV. THE PERMIT MUST ADDRESS PFAS DISCHARGES FROM THE EVERETT WASTEWATER TREATMENT PLANT

A. PFAS Background

PFAS, called "forever chemicals," are a class of persistent, bioaccumulating toxics. Some PFAS compounds, such as PFOA and PFOS, have been linked to adverse health effects in humans and animals, including cancer and harms to the liver, thyroid, immune system, as well as impacts to fetal development.[56] Industry and regulators have worked to phase out "long-chain" PFOA and PFOS compounds, though they continue to persist in the ecosystem and be present in fish tissues sampled in Washington.[57] Yet these compounds have to a significant extent been replaced by short-chain compounds that may be *more* persistent in the environment though potentially less bioaccumulative.[58] Nearly everyone in the United States is exposed to PFAS through various media, including water, air, soil, and food.

In 2010, Ecology analyzed the discharge from 10 WWTPs discharging into Puget Sound, including the Everett WWTP. All the plants discharged several PFAS compounds; Everett's total discharge for sampled PFAS compounds was almost 200 ng/L in February 2009 and nearly 11 ng/L in July 2009.[59] Other Ecology studies that sampled wastewater treatment

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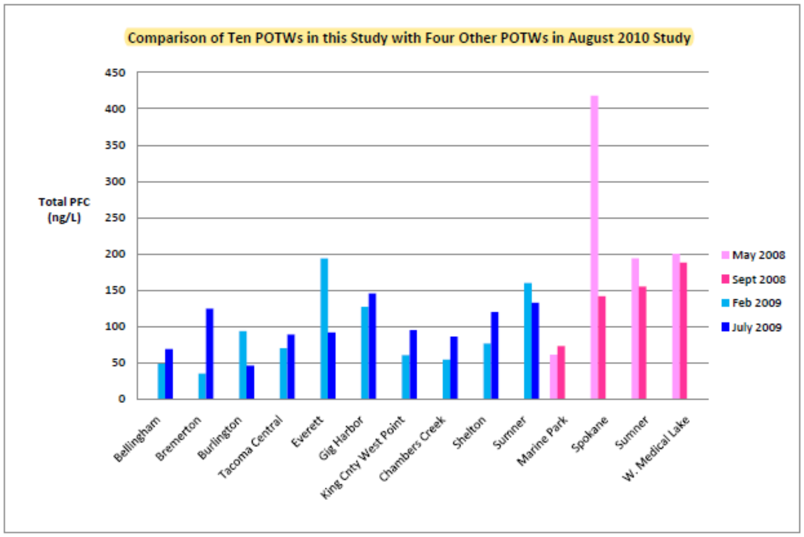
[56] U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan* (Feb. 2019) at 13, https://www.epa.gov/sites/default/files/2019-02/documents/pfas_action_plan_021319_508compliant_1.pdf (hereinafter "EPA Action Plan"); U.S. Dep't of Health & Human Servs., Div. of the Nat'l Toxicology Program, *Monograph on Immunotoxicity Ass'n with Exposure to Perfluorooctanoic Acid (PFOA) or Perfluorooctane Sulfonate (PFOS)* (Sept. 2016); Interstate Technology Regulatory Council, Human & Ecological Health Effects and Risk Assessment of PFAS, (Sept. 2023); *PFAS 'Forever Chemicals' Are Getting Into Ocean Ecosystems, Where Dolphins, Fish and Manatees Dine – We Traced Their Origins,* The Conversation (Nov. 14, 2023), https://theconversation.com/pfas-forever-chemicals-are-getting-into-ocean-ecosystems-where-dolphins-fish-and-manatees-dine-we-traced-their-origins-216254.

[57] PFAS compounds have varying lengths of carbon-fluorine chains. Compounds can be divided into "long-chain," such as PFOS and PFOA, or "short-chain," such as PFBS and PFBA. Callie Mathieu & Melissa McCall, *Survey of Per- and Poly-fluoroalkyl Substances (PFASs) in Rivers and Lakes,* 2016 (Sep. 2017), Dep't of Ecology, https://apps.ecology.wa.gov/publications/documents/1703021.pdf.

[58] Guomao Zheng, Stephanie M. Eick, & Amina Salamova, *Elevated Levels of Ultrashort- and Short-Chain Perfluoroalkyl Acids in US Homes and People*, 57 Envt. Sci. & Tech. 15771 (2023), https://pubs.acs.org/doi/10.1021/acs.est.2c06715.

[59] Wash. Dep't of Ecology and Herrera Environmental Consultants Inc., *Control of Toxic Chemicals in Puget Sound* (Dec. 2010), https://apps.ecology.wa.gov/publications/documents/1010057.pdf.

plants in Washington show that virtually every plant discharges measurable levels of PFAS.[60] Puget Sound waters and sediment have measurable PFAS contamination.[61]



Wastewater treatment plants have been identified as a primary source of PFAS releases nationwide, due in part to receiving PFAS-laden wastewaters from industrial users and landfills, and in part to standard treatment methods that inadvertently transform PFAS precursors into PFAS compounds.[62] In Washington, sampling data from various industrial users and from treatment plants show that large concentrations of PFAS are discharged into wastewater from

[60] *See Chad Furl & Callie Meredith, Perfluorinated Compounds in Washington Rivers and Lakes* (Aug. 2010), Wash. Dep't of Ecology, https://apps.ecology.wa.gov/publications/documents/1003034.pdf; Callie Mathieu & Melissa McCall, *Survey of Per- and Poly-fluoroalkyl Substances (PFASs) in Rivers and Lakes, 2016* (Sep. 2017), Wash. Dep't of Ecology, https://apps.ecology.wa.gov/publications/documents/1703021.pdf;

[61] Margaret Dutch, et al., *Pharmaceuticals, Personal Care Products, and Per- and Polyfluoroalkyl Substances in Puget Sound Sediments: 2010-2019 Data Summary*, Wash. Dep't of Ecology (Dec. 2021), at 57, https://apps.ecology.wa.gov/publications/documents/2103015.pdf (sediment sampling, with PFHxA detectable at Everett sampling site).

[62] *See, e.g.*, EPA Action Plan at 12, 29; Wash. Dep't of Ecology and Herrera Environmental Consultants Inc., (2010); Xindi C. Hu, et al., *Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants*, 3 Envtl. Sci. & Tech. Letters 344-350 (Oct. 11, 2016), https://pubs.acs.org/doi/10.1021/acs.estlett.6b00260.

both sources.[63] Therefore based on existing data, we know the Everett plant and its industrial users are discharging PFAS into wastewater at unknown volumes and concentrations.

Like PBDEs, although Washington has not adopted numeric water quality criteria for PFAS, the discharge of PFAS into surface waters is subject to narrative water quality standards that prohibit toxic discharges at levels that individually or cumulatively harm biota or impair designated uses including salmonid spawning, rearing, and migration. PFAS have the potential to harm aquatic species,[64] and can act synergistically with other chemicals to cause endocrine disruption and reproductive harm to species such as Puget Sound Chinook salmon.[65] Though the concentrations of PFAS discharges and subsequent accumulation in aquatic species' body tissues requires more study, it is without question that PFAS pollution is a problem in Puget Sound and must be addressed.

Everett's PFAS discharges are particularly concerning because Puget Sound and the Snohomish River are home to several fish species regularly consumed by people.[66] Several studies have demonstrated that consuming fish and shellfish exposed to PFAS can dramatically increase PFAS in the human body, and may pose an even greater risk to human health than PFAS in drinking water.[67]

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[63] Siana Wong, *Chemicals of Emerging Concern in Pretreated Industrial Wastewater in Northwestern Washington State (hereinafter "Chemicals of Emerging Concern")*, Wash. Dep't of Ecology (Aug. 2022), at 28, https://apps.ecology.wa.gov/publications/documents/2203013.pdf; Callie Mathieu, *Per- and Polyfluoroalkyl Substances in Freshwater Fish, 2018: Lake Meridian, Lake Sammamish, and Lake Washington*, at 8, Wash. Dep't of Ecology, (March 2022) https://apps.ecology.wa.gov/publications/documents/2203007.pdf.

[64] *See generally* Gerald T. Ankley, et al., *Assessing the Ecological Risks of Per- and Polyfluoroalkyl Substances: Current State-of-the Science and a Proposed Path Forward, 40 Envtl. Toxicology & Chemistry* 539 (Mar. 2021), https://setac.onlinelibrary.wiley.com/doi/full/10.1002/etc.4869.

[65] Suzanne C. Ball, *Exposure of Juvenile Chinook Salmon to Effluent From A Large Urban Wastewater Treatment Plant: Part 1. Physiological Responses*, Aquaculture & Fisheries (June 19, 2023), https://www.sciencedirect.com/science/article/pii/S2468550X23000898.

[66] *See* Wendee Nicole, *Meeting the Needs of the People: Fish Consumption Rates in the Pacific Northwest* (2013), 121 Envt'l Health Perspectives 335, https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.121-A334.

[67] Nadia Barbo, et al., *Locally Caught Freshwater Fish Across the United States Are Likely a Significant Source of Exposure to PFOS and Other Perfluorinated Compounds*, 220 Env'tl Research (March 1, 2023), https://doi.org/10.1016/j.envres.2022.115165 (finding that consumption of one locally caught freshwater fish per year per year could yield equivalent PFOS levels to drinking water with 48 ppt PFOS); Krista Y. Christensen, et al., *Perfluoroalkyl Substances and Fish Consumption*, 154 Env'tl Research 145 (2017), https://mejo.us/wp-content/uploads/2018/08/2017-Christenson-et-al.PFAS-and-fish-consumption.pdf (multi-year analysis finding correlation between consumption of fish or shellfish and PFAS in humans).

Meaningful efforts to conduct regular sampling for PFAS pollution and reduce or treat any PFAS-containing discharge are necessary. Indeed, the EPA has issued guidance urging states to include requirements for sampling discharges from industries associated with PFAS releases and the development of pollution prevention plans in NPDES permits.[68] Additionally, several states have established PFAS water quality standards or guidance to set effluent limits in NPDES permits. Ecology should incorporate EPA's guidance into Everett's NPDES permit to ensure the treatment plant does not exacerbate PFAS problems and that its actions correspond to sound scientific principles.

B. PFAS Provisions in the Draft Permit

The draft permit for the Everett Plant would require Everett to update its industrial user inventory to identify users in industries known or suspected to discharge PFAS, enter into pre-treatment agreements with these users, and update those pretreatment agreements to require those sources to evaluate pollution prevention and source reduction measures. It also requires Everett to evaluate other best management practices and pollution prevention strategies for PFAS dischargers, which may include "encouraging" identification and implementation of reduction activities by industrial users, where feasible. But, as with PBDEs, the permit does not contain any technology-based or effluent limits and would not require monitoring specific to each industrial user, implementation of any pollution reduction measures, establishment of compliance deadlines, or achievement of any reductions in PFAS pollution.

Ecology should seize this opportunity to construct meaningful sideboards in Everett's permit that will ensure effective PFAS monitoring and PFAS discharge reductions and can serve as a model for other facilities associated with significant PFAS pollution.

C. Permit Recommendations

1. Include AKART analysis and establish effluent limits in the permit

The draft permit recognizes that Everett discharges PFAS. But Ecology has not attempted to fulfill its duty to evaluate AKART and establish technology-based or water quality-based effluent limits. Ecology must do so.

EPA has been investigating PFAS dischargers for the purpose of establishing nationwide effluent guidelines. To date, EPA is engaged in an ongoing POTW influent study for PFAS, an ongoing study of PFAS discharges from textile manufacturers, and has prioritized revisions to effluent guidelines for landfills, metal finishing and electroplating, and organic chemicals,

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[68] Memorandum from Radhika Fox, EPA Assistant Administrator to EPA Regional Water Division Directors, Regions 1-10, re: *Addressing PFAS Discharges in NPDES Permits and Through the Pretreatment Program and Monitoring Programs* (Dec. 5, 2022) (hereinafter "EPA PFAS Guidance for NPDES Permits"), https://www.epa.gov/system/files/documents/2022-12/NPDES_PFAS_State%20Memo_December_2022.pdf.

plastics, and synthetic fibers (OCPSF).[69] These investigations demonstrate that PFAS must — and will — be subject to effluent limitations. Rather than simply waiting, Everett should be addressing these toxic compounds of concern in this permit cycle.

Ecology has previously reviewed PFAS treatment technologies, as have other research and regulatory bodies.[70] Many wastewater treatment technologies are effective at removing many PFAS compounds. Studies show that, on aggregate, granular activated carbon (GAC) filters are 80–90% efficient at removing long-chain PFAS.[71] Another treatment relies on ion exchange resins—a technology that works like tiny magnets to attract and hold contaminated materials passing through the water system.[72] Ion exchange resin technology is also effective at removing some PFAS compounds, including short-chain compounds that are not remediated by activated carbon adsorption processes.[73] High-pressure membrane systems like reverse osmosis and nanofiltration are also highly efficient at removing some PFAS compounds, achieving reductions from 90% to greater than 99% of PFAS.[74] Ecology will, of course, have to consider whether and how removal of toxics from wastewater discharges may cause increased accumulation in sediments and biosolids generated at the Plant. This issue is discussed further below.

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[69] EPA, *Effluent Guidelines Program Plan* 15 (Jan. 2023), https://www.epa.gov/system/files/documents/2023-01/11143_ELG%20Plan%2015_508.pdf.

[70] *See, e.g.*, Wash. Dep't of Ecology, *Guidance for Investigating and Remediating PFAS Contamination in Washington State* (June 2023), https://apps.ecology.wa.gov/publications/documents/2209058.pdf; Interstate Technology Regulatory Council, *Treatment Technologies* (updated Sep. 2023), https://pfas-1.itrcweb.org/12-treatment-technologies/.

[71] *Id.*

[72] U.S. EPA, *Science in Action: Perfluoroalkyl and Polyfluoroaklyl Substances (PFAS)* (Oct. 2019), https://www.epa.gov/sites/default/files/2019-10/documents/pfas_drinking_water_treatment_technology_options_fact_sheet_04182019.pdf.

[73] Fuhar Dixit, et al., *PFAS Removal By Ion Exchange Resins: A Review*, 272 Chemosphere 129777 (June 2021), https://doi.org/10.1016/j.chemosphere.2021.129777.

[74] Caihong Liu et al, *Evaluating the Efficiency of Nanofiltration and Reverse Osmosis Membrane Processes for the Removal of Per- and Polyfluoroalkyl Substances From Water: A Critical Review*, 302 Separation & Purification Tech. 122161 (Dec. 1, 2022), https://www.sciencedirect.com/science/article/abs/pii/S1383586622017166.

In determining effluent limits, Ecology can look for guidance to numeric water quality standards for PFAS developed by EPA,[75] Colorado,[76] New York,[77] and Michigan,[78] as well as to the effluent limits for PFOS and PFOA developed by Michigan.[79] These regulators have amassed a large and growing body of research related to sampling, determining numeric criteria for human health and aquatic life, and addressing PFAS pollution from wastewater. Importantly, because of the bioaccumulative and persistent nature of PFAS, effluent limits should consider the existing pollution levels in the Snohomish and Puget Sound and PFAS

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[75] EPA's numeric criteria for PFOS and PFOA were released in draft form in April 2022 and are intended to protect aquatic life. U.S. EPA, *Draft Aquatic Life Ambient Water Quality Criteria for Perfluorooctane Sulfanate (PFOS)* (Apr. 2022), https://www.epa.gov/system/files/documents/2022-04/pfos-report-2022.pdf (freshwater PFOS criteria of 3.0 mg/L acute, 0.0084 mg/L chronic, plus tissue-based criteria); U.S. EPA, *Draft Aquatic Life Ambient Water Quality Criteria for Perfluorooctanoic Acid (PFOA)* (Apr. 2022), https://www.epa.gov/system/files/documents/2022-04/pfoa-report-2022.pdf (freshwater PFOA criteria of 49 mg/L acute, 0.094 mg/L chronic, plus tissue-based criteria).

[76] Colorado has developed numeric water quality standards for PFAS translated from narrative criteria that also apply to parent compounds: 70 ppt PFOA, 70 ppt PFOS, 70 ppt PFNA, 700 ppt PFHxS, and 400,000 ppt PFBS. Colo. Dep't of Pub. Health & Envt., *Policy 20-1: Policy for Interpreting the Narrative Water Quality Standards for Per- and Polyfluoroalkyl Substances (PFAS)* (July 14, 2020), available at https://cdphe.colorado.gov/wqcc-policies.

[77] New York established "guidance values" for both acute and chronic exposures to PFOS and 1,4-Dioxane, and chronic exposures to PFOA, intended to protect aquatic life. N.Y. State Dep't of Env'tl Conservation, *Water Quality Standards and Classifications* (last visited Jan. 16, 2024), https://dec.ny.gov/environmental-protection/water/water-quality/standards-classifications#Water_Quality_Guidance_Values.

[78] Michigan has established surface water quality values for PFOS, PFOA, and PFBS to protect aquatic life and human health. Mich. Dep't of Env't, Great Lakes, & Energy (EGLE), *EGLE Establishes New Surface Water Values for Two PFAS Chemicals* (July 27, 2022), https://www.michigan.gov/egle/newsroom/mi-environment/2022/07/27/egle-establishes-new-surface-water-values-for-two-pfas-chemicals.

[79] Michigan now requires effluent limits to be established in NPDES permits where PFAS is discharged. Permittees must prohibit discharges from their users that cause treatment plants to pass through levels of PFOS and PFOA to surface water in amounts greater than allowed under applicable water quality standards. *See* Mich. Dep't of Env't, Great Lakes, & Energy (EGLE), *Municipal NPDES Permitting Strategy for PFAS* (March 2023), https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/WRD/NPDES/Municipal-permitting-strategy-PFOS-PFOA.pdf?rev=5df849e24a5d4c07b7559a714e292210&hash=7CB32D473549E943373600D00B999D1B (effluent limits based on WQVs); EGLE, *Wastewater Treatment Plants / Industrial Pretreatment Program* (March 2023), https://www.michigan.gov/pfasresponse/investigations/wastewater (updated WQVs).

(particularly PFOS) presence in fish tissues to establish a sufficiently protective limit that will ensure against harm to aquatic life or degradation of water quality.

2. Clearly define PFAS in the permit

The permit should explicitly define PFAS chemicals. Washington has defined them under RCW 70A.350.010 as follows: "'Perfluoroalkyl and polyfluoroalkyl substances' or 'PFAS chemicals' means a class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom." We support incorporating this definition to ensure that attention is paid to the broad range of existing and new compounds within this chemical class.

3. Expand the categories of users "suspected or known" to discharge PFAS to include aerospace, industrial laundries, industrial gas manufacturing, and inorganic chemical manufacturing.

Currently, the draft permit lists the following industries known to discharge or suspected of discharging PFAS: organic chemicals, plastics, and synthetic fibers (OCPFS); metal finishing; electroplating; electric and electronic components; landfills; pulp, paper, and paperboard; leather tanning and finishing; plastics molding and forming; textile mills; paint formulating; and airports.

While it includes important categories of potential PFAS dischargers, the list is underinclusive. A 2021 Ecology report sampling seven facility category types showed that aerospace and aircraft modification facilities discharged the highest total PFAS concentrations, and an industrial laundry discharged wastewater with some of the highest PFOS concentrations.[80]

Ecology should also add industrial gas manufacturing and inorganic chemical manufacturing to the list of industries known to discharge PFAS. While the permit lists organic chemicals, plastics, and synthetic fibers, the manufacture of inorganic chemicals and both organic and inorganic gases, including for refrigeration systems, is also a significant source of PFAS nationwide.[81] Analysis by the Consumer Product Safety Commission found that nearly two-thirds of manufactured and imported PFAS was from industries associated with industrial gas manufacturing and inorganic chemical manufacturing.[82]

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[80] Wash. Dep't of Ecology, *Chemicals of Emerging Concern in Pretreated Industrial Wastewater in Northwestern Washington State (hereinafter "Chemicals of Emerging Concern")* (Aug. 2022), at 28, https://apps.ecology.wa.gov/publications/documents/2203013.pdf.

[81] *See, e.g.*, Juliane Gluge et al., *An Overview of the Uses of Per- and Polyfluoroalkyl Substances (PFAS)*, 22 Env'tl Science: Processes and Impacts 2345 (2020), https://pubs.rsc.org/en/content/articlelanding/2020/em/d0em00291g (Table 3).

[82] Data from 2012, 2016, and 2020 shows that 32.4% of manufactured and imported PFAS by volume was from the industrial gas manufacturing [NAICS code 325120] and 31.5% was from

Everett should add these additional industrial categories to the PFAS IU inventory assessment.

4. Require source-specific, time series sampling and monitoring at IUs; sample concurrent POTW influent and treated effluent.

The current draft permit purports to update and expand the IU inventory of known or suspected dischargers of PFAS, but does not expressly require that such dischargers will be require to sample their pretreated wastewater in order to enable the Plant or Ecology to determine the volume or concentration of PFAS pollution entering the Plant from each industrial source, and does not require the Plant to monitor PFAS levels in its effluent over time. The draft permit therefore contains no measures to assess the severity of Everett's current or future contributions to PFAS pollution in Puget Sound and the Snohomish River or the efficacy of any PFAS reduction strategies. Although Ecology has indicated that it intends to incorporate into the final permit a requirement for influent monitoring for PFAS, it is our understanding that the monitoring requirement will not take effect until 2026.

Ecology can and should require more. Ecology should exercise its authority to require permittees to provide PFAS discharge information and strengthen the PFAS monitoring sampling provisions in Everett's permit.[83] The permit should require that pretreatment agreements with IUs include initial time series sampling to determine which IUs are discharging PFAS.[84] Pursuant to EPA guidance regarding PFAS provisions in NPDES permits, the permit should also require quarterly IU-specific monitoring for IUs that are found to discharge PFAS. Unless Ecology determines there is a more sensitive analytical method or one capable of analyzing more PFAS compounds, analyses should be conducted pursuant to EPA draft analytical method 1633 for the 40 PFAS analytes detectable under that method.[85] The permit should require disclosure of PFAS sampling data from IUs to the Everett Plant and Ecology and

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basic inorganic chemical manufacturing. U.S. Consumer Prod. Safety Commission, Characterizing PFAS Chemistries, Sources, Uses, and Regulatory Trends in U.S. and International Markets: Final White Paper (June 20, 2023) at 4-31, https://www.regulations.gov/document/CPSC-2023-0033-0001.

[83] *See* 40 C.F.R. 122.21(e), (g)(13); *see also* U.S. EPA, PFAS Guidance for NPDES Permits at 2.

[84] This recommendation was also made in Ecology's PFAS screening report. *See* Chemicals of Emerging Concern, at 40.

[85] The sampling method should be updated once EPA publishes an update under 40 C.F.R. part 136. Any additional PFAS compounds that can be detected through updated methods should also be analyzed.

disclosure of Everett's own PFAS sampling and monitoring data to Ecology.[86] And, as with all sampling and monitoring reports, this information should be and remain publicly available.[87]

Michigan's approach to addressing PFAS, both in industrial pretreatment agreements and in NPDES permits with municipal wastewater treatment plants, is a good model for monitoring and addressing discharges.[88] PFAS sampling is now included in routine permit compliance inspections for 56 WWTPs and 41 industrial dischargers. Additionally, WWTPs with confirmed PFAS discharges must identify and sample potential IU sources of PFAS, as well as require confirmed sources to undertake routine monitoring and reporting and implement measures to reduce PFAS such as cleaning contaminated areas, product substitution, or installation of treatment methods.[89] Michigan's program has shown immense success so far: with a few exceptions, most WWTPs have achieved reductions in PFOS discharge of over 90%, and some of these reductions resulted from pretreatment at only one industrial source.

In addition, the permit should also require that Everett determine a sampling schedule that enables it to assess relative contributions from IUs and non-regulated sources of wastewater (such as domestic wastewater), as well as to assess whether PFAS volumes or concentrations increase during treatment at the Plant. Ongoing monitoring will also enable Everett to determine the effectiveness of IU pretreatment and the effectiveness of its own secondary treatment where and if applicable.

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[86] These requirements should pose neither a surprise nor an undue burden to discharging industries; indeed, some industrial users are already subject to EPA reporting requirements for 196 PFAS compounds in the Toxics Release Inventory. U.S. EPA, *EPA Requires Toxics Release Inventory Reporting for Seven Additional PFAS* (Jan. 9, 2024), https://www.epa.gov/newsreleases/epa-requires-toxics-release-inventory-reporting-seven-additional-pfas.

[87] *See* U.S. EPA, *Introduction to the National Pretreatment Program* (June 2011), https://www.epa.gov/sites/default/files/2015-10/documents/pretreatment_program_intro_2011.pdf (explaining that monitoring data from IUs pursuant to pretreatment agreements, and from POTWs, must be publicly accessible).

[88] *See* EGLE, *Municipal NPDES Permitting Strategy for PFAS* (March 2023), https://www.michigan.gov/pfasresponse/-/media/Project/Websites/egle/Documents/Programs/WRD/NPDES/Municipal-permitting-strategy-PFOS-PFOA.pdf; EGLE, Addressing PFAS (PFOS/PFOA) *From Industrial Direct and Industrial Stormwater Discharges* (May 2023), https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Programs/WRD/NPDES/ISW-PFOS-PFOA-permitting-strategy.pdf?rev=6519504b353f4fdea754ae519a5f76be.

[89] EGLE, Addressing PFAS (PFOS/PFOA) *From Industrial Direct and Industrial Stormwater Discharges* (May 2023), https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Programs/WRD/NPDES/ISW-PFOS-PFOA-permitting-strategy.pdf?rev=6519504b353f4fdea754ae519a5f76be.

5. *Strengthen pretreatment requirements for industrial users discharging PFAS*

Ecology should strengthen the permit provisions pertaining to industrial users. The draft permit provisions related to PFAS reductions by industrial users are even weaker than the analogous PBDE provisions, and fail to ensure that PFAS will be reduced to non-harmful levels. As with PBDEs, the plans must identify all possible strategies for reducing PFAS in each PFAS discharger's wastewater, and any obstacles to feasibility. The permit should specify that Everett and its Ius must evaluate potential sourcing and operational changes (such as product substitution) to reduce PFAS as well as treatment technologies to remove PFAS from wastewater before it is sent to Everett. As with PBDEs, Everett should establish a toxics reduction plan to establish targets for reductions from the baseline, specify pollution reduction actions, set implementation timelines, and include additional measures in annual updates if monitoring shows the plan's targets have not been met.

Requiring consideration and phased-in implementation of treatment technologies is especially important for industrial users with comparatively little ability to prevent toxics from entering its waste stream, such as landfills. In Vermont, regulators required the state's only open landfill to evaluate pretreatment technologies that would remove PFAS from landfill leachate before sending it to the wastewater treatment facility and to devise a plan to implement a pretreatment process.[90] The planning requirement was incorporated into the landfill's pretreatment discharge permit and required the landfill to file a proposed pretreatment process for public comment and agency approval.[91] Without similarly strong pretreatment requirements, the Everett Plant risks continued acceptance and pass-through of significant quantities of toxics.

6. *Specify implementation timelines in pretreatment agreements and in the permit*

In order to meet legal requirements for enforceable control mechanisms, the permit should set deadlines for initial IU sampling and reporting, selection of best practices, and implementation of monitoring and pollution prevention/reduction practices along with regular reporting. This would establish a baseline early in the permit cycle and ensure that meaningful reduction measures are in place within the five-year permit period.

We recommend that the initial IU screening deadline be at the latest one year from date of permit issuance. IU selection of best practices and development of implementation plans should be completed by the end of the second year following permit issuance, and the phased-in implementation of best management practices should begin in the third year of the permit. For sources that identified waste treatment as a component of their source reduction/pollution prevention practices — including sources that have little capacity to prevent PFAS from

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[90] *E.g.*, Leachate Study Plan for New England Waste Services (NEWSVT) Landfill (Apr. 4, 2023), https://npr.brightspotcdn.com/c8/a8/7e90f8204411a77cc3d26b393fdb/21339-newsvt-pfas-pilot-study-plan-final-signed.pdf;

[91] *Id.*

entering their waste stream, such as landfills — installation of waste treatment should begin at the start of the fourth year of the permit.[92]

The monitoring deadlines are not particularly onerous or unreasonably short. For comparison, Michigan set a one-year compliance deadline for initial screening, and found that most WWTPs were able to complete this process within six months. EPA guidance recommends six months. In the NPDES permit for one of the largest WWTPs in the United States, Massachusetts has required categorical IUs to commence annual sampling in the first year after the effective date of the permit. These examples demonstrate that a wide variety of WWTPs and industrial dischargers can complete sampling requirements within the year, if not less.

Setting compliance deadlines for IUs to identify and implement best management practices is necessary to ensure PFAS pollution is adequately addressed. And mandating pretreatment requirements in this permit cycle is necessary to comply with applicable legal requirements.

While source reduction is the most effective approach to reduce PFAS discharge in effluent, if PFAS in the Plant's effluent remains at significant levels following the implementation of source reduction measures, the treatment facility must consider ways it can improve outcomes in the toxics reduction plan and the next permit cycle. At the end of the permit cycle there should be a stocktake of results to determine whether additional source reduction measures are required under IU pretreatment agreements, or whether other measures — such as a pilot treatment method at the Plant — should be explored.

7. Halt the application of biosolids until sampling and pretreatment measures are in place

Sewage sludge containing PFAS that is spread on land presents a high risk of PFAS migration to the soil, surface water, and groundwater, and can remain in these media for years.[93] Application of PFAS-contaminated biosolids to land can thereby become a vector for drinking water pollution, bioaccumulation of PFAS in wildlife and, in the case of agricultural land, PFAS contamination in food.[94] Some farmers have unwittingly caused serious contamination of their

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[92] This was Vermont's approach for its sole landfill.

[93] Johnson, G. R., *PFAS in soil and groundwater following historical land application of biosolids*, Water Research vol. 211 (Mar. 1, 2022) at 118035, https://doi.org/10.1016/j.watres.2021.118035.

[94] Scearce, A. E., Goossen, C. P., Schattman, R. E., Mallory, E. B., & MacRae, J. D., *Linking drivers of plant per- and polyfluoroalkyl substance (PFAS) uptake to agricultural land management decisions*, Biointerphases 18(4) (July 2023), https://doi.org/10.1116/6.0002772.

lands due to application of sludge, resulting in significant concerns to their health and consequences to their livelihoods.[95]

Until the concentration of PFAS in biosolids emerging from the Everett Plant is, at the very least, ascertained, Everett should halt its practice of providing its treated biosolids for land application. Those receiving or seeking to receive sludge for land application should be notified of the presence of PFAS and have sampling results disclosed to them. Ecology should also, in proceedings separate from this permit, determine whether to establish concentration limits for land application or to stop land application altogether.[96] Finally, Everett and Ecology should ensure ongoing sampling of the sludge because treatment methods that remove PFAS from wastewater likely will cause PFAS concentrations in biosolids to increase.

V. THE PERMIT MUST ADDRESS NUTRIENT POLLUTION FROM THE EVERETT PLANT

A. Nutrient Pollutants and Puget Sound

Many, if not most, of the nation's marine ecosystems are polluted by excess nutrients; both nitrogen and phosphorus.[97] Furthermore, at least two-thirds of U.S. estuaries and marine coastal waters have been assessed as seriously degraded by chronic nutrient pollution.[98] Water systems are considered impaired when the water fails to meet the standards required to protect

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[95] Tom Perkins, *I Don't Know How We'll Survive: The Farmers Facing Ruin in America's Forever Chemicals Crisis*, The Guardian (Mar. 22, 2022), https://www.theguardian.com/environment/2022/mar/22/i-dont-know-how-well-survive-the-farmers-facing-ruin-in-americas-forever-chemicals-crisis.

[96] For instance, Michigan has implemented a biosolids strategy that aims to reduce concentrations of PFOS and PFOA in biosolids. The presence of PFAS in biosolids intended for land application must be communicated to landowners, and those intending to apply biosolids containing over 50 ppb PFOS must mitigate the risk (for instance, by reducing application) and developing a source reduction program, while sludge containing over 150 ppb PFOS cannot be applied and a source reduction program must be implemented. Michigan, Maine, and some other states have established maximum concentrations of PFOS, PFOA, and PFBS that can be present in land-applied soil. The Connecticut Department of Agriculture advises not applying sludge with a combined PFAS concentration of over 1.4 ppb to farmland. Maine has outright banned application of sludge as fertilizer.

[97] U.S. EPA, *Nutrient Criteria Technical Guidance Manual: Estuarine and Coastal Waters* at xvii and 1-1 (Oct. 2001), https://www.epa.gov/sites/default/files/2018-10/documents/nutrient-criteria-manual-estuarine-coastal.pdf (hereinafter "EPA Nutrient Guidance").

[98] National Research Council, *Clean Coastal Waters – Understanding and Reducing the Effects of Nutrient Pollution*, Nat'l Acad. Press (2000); S.B. Bricker et al., *Effects of nutrient enrichment in the nation's estuaries: A decade of change*, *Harmful Algae* 8: 21–32 (2008).

specified designated uses and that includes narrative standards for aquatic life.[99] Nutrient pollution can cause increases in harmful algal growth, which in turn can result in reduced or depleted levels of oxygen, an imbalance of the ecosystem, public health concerns, loss of critical habitat for beneficial aquatic life, greatly reduced biodiversity, and a general decline in fish and aquatic life.[100] Harmful algal "blooms" (outbreaks) have been linked to major fish kills, significantly affecting local recreational and commercial fisheries.[101] Blooms of certain cyanobacterial species produce toxins that can cause disease and death of beneficial aquatic life and humans.[102] Depletion of dissolved oxygen can cause stress and death in bottom-dwelling organisms such as sessile, ecologically, and commercially important marine shellfish.[103] Moreover, all of these adverse impacts are exacerbated by warming waters inherent in climate change.

Chronic nutrient pollution and a related array of negative impacts are present in Puget Sound.[104] As acknowledged by Ecology on its own website and in the Permit Fact Sheet, "[d]ischarges of excess nutrients, particularly nitrogen, to Puget Sound from domestic wastewater treatment plants (WWTPs) are significantly contributing to low oxygen levels in Puget Sound." [105] Violations of dissolved-oxygen standards have been found so far in 194

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[99] National Research Council, *Clean Coastal Waters – Understanding and Reducing the Effects of Nutrient Pollution*, Nat'l Acad. Press (2000); S.B. Bricker et al., *Effects of nutrient enrichment in the nation's estuaries: A decade of change*, *Harmful Algae* 8: 21–32 (2008).

[100] EPA Nutrient Guidance at 1-1, 1-5; J.M. Burkholder & P.M. Glibert, *Eutrophication and oligotrophication*, *Encyclopedia of Biodiversity, Vol. 2* at 347–71 (2013).

[101] J.M. Burkholder, *Implications of harmful marine microalgae and heterotrophic dinoflagellates in management of sustainable marine fisheries*, Ecological Applications 8: S37–S62 (1998); EPA Nutrient Guidance at 4.

[102] *Toxic Cyanobacteria in Water: A Guide to Their Public Health Consequences, Monitoring, and Management* (I. Chorus & J. Bartram, eds. 1999), https://cdn.who.int/media/docs/default-source/wash-documents/water-safety-and-quality/toxic-cyanobacteria---1st-ed.pdf; EPA Nutrient Guidance at 1-1.

[103] *Toxic Cyanobacteria in Water: A Guide to Their Public Health Consequences, Monitoring, and Management* (I. Chorus & J. Bartram, eds. 1999), https://cdn.who.int/media/docs/default-source/wash-documents/water-safety-and-quality/toxic-cyanobacteria---1st-ed.pdf; EPA Nutrient Guidance at 1-1; *see also* Wash. Dep't of Ecology, *South Puget Sound Dissolved Oxygen Study Interim Data Report* at 13 (Dec. 2008); Wash. Dep't of Ecology, *Puget Sound and Straits Dissolved Oxygen Assessment* at 11 (2014).

[104] *See also* Univ. of Wash., Puget Sound Institute, https://www.eopugetsound.org/magazine/is/nutrients; Univ. of Wash., Puget Sound Institute, https://www.pugetsoundinstitute.org/2017/10/puget-sounds-growing-nutrient-problem/.

[105] Wash. Dep't of Ecology, Fact Sheet, Puget Sound Nutrient General Permit (Dec. 1, 2021), https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=434350; *see also* T. Khangoankar et al., *Analysis of Hypoxia and Sensitivity to Nutrient Pollution in Salish Sea*, Jour. of Geophysical Research (2018). More recent indications of Puget Sound being out of

designated areas within 46 bays, inlets and open-water sectors in Puget Sound, according to Ecology's Water Quality Assessment, the 303(d) list of impaired waters. Another 290 areas in 45 inlets are on the list for low-oxygen problems. According to Ecology, the Whidbey Basin section of Puget Sound, on which Everett is part and into which Everett discharges, is among the worst areas for dissolved oxygen problems. According to Ecology, approximately 20 percent of Puget Sound is currently not meeting water quality standards for dissolved oxygen and Ecology's Salish Sea Model shows parts of Puget Sound failing to meet the standards for 120+ days, one third of the year or more. Information from the Environmental Protection Agency ("EPA") confirms that dissolved oxygen standards are not being met in Puget Sound and that those conditions are trending worse, not better. https://www.epa.gov/salish-sea/marine-water-quality.

Ecology estimates over 69% of the nutrient pollution to the Sound is from WWTPs, like Everett, that discharge directly to Puget Sound, with 31% from "watershed sources" (which include WWTPs that discharge to rivers that are tributary to the Sound.)[106] The Puget Sound region (human population more than 4.5 million) is predicted to sustain a 40% increase (1.8 million more) by 2050.[107] Domestic wastewater contains a high proportion of biologically available nitrogen and phosphorus, to such an extent that sewage sources are considered much more potent and high-impact than other nutrient pollution sources.[108] As stated in Ecology's Puget Sound Nutrient General Permit ("PSNGP") Fact Sheet, "WWTPs are the dominant land-based dissolved inorganic nitrogen (DIN) source during the low flow (summer) months" and "cumulatively contribute to DO impairments in other locations due to the water exchange that

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balance from excess nutrients (nitrogen and phosphorus), which has been exacerbated by warming trends and other impacts of climate change, can be seen in the "Blob's" extreme adverse impacts on aquatic ecosystems in the northeastern Pacific Ocean, explosions of jellyfish populations, and ocean acidification interfering with shellfish being able to form shells. NOAA, *New marine heat wave emerges off West Coast, resembles "The Blob"* (2019), https://www.fisheries.noaa.gov/feature-story/new-marine-heatwave-emerges-west-coast-resembles-blob; Allegra Abramo, *Outdated sewage treatment is suffocating fish in Puget Sound*, InvestigateWest (Dec. 7, 2020), https://crosscut.com/environment/2020/12/outdated-sewage-treatment-suffocating-fish-puget-sound.

[106] Wash. Dep't of Ecology, *Puget Sound Nutrient Source Reduction Project, Volume 1: Model Updates and Bounding Scenarios, Pub. No. 19-03-001* (Jan. 2019), https://apps.ecology.wa.gov/publications/documents/1903001.pdf.

[107] Eleanor Ott, Wash. Dep't of Ecology, *Puget Sound Nutrient General Permit, ACWA Nutrients Permitting Workshop* at 7 (Oct. 27, 2020), https://www.acwa-us.org/wp-content/uploads/2020/11/Session-1-Ott.pdf.

[108] H.P. Jarvie et al., *Sewage-effluent phosphorus: A greater risk to river eutrophication than agricultural phosphorus?*, Science of the Total Environment 360: 246–53 (2006); H.K.G.R. Millier & P.S. Hooda, *Phosphorus species and fractionation – why sewage derived phosphorus is a problem*, Environmental Management 92: 1210–14 (2011); J.J. Venkiteswaran et al., *Quantifying the fate of wastewater nitrogen discharged to a Canadian river*, FACETS 4: 315–35 (2019).

occurs between basins."[109] Ecology has also clearly demonstrated the need to reduce WWTP nutrient discharges as an important path forward to controlling and reversing the devastating effects of nutrient pollution on Puget Sound.[110]

Everett is one of the top dischargers of the nutrient pollution that is causing Puget Sound to fail to meet water quality standards,[111] yet this permit includes no limits or control requirements on nutrients from the Everett Plant. As a result, the proposed Permit fails to meet the most basic requirements of state and federal law.

B. The Permit Fails To Include Numeric Effluent Limits In Violation Of State And Federal Permitting Requirements.

The Permit makes no findings regarding AKART or reasonable potential to cause or contribute to violations of water quality standards and imposes no numeric effluent limits, AKART or otherwise, on nutrient discharges by the Everett Plant into Puget Sound. As currently drafted, the Permit is indefensible both legally and factually.

As set forth above, both federal and state law require imposition of effluent limits. Under state law, Ecology must determine all known, available, and reasonable treatment technology and require that all pollutants be prevented and treated with it, regardless of the status of the receiving water. It is Ecology's affirmative duty to assess and make a formal determination, when issuing a permit, as to what constitutes AKART and to then include that requirement in the permit.[112]

Ecology has failed to do so here. Ecology is, and plainly should be, aware that technology limiting nitrogen discharges to 3 mg/L and phosphorus in the range of 0.05 to 0.3 mg/L is known, reasonable, and in use (for decades) by wastewater dischargers elsewhere.[113] EPA has

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[109] Wash. Dep't of Ecology, Fact Sheet, Puget Sound Nutrient General Permit (Dec. 1, 2021) at 30, https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=434350.

[110] Wash. Dep't of Ecology, Fact Sheet, Puget Sound Nutrient General Permit (Dec. 1, 2021) at 18, https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=434350 (noting the significant contribution of domestic WWTPs to the increasingly pervasive dissolved oxygen deficits in Washington).

[111] *See*, *e.g.*, Wash. Dep't of Ecology, Puget Sound Nutrient General Permit S1, Table 3, https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=390719 (listing Everett as a "dominant" wastewater treatment plant based on its total inorganic nitrogen load).

[112] *Port of Seattle v. Ecology*, 2004 WL 2372063 (PCHB Oct. 18, 2004); *see also* Wash. Office of the Attorney Gen., *AGO 1983 No. 23, Relationship Between Federal and Waste Discharge Permits* at 9 (Nov. 2, 1983), https://www.atg.wa.gov/ago-opinions/relationship-between-federal-and-waste-discharge-permits.

[113] *See, e.g.,* Wash. Dep't of Ecology, Nutrient General Permit S.4.E.5.e, https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=390719; *see also* U.S. EPA, *Biological Nutrient Removal Processes and Costs, EPA Fact Sheet* (June 2007),

published multiple papers showing WWTPs achieving these levels of nutrient limitations in their effluent, all accessible through EPA's website. Treatment to 3 mg/L nitrogen and 0.05 to 0.3 mg/L phosphorus has been described as readily available and current technology.[114] Further, technologies that limit nitrogen to 3 mg/L and phosphorus to 0.3 mg/L have been identified in EPA documents as worthwhile and cost-effective in terms of cost relative to pollutants removed and water quality benefits achieved.[115] This is not "new" technology. EPA's assessment of biological nutrient removal dates to 2007—well over a decade ago. Other facilities, in states such as Florida, Virginia, and Michigan, have been meeting 3 mg/L nitrogen and 0.3 mg/L phosphorus limits, or lower, since the mid-2000s. Biological nutrient removal to 3 mg/L nitrogen and at least 0.3 mg/L phosphorus is AKART and must be required for Everett as an effluent limit in this Permit.[116]

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https://19january2017snapshot.epa.gov/sites/production/files/documents/criteria_nutrient_bioremoval.pdf. EPA's fact sheet on biological nitrogen removal notes that some facilities may be able to achieve nitrogen concentrations below 3 mg/L due to site-specific conditions.

[114] To the extent that Ecology or Everett argue that only nitrogen need be controlled, that position is unsupported by the best available science on nutrient impacts and the need to control both pollutants in balance. Nutrient pollution affects aquatic ecosystems—through *supplies (concentrations)* of <u>both</u> nitrogen and phosphorus, and through the *balance or proportion* of N and P supplies, commonly considered as the N:P ratio. R.W. Sterner & J.J. Elser, *Ecological Stoichiometry: The Biology of Elements from Molecules to the Biosphere* (Princeton Univ. Press, 2002); J.M. Burkholder & P.M. Glibert, *Eutrophication and oligotrophication*, *Encyclopedia of Biodiversity, Vol. 2* at 347–71 (2013). To protect and improve aquatic ecosystems degraded by nutrient pollution, the highly bioavailable forms of nitrogen and phosphorus in domestic sewage must be co-managed; that is, they must be significantly decreased in concentration, and in the right proportion to re-establish the Sound's N:P balance. P.M. Glibert et al., *Ecological stoichiometry, biogeochemical cycling, invasive species and aquatic food webs: San Francisco Estuary and comparative systems,* Reviews in Fisheries Science 19: 358-417 (2011); U.S. EPA, *Preventing Eutrophication: Scientific Support for Dual Nutrient Criteria, Fact sheet #EPA-820-S-15-001* (2015).

[115] In fact, using current technology, it is possible to remove effluent Total Inorganic Nitrogen ("TIN") to less than 1 mg/L after coagulation and filtration. Even allowing for residual recalcitrant dissolved organic nitrogen—dissolved organic nitrogen that is not removed during the wastewater treatment process—of 0.5 to 1.5 mg/L in municipal wastewater, an effluent limit for total nitrogen of less than 3 mg/L can be achieved. James. L. Barnard, *Biological Nutrient Removal: Where we have been, Where we are going?*, Water Environment Federation, WEFTEC (2006).

[116] Total nitrogen, not Total Inorganic Nitrogen ("TIN"), must be the pollutant controlled to 3 mg/L. While TIN is well known to stimulate algal growth, *organic* nitrogen constituents in the total Kjeldahl N (TKN) component of the effluents include stimulatory substances as well. P.M. Glibert et al., *Ecological stoichiometry, biogeochemical cycling, invasive species and aquatic food webs: San Francisco Estuary and comparative systems,* Reviews in Fisheries Science 19: 358-417 (2011); P.M. Glibert et al., *Pluses and minuses of ammonium and nitrate uptake and assimilation by phytoplankton and implications for productivity and community*

To the extent that, based upon past statements, Ecology or the discharger argues that more must be known about Everett's specific contribution (or cause) of nutrient pollution and/or low dissolved oxygen before including limits in the permit, that position is contrary to law. Again, AKART is required to be applied to all discharges of pollutants authorized by any NPDES permit, including this one, *regardless* of the quality of the receiving water and/or Everett's specific impact on that quality. RCW 90.48.520; 90.54.020(b). AKART is effluent limits of 3 mg/L nitrogen and 0.3 mg/L phosphorus, regardless of receiving water quality.[117]

The Permit's failure to include effluent limits of 3 mg/L nitrogen and 0.3 mg/L phosphorus is a violation of RCW 90.48.010; 90.48.520; 90.54.020 and WAC 173-226-070, and of 40 C.F.R. §§ 122.44(a) and 122.45(d).

C. The Permit Fails To Ensure That Discharges Authorized Under The Permit Do Not Cause Or Contribute To Violations Of Water Quality Standards.

Independent of the failure to include limits that are AKART, the Permit also violates the requirements to ensure that pollutant discharges authorized by the permit do not cause or contribute—or even have the *potential* to cause or contribute—to a violation of water quality standards, either narrative or numeric. Ecology admits that large areas of Puget Sound already violate numeric standards for dissolved oxygen.[118] It is likely that the areas of impairment—violations of dissolved oxygen standards—are much more extensive than reflected on the latest section 303(d) list of impaired waters or than monitored to date.[119] Further, narrative standards are plainly violated considering the incidence of algal blooms, acidification, and related adverse

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composition, with emphasis on nitrogen-enriched conditions, Limnology and Oceanography 61: 165–97 (2016). For example, urea is the major organic component of human urine. Various harmful algae, including well-known bloom formers in Puget Sound such as *Heterosigma akashiwo*, can thrive on urea as a nitrogen source. P.M. Glibert et al., *Escalating worldwide use of urea – a global change contributing to coastal eutrophication*, Biogeochemistry 77: 441–63 (2006). Urea has also been related to increased toxicity of harmful taxa such as *Pseudo-nitzschia australis*, important in West Coast blooms. M.D.A. Howard et al., *Nitrogenous preference of toxigenic Pseudo-nitzschia australis (Bacillariophyceae) from field and laboratory experiments*, Harmful Algae 6: 206–17 (2007). A limit on TIN only will not be protective of the Sound ecosystem.

[117] It should be noted that as low as .1 mg/L phosphorus is achieved at other WWTPs and could be considered AKART, but experts consulted by Puget Soundkeeper have noted that achieving the proper balance between nutrient pollutants is important and that .3 mg/L phosphorus achieves that balance.

[118] *See*, *e.g.*, Wash. Dep't of Ecology, Fact Sheet, Puget Sound Nutrient General Permit at 25–27 (Dec. 1, 2021), https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=434350 (describing history of dissolved oxygen impairments in Puget Sound).

[119] *See* Wash. Dep't of Ecology, Fact Sheet, Puget Sound Nutrient General Permit (Dec. 1, 2021), https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=434350.

impacts to aquatic life, exacerbated by warming temperatures.[120] Chronic nutrient pollution to Puget Sound is impairing the designated uses of the Sound, resulting in harmful algal blooms, fish kills, contamination of seafood with algal toxins, and imbalances in the overall ecosystem. Those are violations of narrative standards that are supposed to protect the chemical, physical, and biological integrity of the Sound.

Ecology has already identified wastewater treatment plant polluters as the dominant cause of dissolved oxygen violations (and likely the cause of narrative standard violations) in the Sound.[121] Further, at a minimum, even if a polluter is not the "cause," further addition of nutrients to this already impaired and failing ecosystem will contribute to ongoing violations of water quality standards. This situation must be addressed with numeric WQBELs in the Permit. 40 C.F.R. § 122.44(d); RCW 90.48.520; WAC 173-201A-510(1); WAC 173-226-070(2), (3). Finally, it is not necessary for Ecology to pinpoint either cause or contribution to a particular degree of certainty. The law requires Ecology to impose WQBELs where there is even the *potential* that a polluter may cause or contribute to an excursion of water quality standards. *Id.*[122] (Although given the sheer size of Everett's nutrient pollution output and the proximity to extremely polluted areas in the area of Puget Sound to which Everett discharges, Everett's contribution to polluted conditions appears likely.) At the minimum, Ecology must set effluent limits on wastewater polluters at levels that will no longer contribute to water quality impairments. That step is critically needed to restore the Sound's ecosystem and create needed resiliency for the expected additional impacts of climate change.

Ecology has failed to do the required analysis for WQBELs and has failed to include a WQBEL in Everett's permit. Ecology has impermissibly done so despite knowing standards are

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[120] Ecology has been negligent in developing numeric criteria for nutrients in Puget Sound. More than twenty years ago, the National Research Council and EPA identified a critical need for states to develop numeric nutrient criteria for U.S. waters. *E.g.*, National Research Council, *Clean Coastal Waters – Understanding and Reducing the Effects of Nutrient Pollution*, Nat'l Acad. Press (2000). Even then, the problem of nutrient pollution was well-known and adversely affecting all of the nation's waters. EPA provided extensive guidance and research to aid states in carrying out their obligations under 33 U.S.C. § 1313(c). *See* U.S. EPA, Office of Water and Office of Science and Technology, *Nutrient Criteria Technical Guidance Manual: Lakes and Reservoirs, Report EPA-822-B00-001* (2000), https://www.epa.gov/sites/default/files/2018-10/documents/nutrient-criteria-manual-lakes-reservoirs.pdf.

[121] See Ecology's application of the Salish Sea Model (SSM) as described in the PSNGP Fact Sheet. Wash. Dep't of Ecology, Puget Sound Nutrient General Permit Fact Sheet, https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?Id=434350.

[122] Plainly this language is meant to address Ecology's failure to include WQBELs in this Permit. Delays in controlling pollutants can always occur where polluters or reluctant regulators search for the perfect information. That kind of delay in controlling pollutants is directly contrary to the very intent and purpose, as well as specific directives, in the Clean Water Act and applicable regulations which is to be proactive, to protect (not just restore after the fact), and to be action-forcing in that protection.

currently violated, WWTPs including Everett are a cause of or contributors to that violation, that nutrient pollution discharges will continue to make it worse and that only by limiting those discharges will we begin to fix violations of standards in Puget Sound. Ecology further knows that technology is available to impose effluent limits to at least curb some of that problem. The statutory and regulatory obligation is Ecology's, and the final permit must conform to this requirement and Ecology's obligation met. The Permit must include numeric WQBELs for all dischargers of nutrients to Puget Sound. Failure to do so violates 40 C.F.R. § 122.44(d) and RCW 90.48.520, WAC 173-201A-510(1), and WAC 173-226-070(2) and (3).

D. <u>Ecology Cannot Defer Permit Limits To An Indefinite, Unenforceable Alternative.</u>

Ecology cannot defer its legal obligations, under both state and federal law, to the Puget Sound Nutrient General Permit, which fails to impose any limit on nutrient discharges and thereby fails to conform to AKART and water quality requirements. Ecology claims in its statements regarding the Everett permit that nutrients are addressed elsewhere. This statement is for all intents and purposes, false.

First, due to ongoing litigation both indirect and direct challenging Ecology's regulation of nutrient pollution from wastewater treatment plants,[123] the Puget Sound Nutrient General Permit is indefinitely stayed in part,[124] and Ecology's ability to control nutrients through the PSNGP in the manner Ecology has chosen is in serious question. Second, the PSNGP also fails to meet the most basic requirements of the law in that it fails to apply AKART or effluent limits to the discharge of nutrients from dischargers such as Everett. The net result is that the PSNGP is not a viable or legal alternative to Ecology's clear legal obligation here to apply AKART to limit the discharge of nutrients by Everett WWTP to 3 mg/L total nitrogen and .3 mg/L phosphorus.[125]

[123] *See* Status Report from the Attorney General to the PCHB, *Puget Soundkeeper Alliance et al. v. Dep't of Ecology*, PCHB No. 21-082c (Oct. 16, 2023) (summarizing status of litigation); Published Opinion, *City of Tacoma et al. v. Dep't of Ecology*, No. 39494-8-III (Ct. App. Sept. 14, 2023) (summarizing litigation history); Dep't of Ecology, Petition for Review, *City of Tacoma et al. v. Dep't of Ecology*, No. 102479-7 (Wash. Oct. 16, 2023).

[124] *See* Am. Stip. For Partial Stay of Puget Sound Nutrient General Permit, *Puget Soundkeeper Alliance et al. v. Dep't of Ecology*, PCHB No. 21-082c (Mar. 4, 2022); Status Report from the Attorney General to the PCHB, *Puget Soundkeeper Alliance et al. v. Dep't of Ecology*, PCHB No. 21-082c (Oct. 16, 2023) (noting that Mar. 4, 2022 partial stay of Puget Sound Nutrient General Permit remains in effect).

[125] Ecology's claim that the general permit adequately addresses monitoring for nitrogen pollution is likewise false. The general permit does not require any monitoring for phosphorous or organic nitrogen, and requires only limited sampling for total inorganic nitrogen.

E. <u>The Permit Must Have Implementation Deadlines for the Plant to Meet Effluent Limits During this Permit Cycle.</u>

The permit must include implementation deadlines for the plant to upgrade it treatment methods to meet the effluent limits within this permit cycle. Nutrient pollution issues in the Sound, as well as treatment methods, are not new and the Plant should not be able to delay addressing this concerning pollution any further. Any planning and permitting must occur in the first year of the permit so that the Plant can shift to appropriate treatment methods by year four at the latest and fully meet the effluent limits by year five at the latest.

VI. CONCLUSION

The Permit does not require any reductions in Everett's discharge of PBDEs, PFAS, or nutrients, in violation of Ecology's legal obligations, and may ultimately result in increases to the pollution that is already harming the Snohomish River, salmon, Puget Sound, and orcas. Ecology must change the draft permit to ensure compliance with water quality standards and the law.

Thank you for the opportunity to submit comments on this critically important issue. Please do not hesitate to contact the undersigned with any questions.

Sincerely,

Patti Goldman

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RE Sources

Laurie Valeriano
Executive Director
Toxic-Free Future

Greg Wingard
Waste Action Project

A Toxics-focused Biological Observing System (T-BiOS)

Mission Statement:

Evaluate the effects of toxic contaminants on marine and anadromous species to:

- *guide efforts to protect fish and shellfish health,*
- *ensure seafood safety (supply data to DOH), and*
- *promote ecosystem recovery.*

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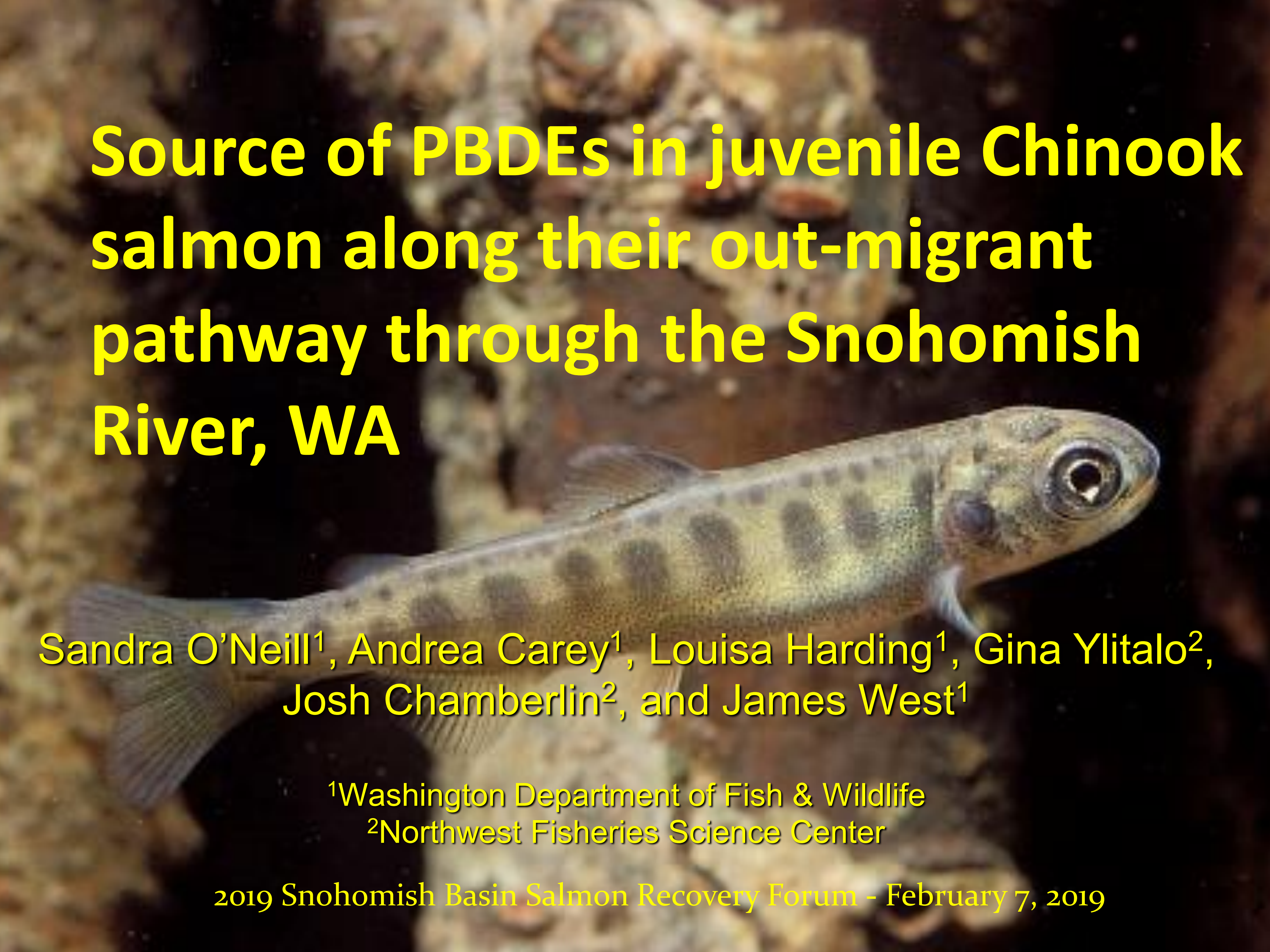

Source of PBDEs in juvenile Chinook salmon along their out-migrant pathway through the Snohomish River, WA

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Kathryn Sobzinski

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Sean Sol
Dan Lomax
Julann Spromberg
Maryjean Willis
Cathy Laetz
Penny Swanson
Casey Rice
David Baldwin
Mark Meyers
David Baldwin
Lyndal Johnson

Talk Outline

- Background – review results of previous studies
- 2016 Snohomish Survey Design
- Results- data types to investigate PBDE “source”
  - PBDE concentrations – where exposure occurs
  - Contaminant Fingerprints – wastewater vs. stormwater source
  - Stable Isotopes – altered nitrogen source – wastewater?
- Conclusions
- Next Steps

Background

Persistent Organic Pollutants (POPs)

Background

Effects of PBDEs on juvenile salmon are evaluated by laboratory exposure studies conducted by Arkoosh et al. 2010, 2018

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Disease susceptibility of salmon exposed to polybrominated diphenyl ethers (PBDEs)

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ABSTRACT

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Dietary exposure to a binary mixture of polybrominated diphenyl ethers alters innate immunity and disease susceptibility in juvenile Chinook salmon (*Oncorhynchus tshawytscha*)

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ARTICLE INFO

ABSTRACT

Salmon with elevated PBDEs have increased susceptibility to disease and altered thyroid function.

Background

PBDEs in Snohomish Chinook at levels high enough to increase their susceptibility to disease and alter thyroid function

Sloan et a. 2010

- 2006 study
- Snohomish plus Skagit, Duwamish, Elliott Bay, Columbia River
- PBDEs highest in salmon from Snohomish and 3 of 6 sites in Columbia River

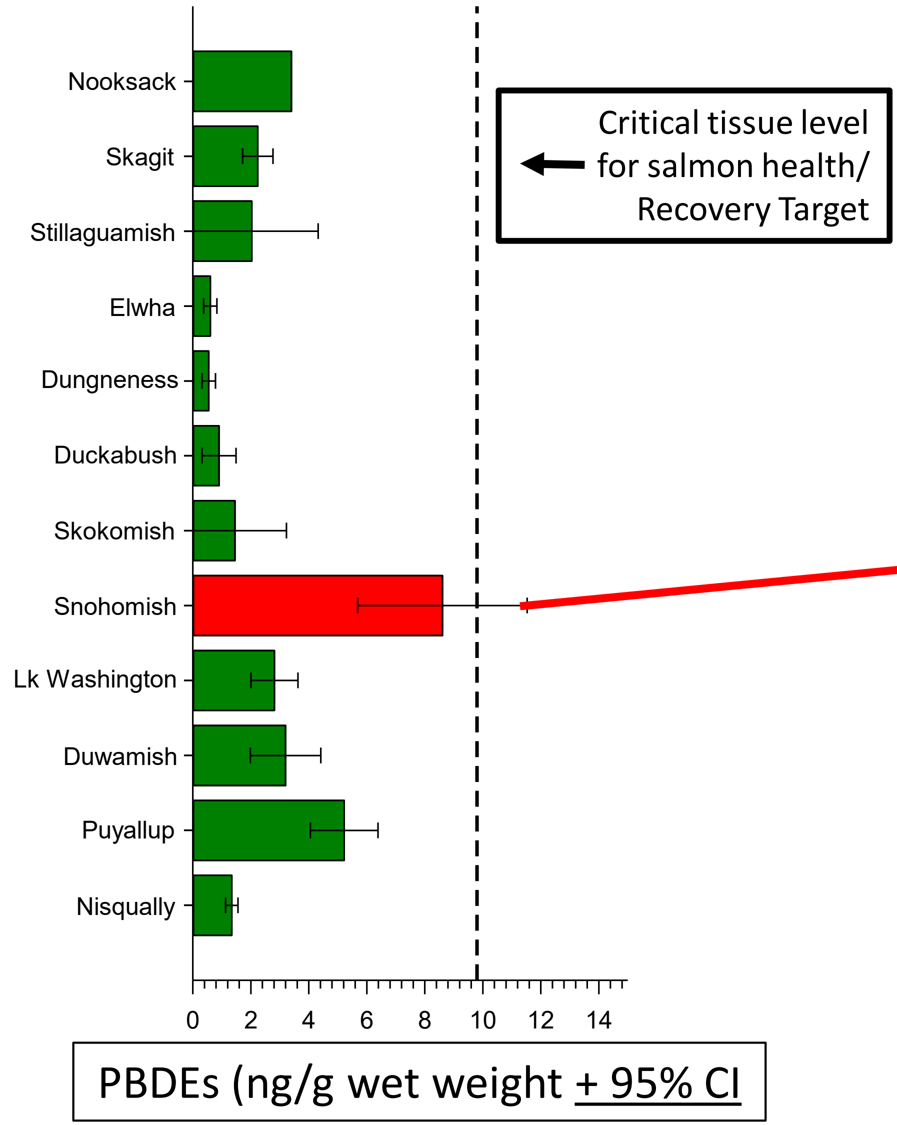
O'Neill et al. 2015

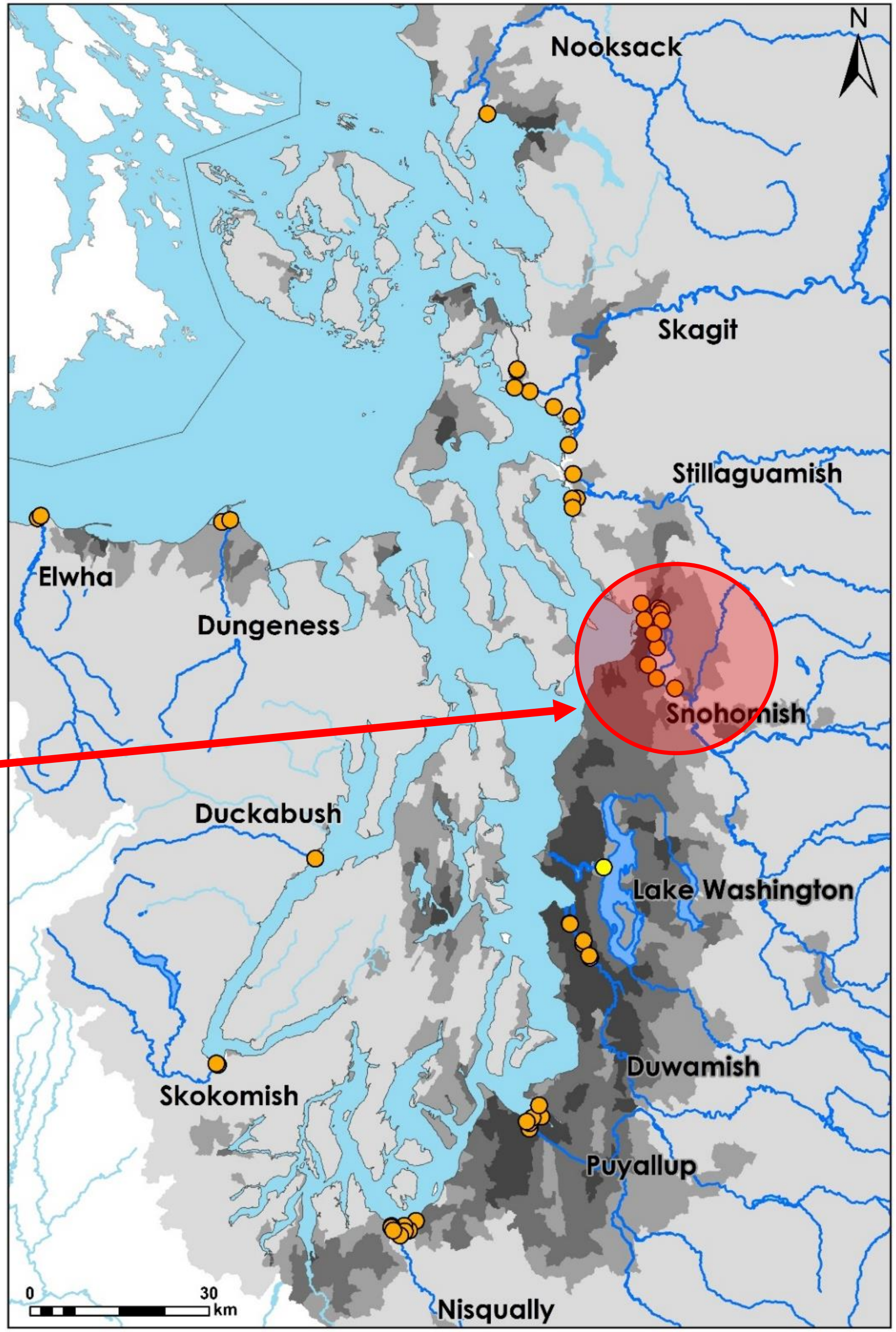
- 2013
- Snohomish plus Skagit, Duwamish, Comm. Bay, Nisqually
- PBDEs highest in fish from Snohomish

Sloan et al. 2010. Arch Environ Contam Toxicol 58:403–414

O'Neill et al. 2015. WDFW Report No FTP 16-02, 116 pages

High PBDEs in Snohomish Chinook Salmon





Talk Outline

- Background – review results of previous studies
- 2016 Snohomish Survey Design
- Results- data types to investigate PBDE “source”
  - PBDE concentrations – where exposure occurs
  - Contaminant Fingerprints – wastewater vs. stormwater source
  - Stable Isotopes – altered nitrogen source – wastewater?
- Conclusions
- Next Steps

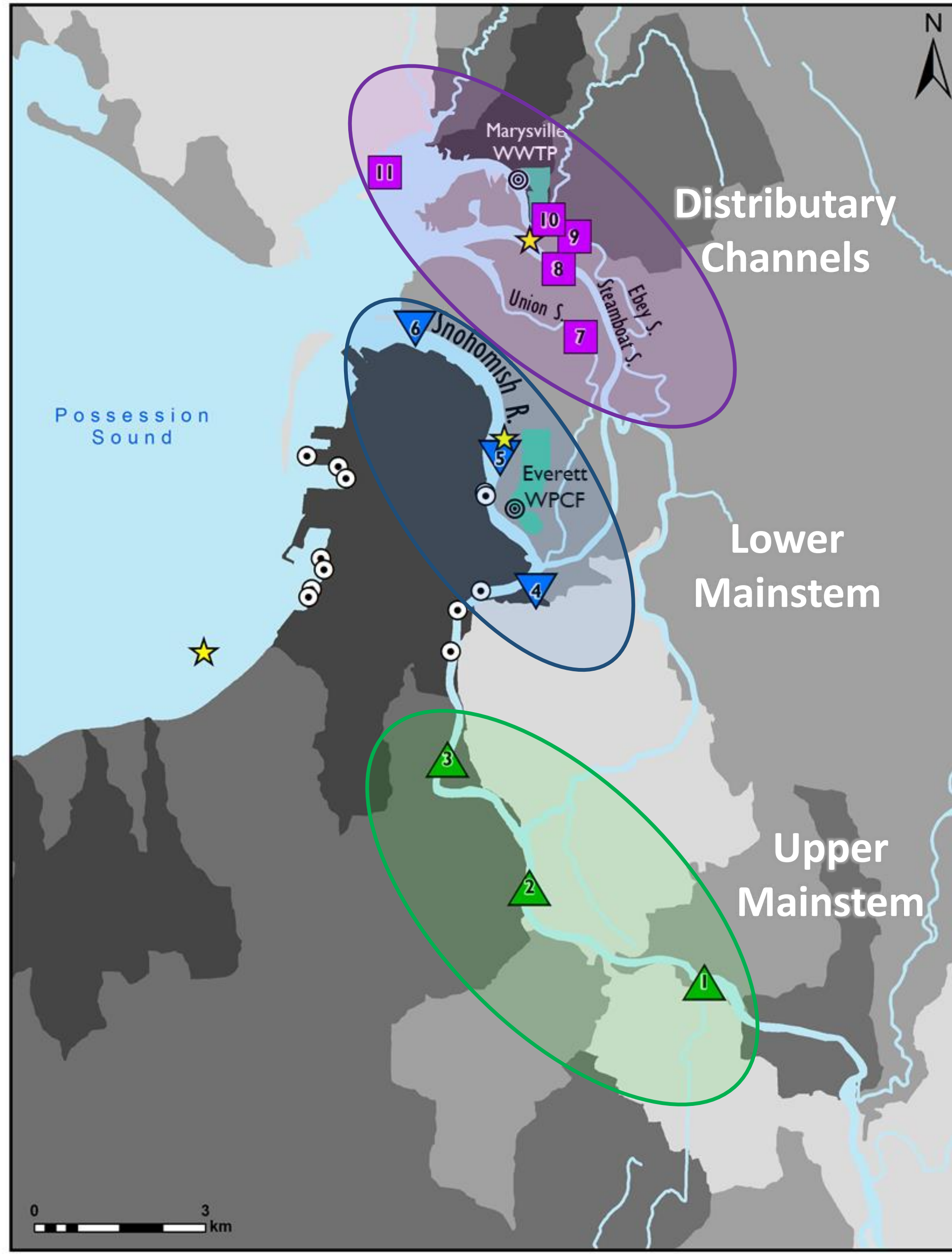
Snohomish River 2016 Study

Where are juvenile Chinook salmon exposed to and accumulating PBDEs?

- Upper Mainstem
- Lower Mainstem
- Distributary Channels

What is the "source" of PBDE inputs?

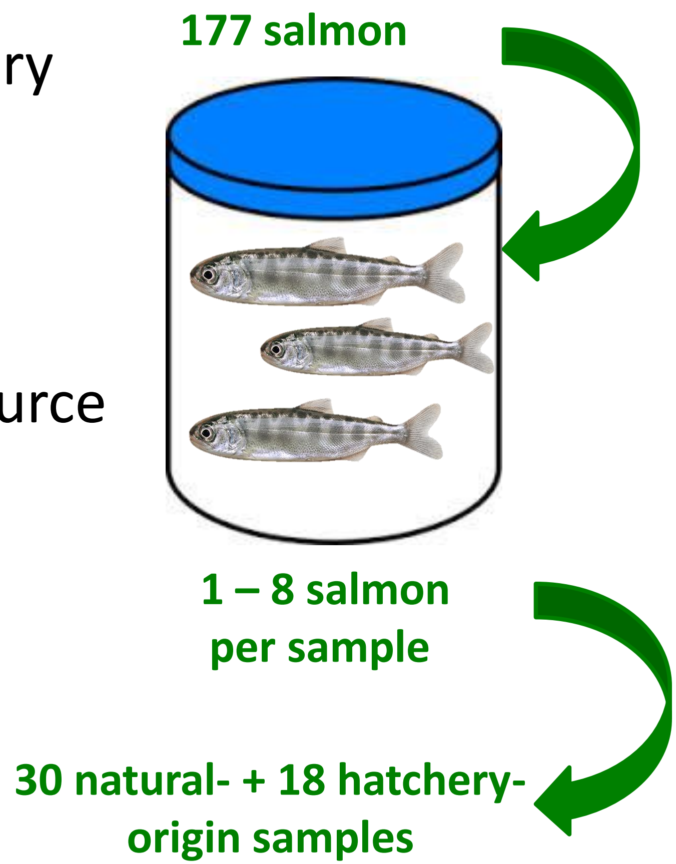
- wastewater (WWTP effluent, CSOs?)
- stormwater (storm drains, CSO, etc.?)



Snohomish River 2016 Study

Types of information collected for juvenile Chinook salmon

- Fish length, weight, origin, age, life history
- **Concentrations** of PBDEs, PCBs, DDTs
  - ✓ indicates where exposure occurs
- Contaminant **fingerprints**
  - ✓ indicates changes in contaminant source
- **Stable isotopes** of nitrogen
  - ✓ Indicates changes in nitrogen source



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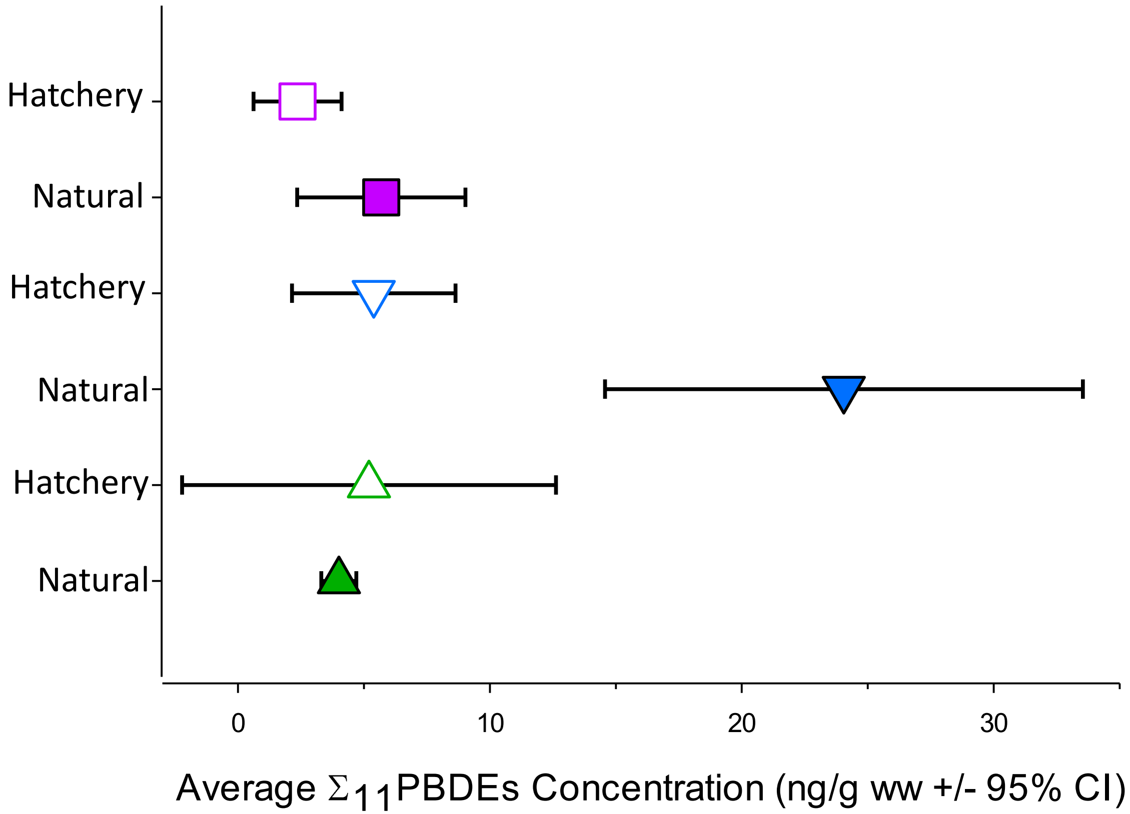
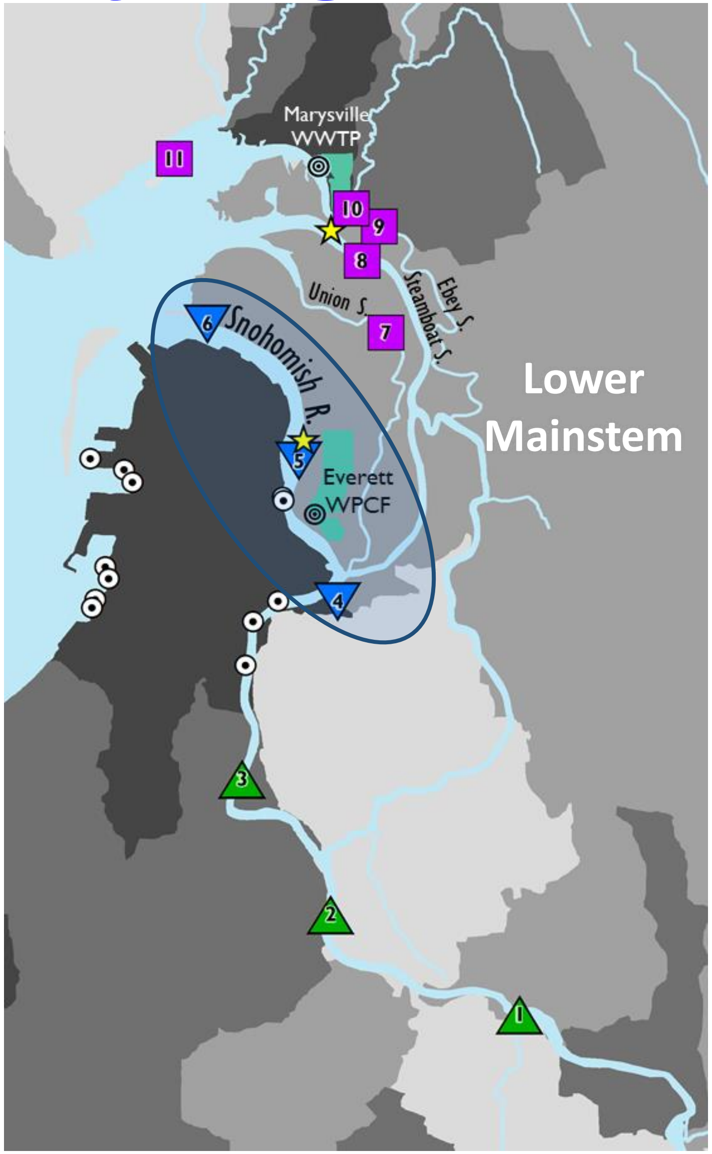
PBDE Concentrations by Region

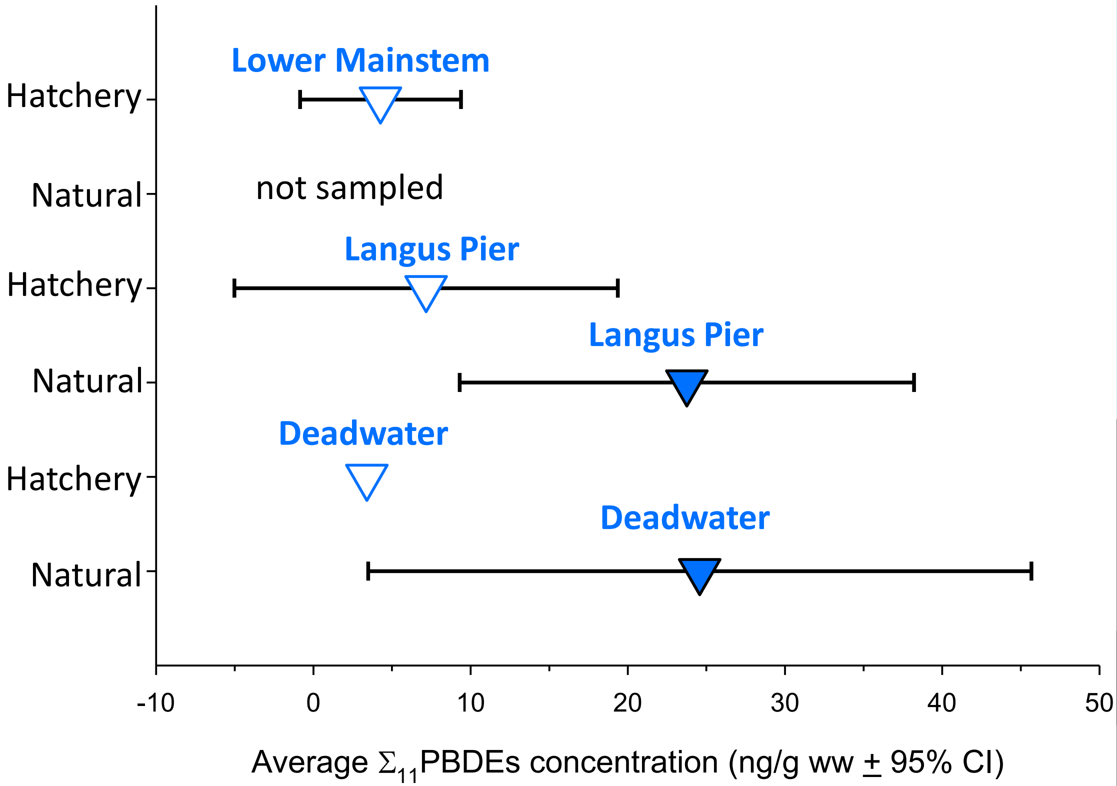
PBDEs were elevated in natural-origin Chinook salmon from the Lower Mainstem

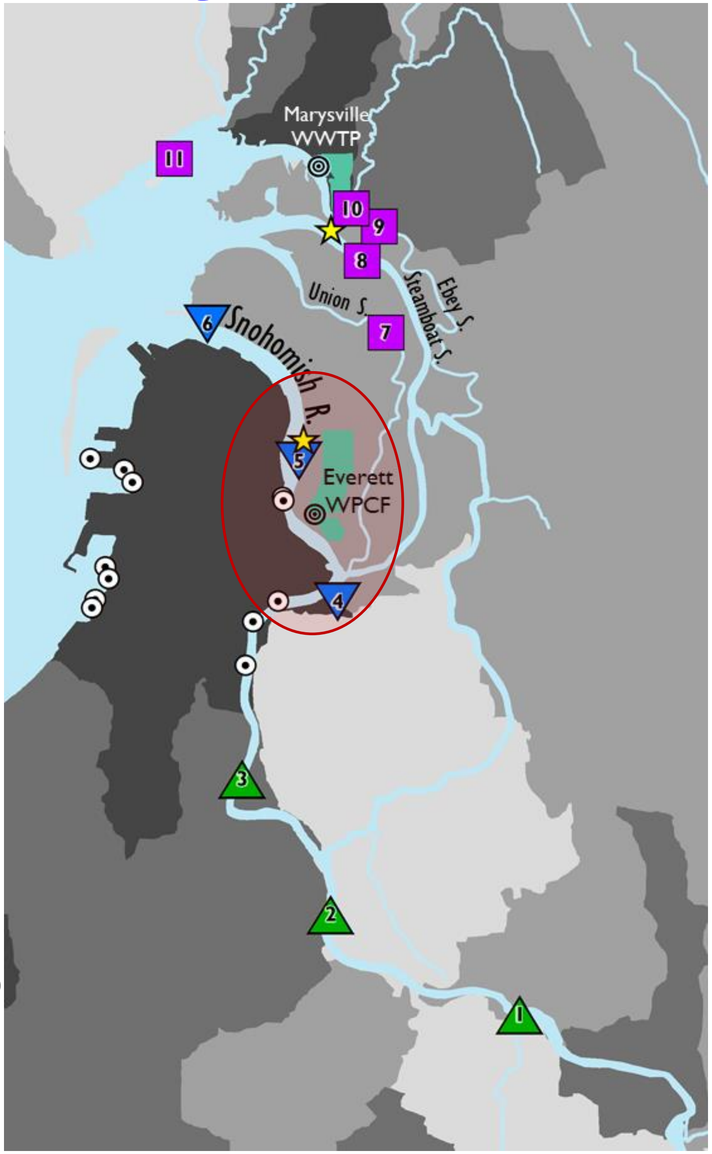




PBDE Concentrations by Site

PBDE concentrations are elevated in natural-origin Chinook from Langus Pier and Deadwater sites

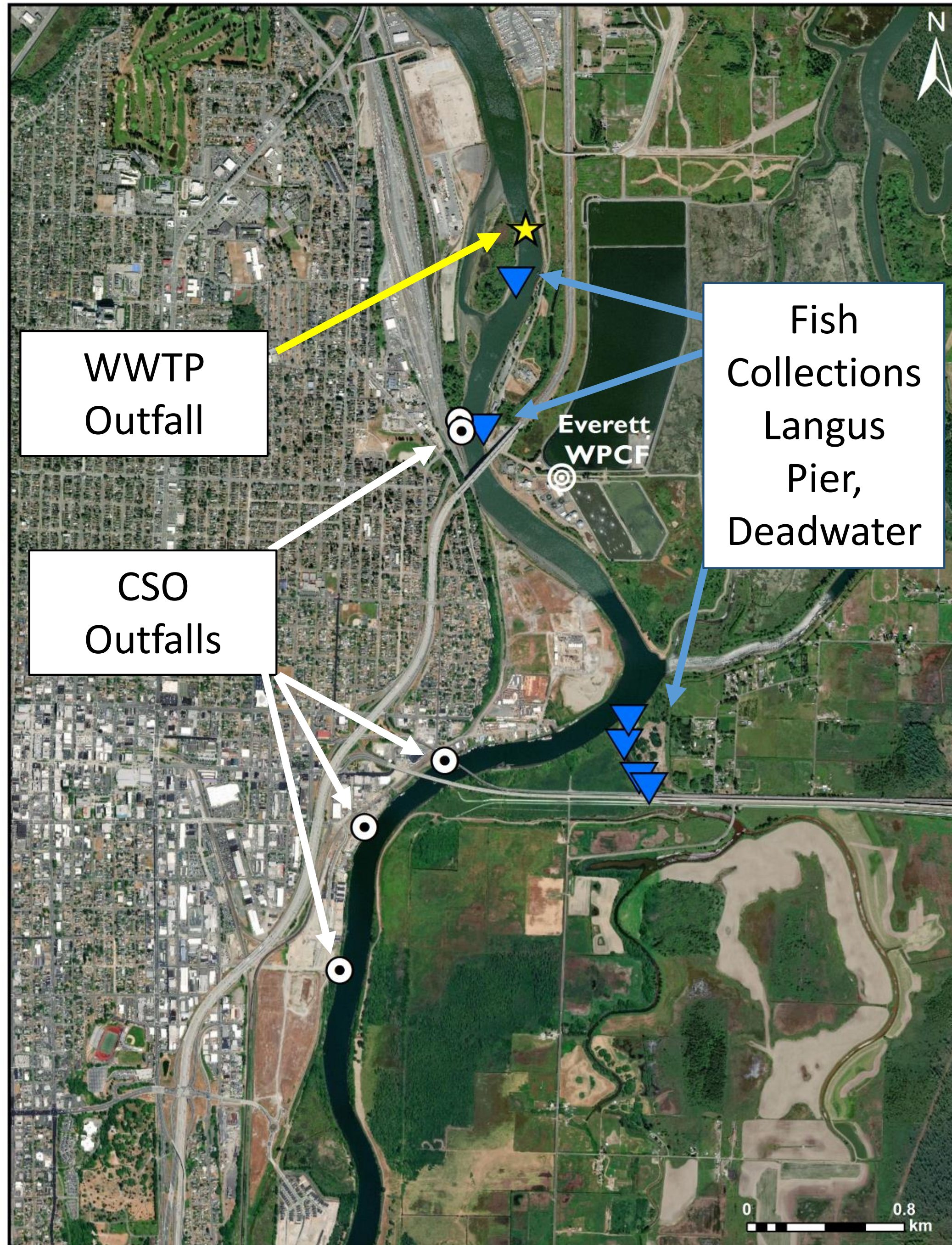




Sampling locations of fish with elevated PBDEs and WWTP outfall and CSOs

Sampling locations of fish with elevated PBDEs and WWTP outfall and CSOs

Sampling locations of fish with elevated PBDEs and WWTP outfall and CSOs

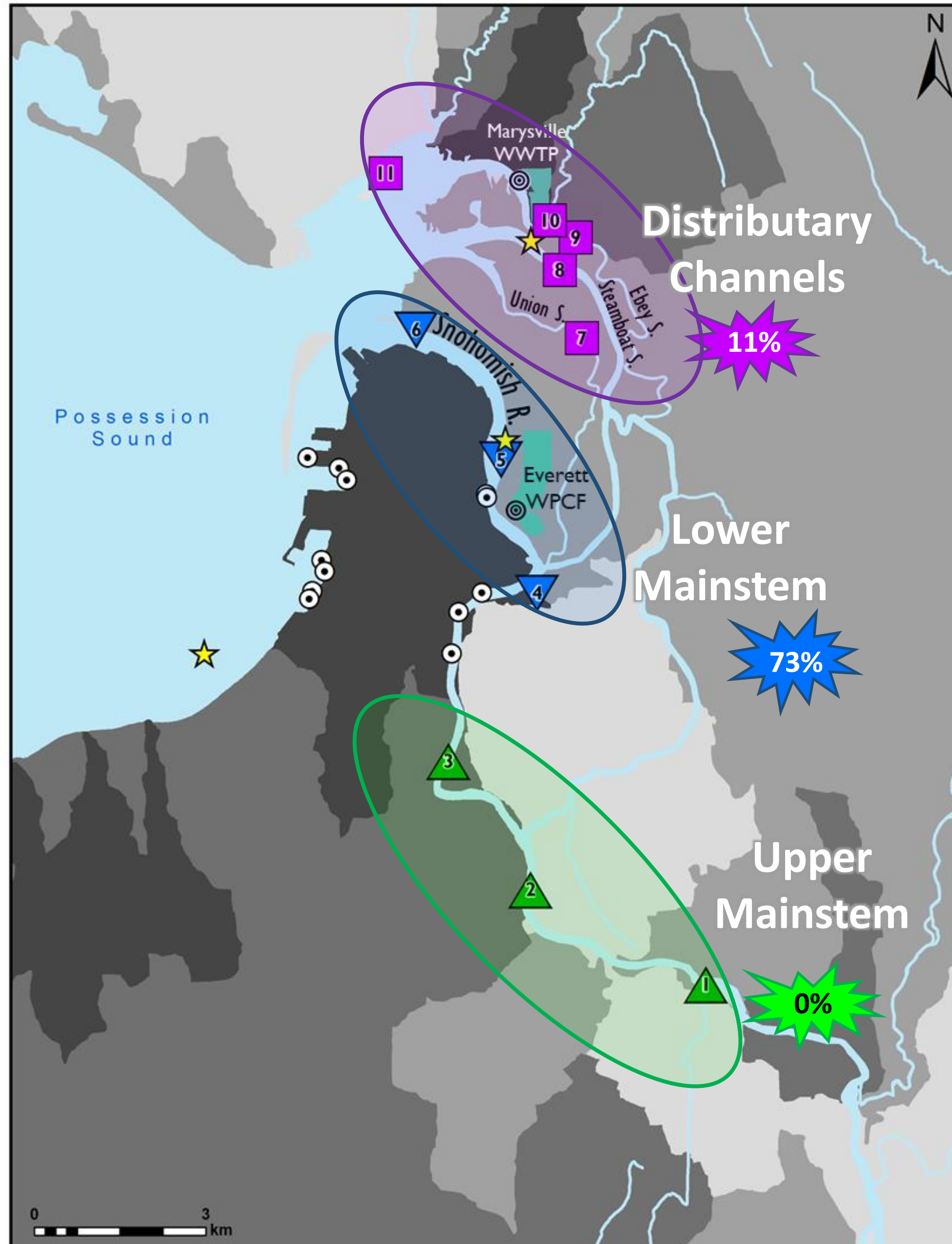


Adverse Effects of PBDEs: Juvenile Salmon Health

In dietary-exposure studies, juvenile Chinook with elevated PBDE concentrations had increased susceptibility to disease

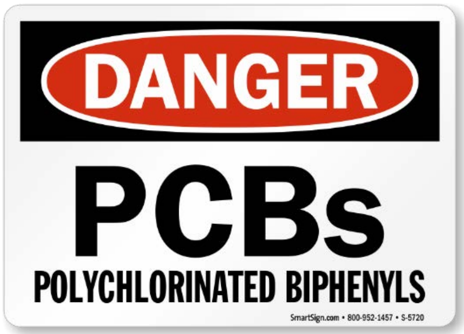
(Arkoosh et al. 2010, 2018)

In Snohomish River only natural-origin fish had PBDE concentration high enough to increase their susceptibility to disease!

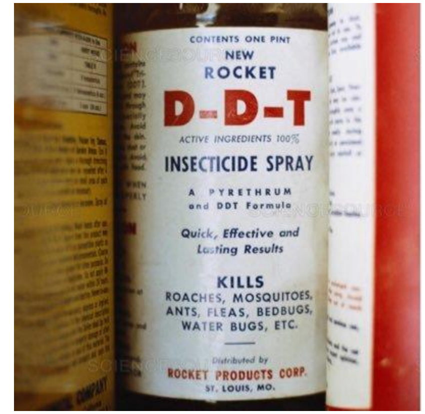


Based on wet weight concentrations

What about other Contaminants?



- elevated concentrations in salmon from Lower Mainstem region
- minor differences between natural- and hatchery-origin salmon



- low concentrations in salmon from all regions
- slightly higher concentrations in natural-origin salmon

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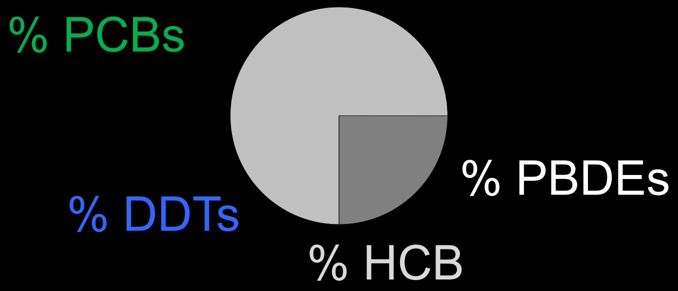
Source Identification
Using Contaminant Fingerprints

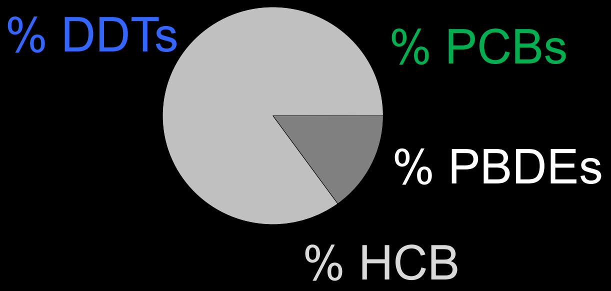
Aquatic environments have distinct patterns of persistent organic pollutants (POPs) based on inputs & environmental attributes

PCBs

DDTs

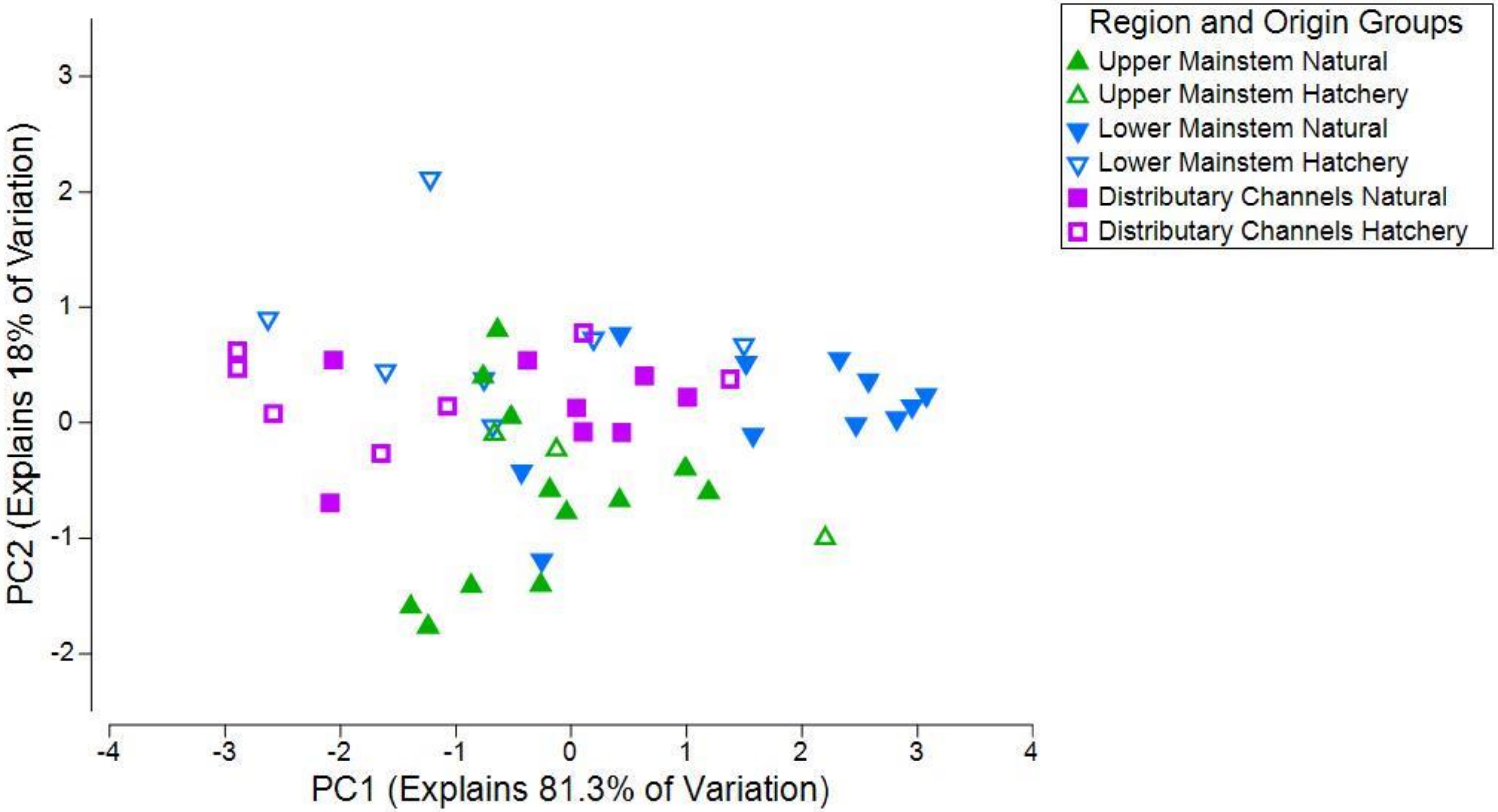
Biota foraging in regions with distinct POPs patterns accumulate specific POPs in proportion to their availability





POP Fingerprints in Chinook salmon

Higher proportion of PBDEs compared to PCBs and DDTs suggests a wastewater input ("source").



Increasing proportion PBDEs

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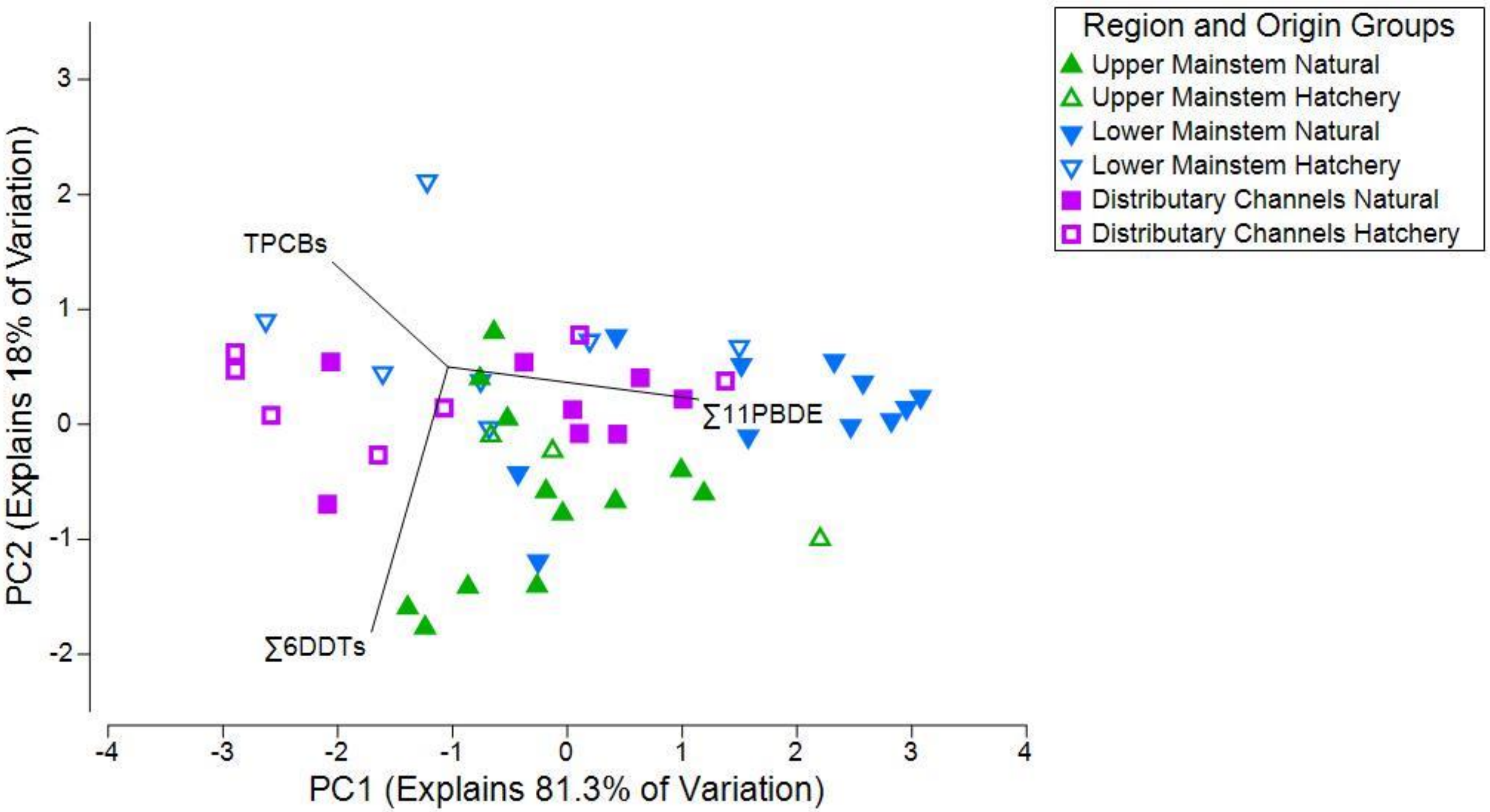

Increasing proportion PBDEs

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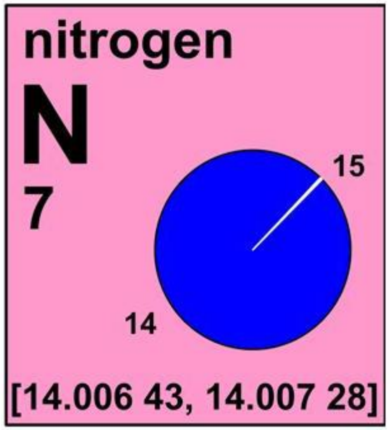
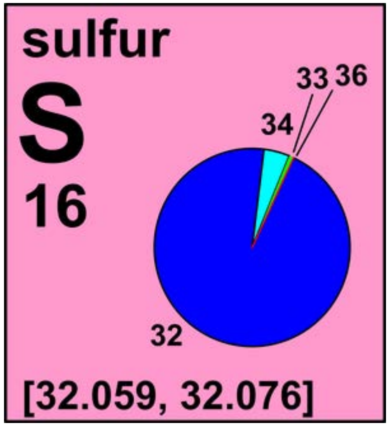
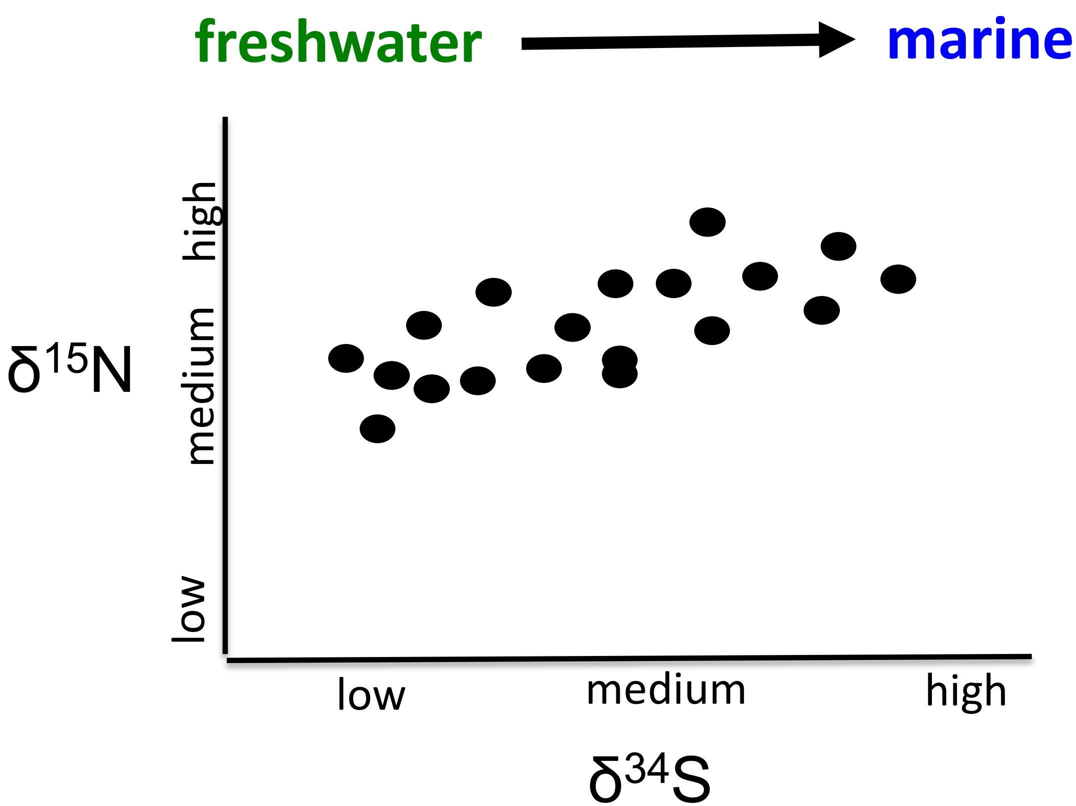
Stable Isotopes: Tools to infer food sources, habitat use & migrations





- Elements occur in various forms (isotopes).
- Stable isotopes of predators reflect characteristics and habitats of their prey.
- Heavier nitrogen isotopes enriched with trophic position but also varies with nitrogen source (fertilizers & wastewater).
- Heavier sulfur isotopes only slightly enriched with trophic levels but vary lots with types of producers.

Typical Stable Isotope Signatures in Migrating Juvenile Chinook

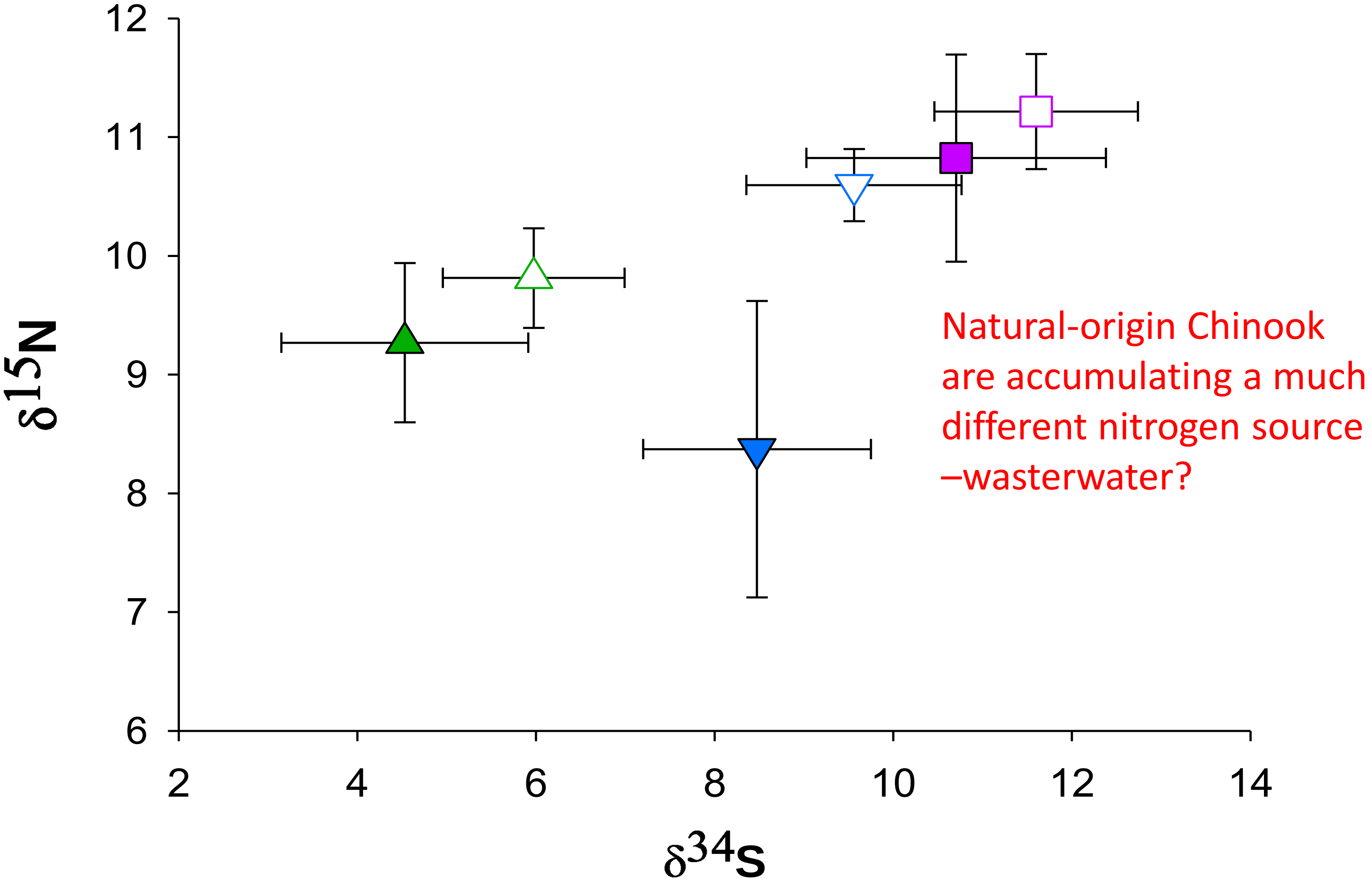


$\delta^{34}S$ becomes greatly enriched in salmon as the migrate towards marine waters but $\delta^{15}N$ is only slightly enriched

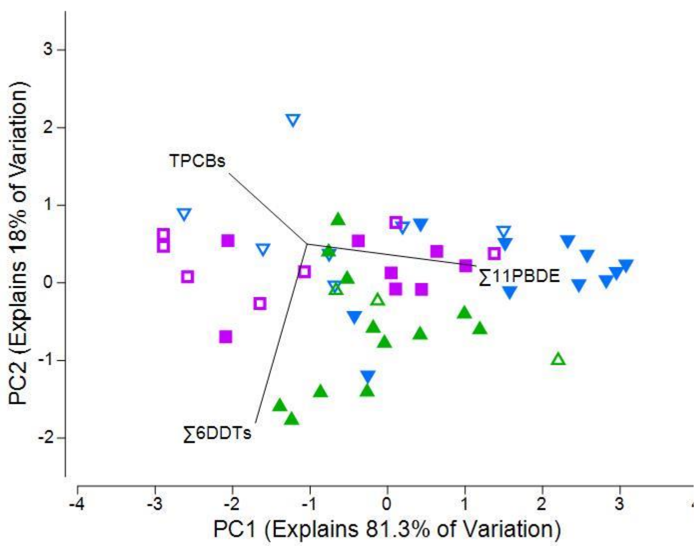
Adapted from Moore et al. 2016 MEPS 559:201-215

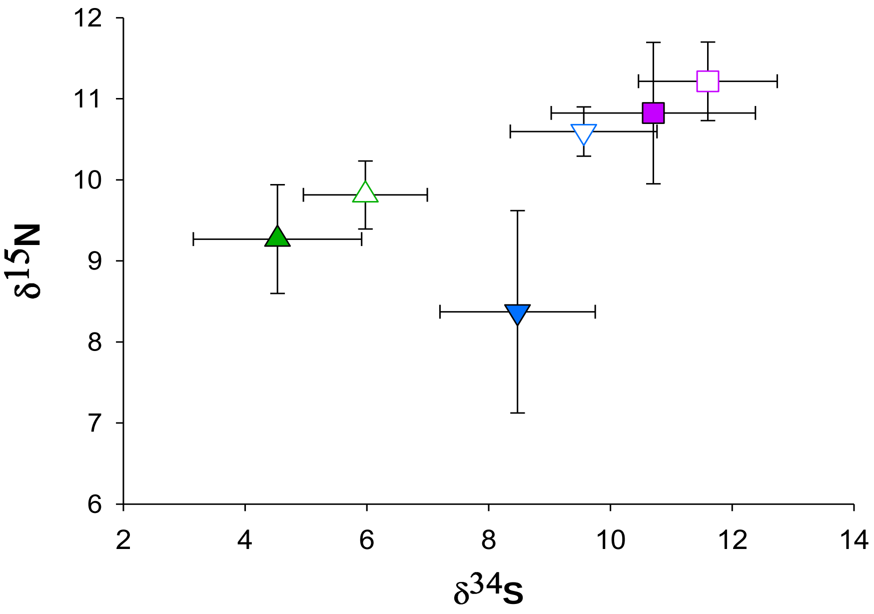
Altered Nitrogen Isotopes

in natural-origin Chinook from Lower Mainstem

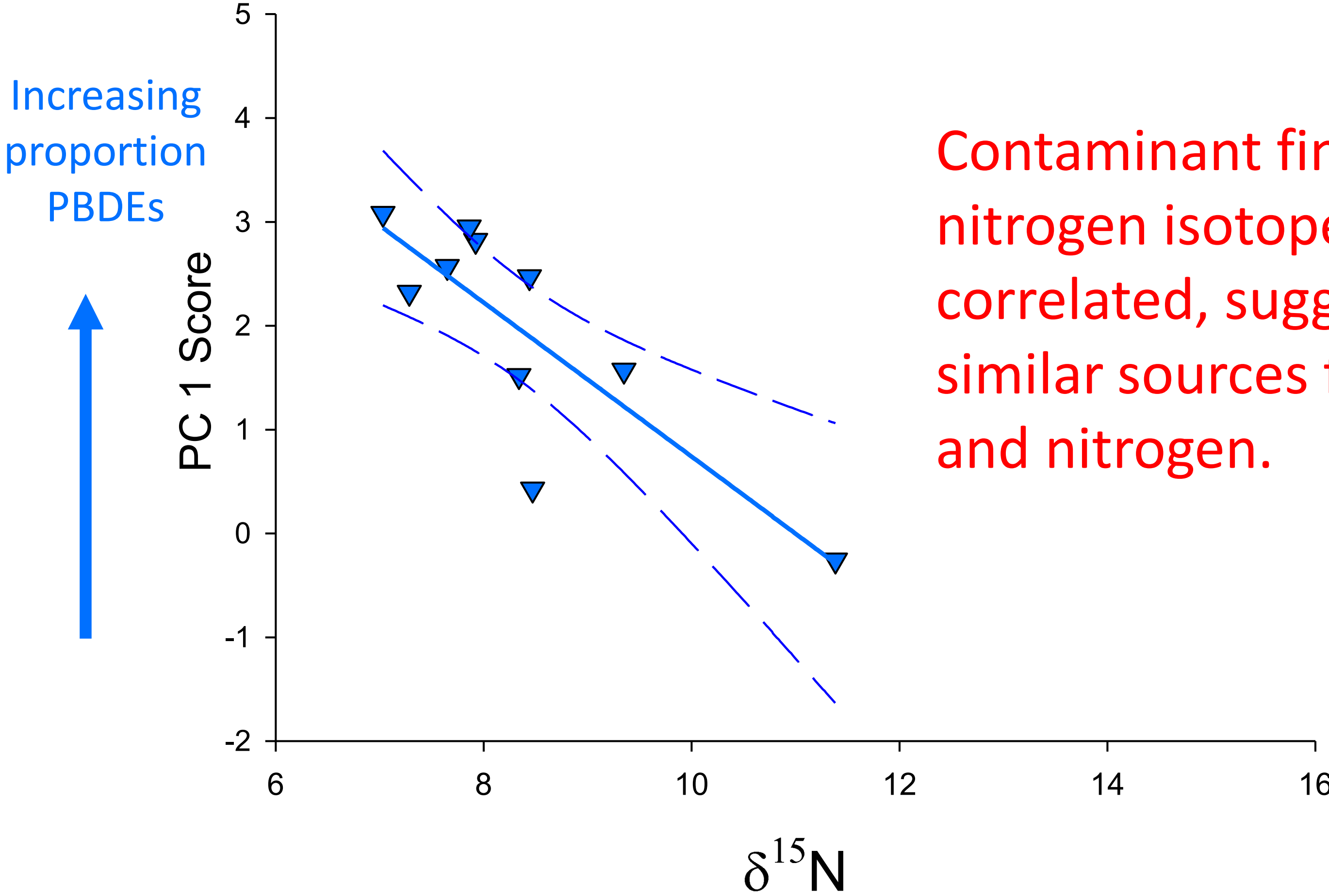


Is the nitrogen source related to contaminant fingerprint?





Sample with higher proportions of PBDES (PC1) have lower $\delta^{15}N$ (more altered nitrogen source)



Contaminant fingerprint and nitrogen isotope ratios are correlated, suggesting similar sources for PBDEs and nitrogen.

Possible Wastewater Sources

- WWTP effluent
  - Frequent discharge (avg 6.2 – 14.4 MGD)
  - nitrogen released as mostly as ammonium compared to nitrate and nitrite
  - other studies with similar release also show depleted $\delta^{15}N$
- CSOs
  - sporadic discharge (range 0.013 – 1.1 MGD)
  - nitrogen released as?

English Sole in Port Gardner

Arch Environ Contam Toxicol
DOI 10.1007/s00244-017-0383-z

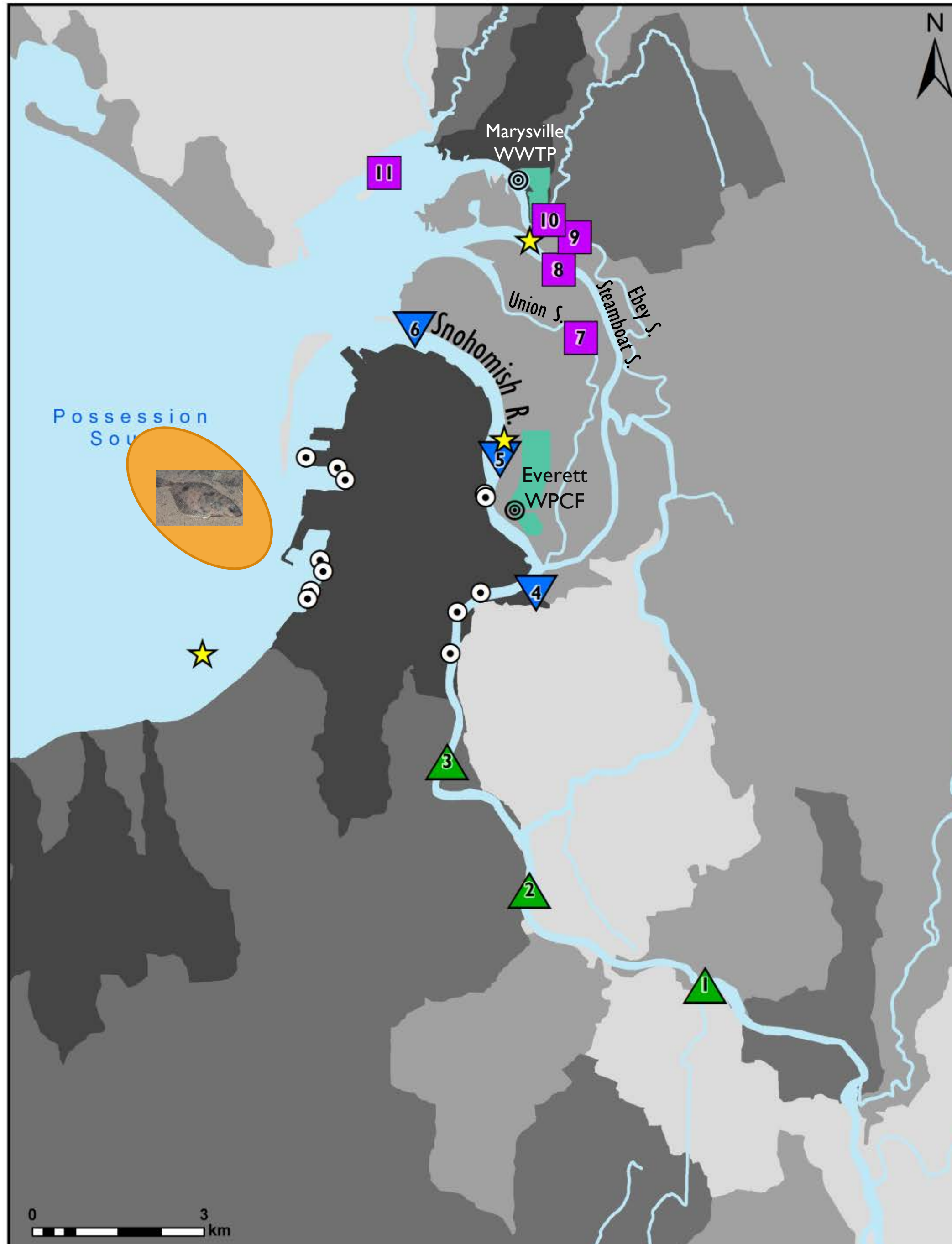
CrossMark

SPECIAL ISSUE: INDICATORS OF OCEAN POLLUTION

Time Trends of Persistent Organic Pollutants in Benthic and Pelagic Indicator Fishes from Puget Sound, Washington, USA

James E. West[1] · Sandra M. O'Neill[1] · Gina M. Ylitalo[2]

English sole from Port Gardner have elevated PBDE levels .



Conclusions ….

- Snohomish River is a PBDE hotspot for juvenile Chinook salmon.
- Highest PBDE exposure occurs in Lower Mainstem, in vicinity of WWTP outfall and CSOs.
- Natural-origin have higher PBDE levels than hatchery-origin Chinook, likely due to longer residence time of natural-origin fish.
- PBDE concentration in juvenile Chinook salmon are high enough to increase their susceptibility to disease, and possibly their marine survival.

Conclusions …

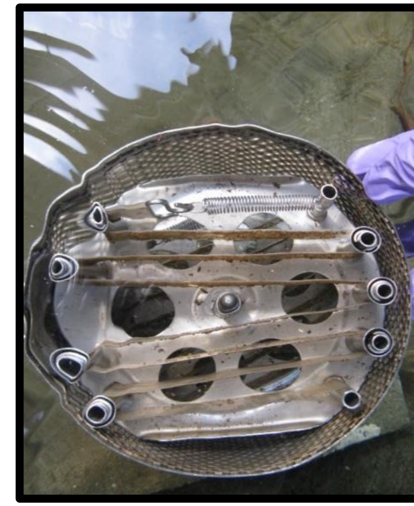
- Wastewater in the Lower Mainstem is likely source (pathway) of PBDEs to salmon:
  - Natural-origin Chinook from the Lower Mainstem have distinct contaminant fingerprints characterized by higher proportions of PBDEs than other POPs, consistent with input from wastewater source.
  - Natural-origin Chinook from the Lower Mainstem also have a distinct isotopic nitrogen ratio, suggesting of a different nitrogen source relative to other locations.
  - Contaminant fingerprint and nitrogen isotope ratios are correlated, suggesting similar sources for PBDEs and nitrogen.

- Loads from WWTP xx to xx times greater than CSOs but additional study needed to confirm which is a greater sources of PBDEs

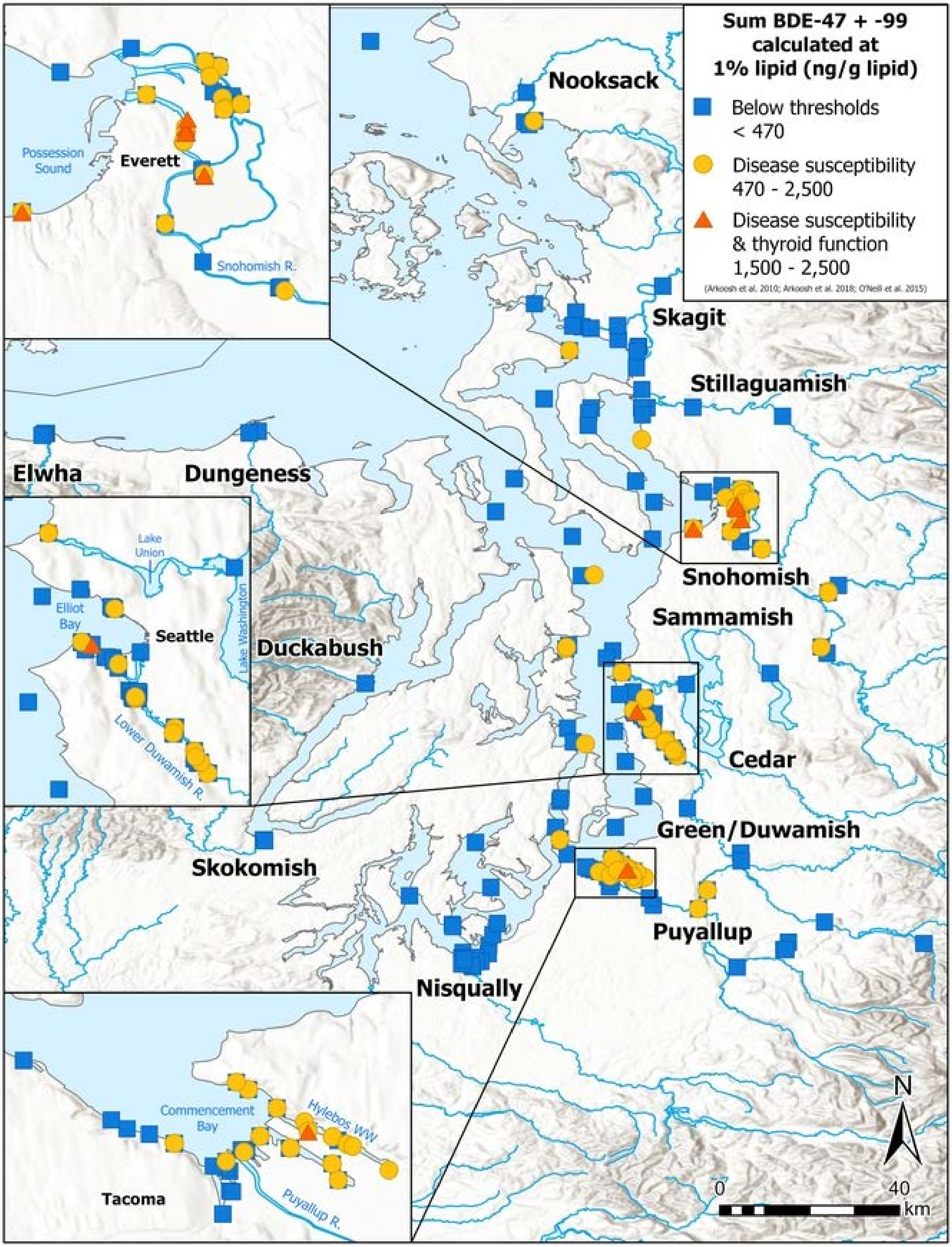
Next Steps…

1. Proposed NTA - basin-wide evaluation of PBDE in water (SPMDs) and biofilms/sediment to further define PBDE inputs:
   - sample during the first low-flow period (while WWTPs would be discharging),
   - follow-up sampling during high flow period with SPMDs and possibly other media.

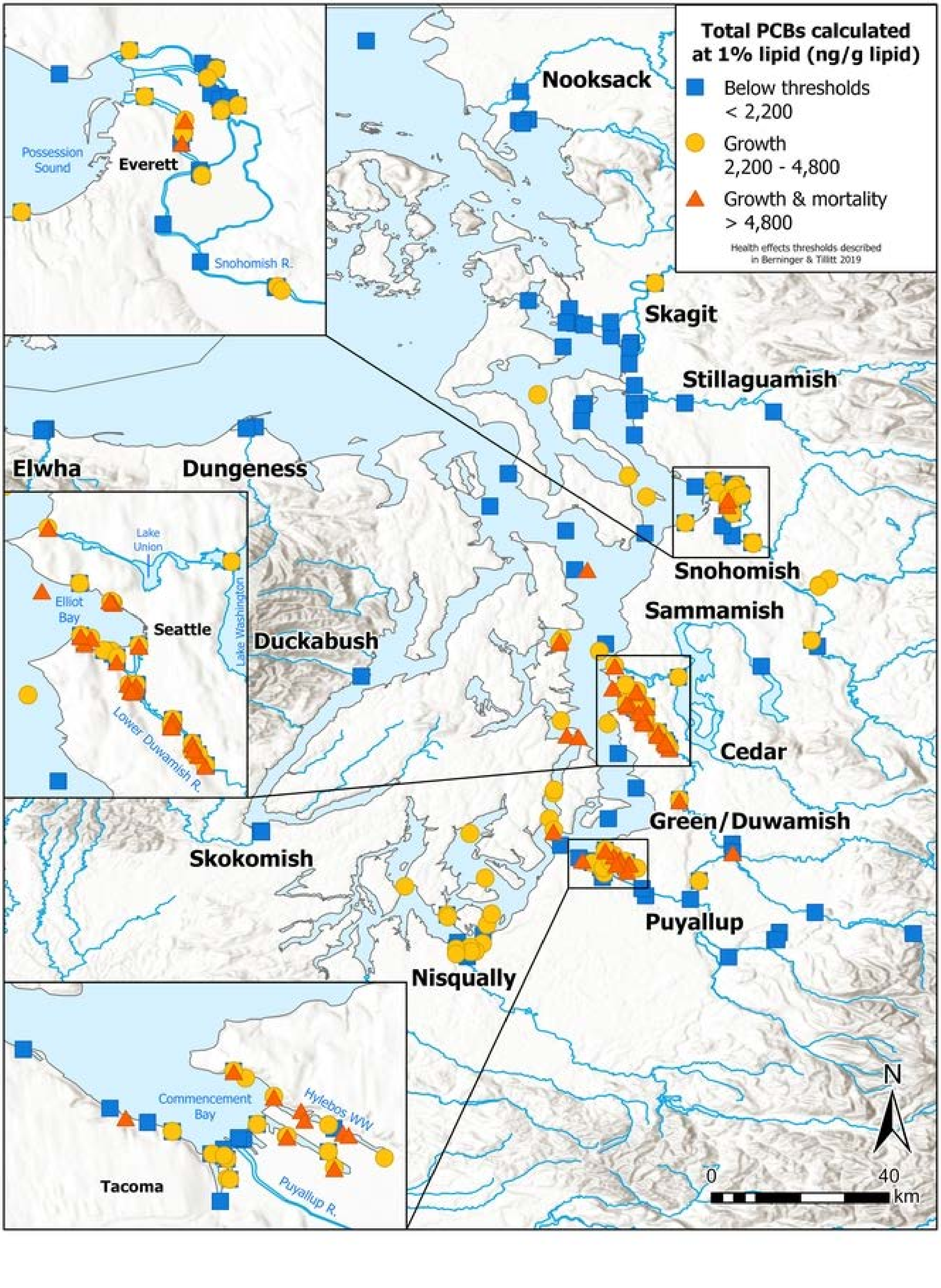
2. Measure PBDEs, other POPs, and nitrogen stable isotopes in WWTP effluent and CSO discharges??



Questions?



Sum BDE-47 + -99 calculated at 1% lipid (ng/g lipid)
Below thresholds < 470
Disease susceptibility 470 - 2,500
Disease susceptibility & thyroid function 1,500 - 2,500
(Arkoosh et al. 2010; Arkoosh et al. 2018; O'Neill et al. 2015)
Nooksack
Skagit
Stillaguamish
Snohomish
Sammamish
Cedar
Green/Duwamish
Puyallup
Nisqually
Skokomish
Duckabush
Dungeness
Elwha
Possession Sound
Everett
Snohomish R.
Lake Union
Lake Washington
Elliot Bay
Seattle
Lower Duwamish R.
Commencement Bay
Hylebos WW
Tacoma
Puyallup R.
N
0
40
km



Total PCBs calculated at 1% lipid (ng/g lipid)
Below thresholds
< 2,200
Growth
2,200 - 4,800
Growth & mortality
> 4,800
Health effects thresholds described in Berninger & Tillitt 2019
Nooksack
Skagit
Stillaguamish
Snohomish
Sammamish
Cedar
Green/Duwamish
Puyallup
Nisqually
Skokomish
Duckabush
Elwha
Dungeness
Possession Sound
Everett
Snohomish R.
Lake Union
Elliot Bay
Seattle
Lake Washington
Lower Duwamish R.
Commencement Bay
Hylebos WW
Tacoma
Puyallup R.
N
0
40
km

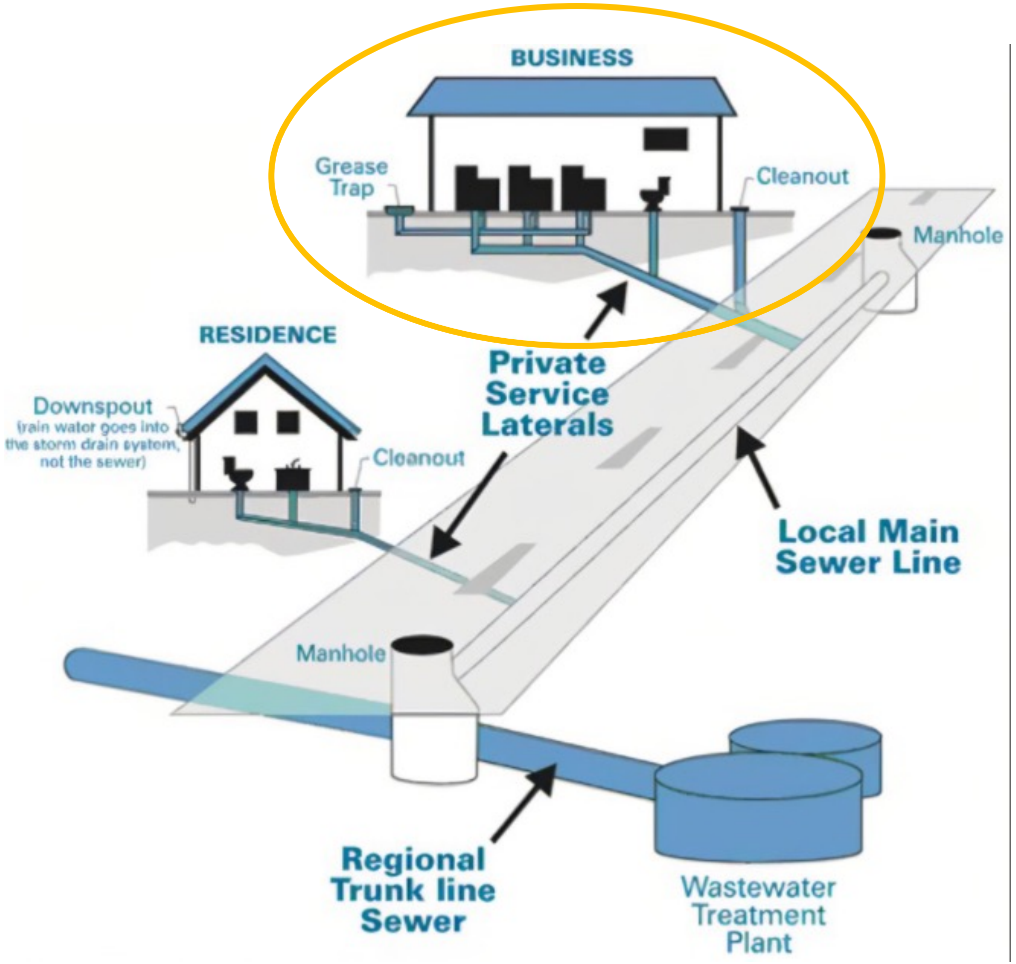
Sampling of Pretreated Industrial Wastewater in NW Washington

Siana Wong, EAP, and Maia Hoffman, WQ

February 3, 2022

DEPARTMENT OF ECOLOGY
State of Washington

Industrial Pretreatment and Permitting



- **Ecology issues permits to industrial facilities** discharging process wastewater to POTWs, implementing effluent limits and other permit conditions to **protect POTWs from pass through or interference that would impact water quality.**

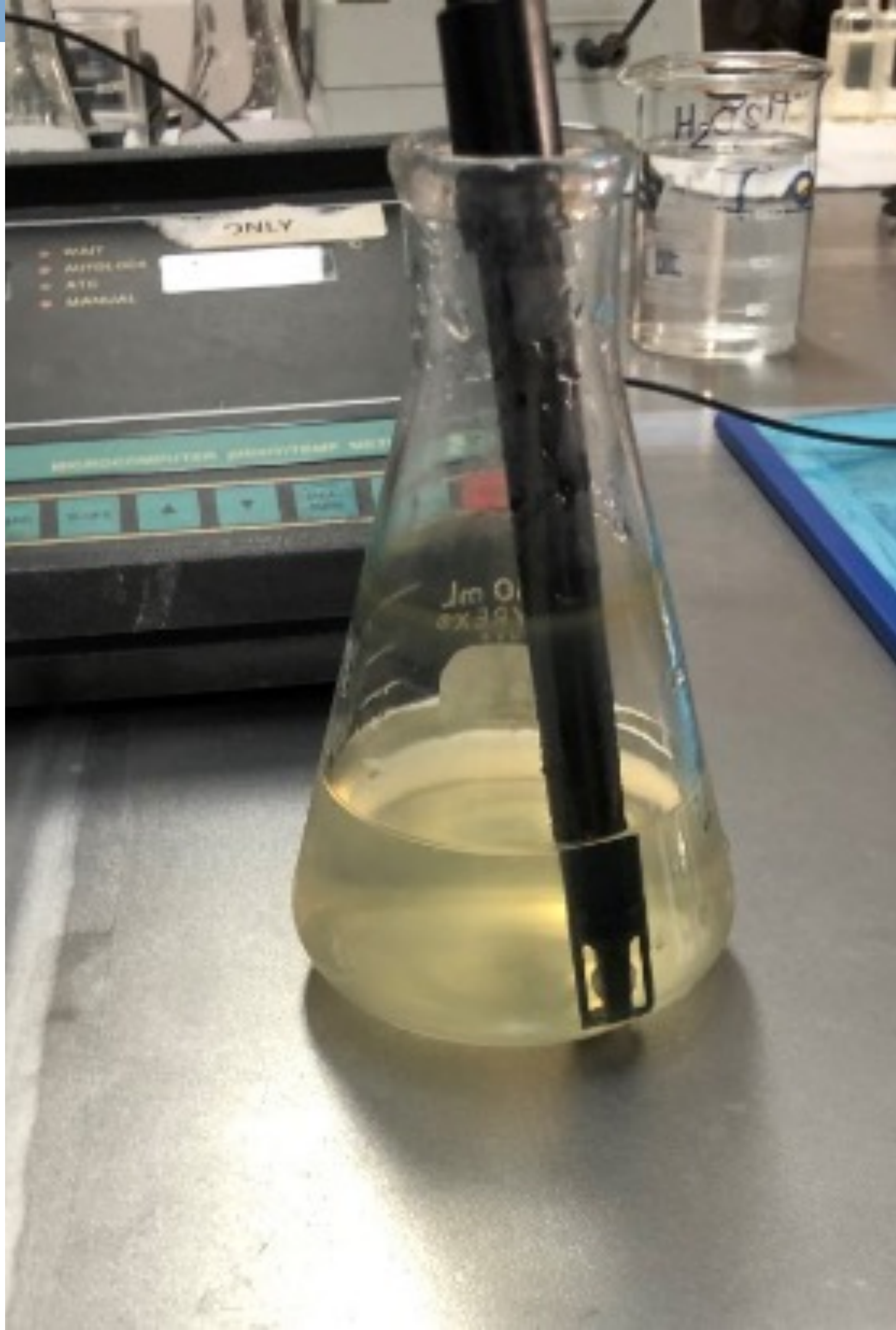
- Permits typically include **routine self monitoring and reporting** of pretreated effluent, following **BMPs**, and complying with **prohibited discharge rules.**

Sampling project

- Ecology's Environmental Assessment Program **sampled pretreated wastewater effluent** for a suite of toxic contaminants from **9 industrial facilities.**

- All facilities sampled are permitted by Ecology or City of Everett.

- In addition to **PBDEs**, parameters sampled and analyzed for include **OPFRs, PFAS, PCBs, phenolic compounds,** and **SVOCs**.



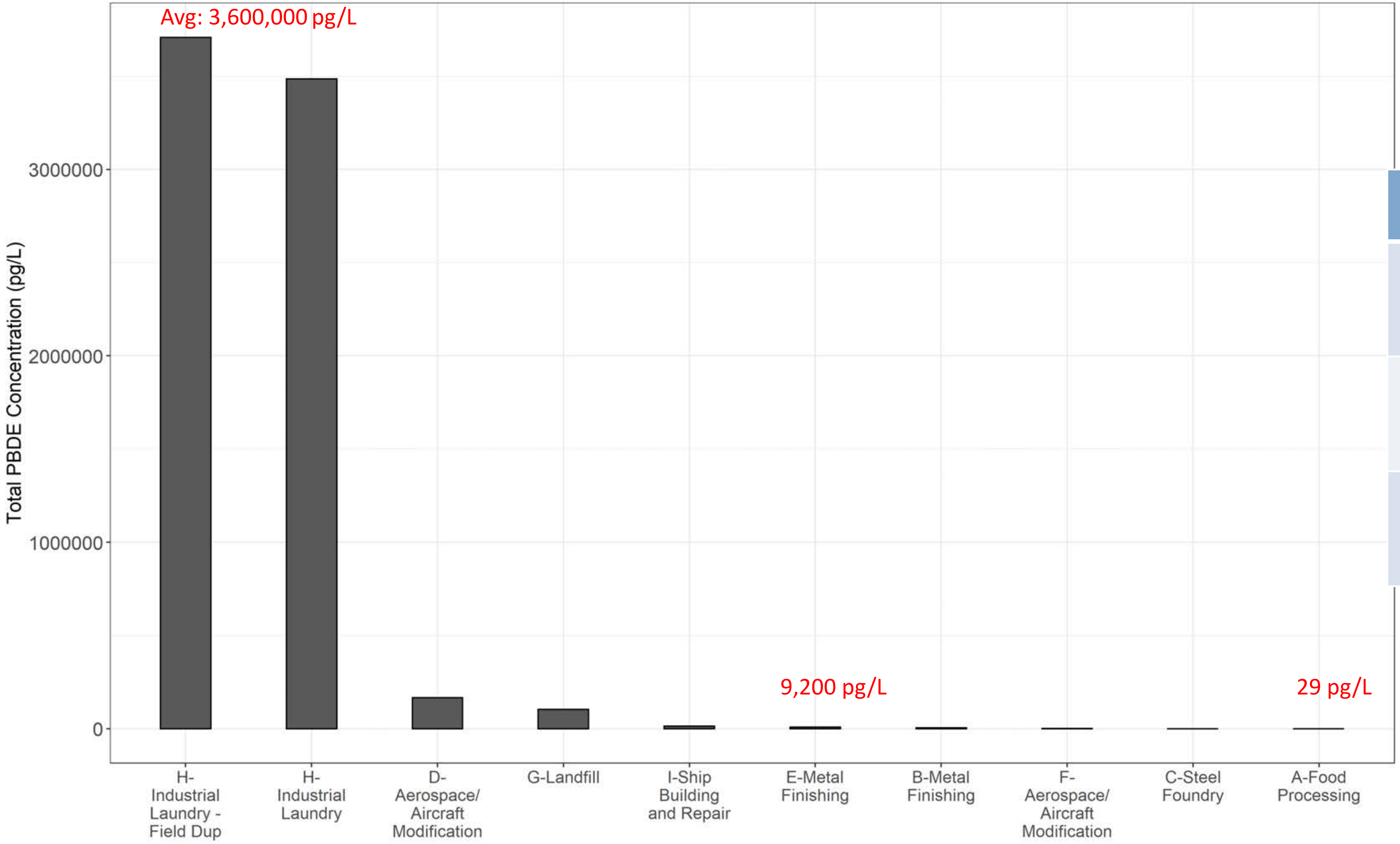
Types of industrial facilities sampled

Facility Site Study ID	Type of Industry	Description of Pretreated Industrial Wastewater Sampled
Facility A	Food Processing	Egg processing and cleanup wastewater
Facility B Facility E	Metal Finishing	Chemical metal finishing process wastewater (acid etch, chromium conversion coating, anodizing, and dyeing)
Facility C	Steel Foundry	Mechanical metal finishing process wastewater (hydroblasting of metal parts)
Facility D Facility F	Aerospace/Aircraft Modification	Chemical metal finishing, aircraft cleaning, and painting cleanup process wastewater
Facility G	Landfill	Leachate and catch basin cleanout wastewater
Facility H	Industrial Laundry	Industrial laundry process wastewater
Facility I	Ship Building and Repair	Facility wide wastewater (chemical metal finishing and various industrial wastewater and domestic wastewater)

Method Summary

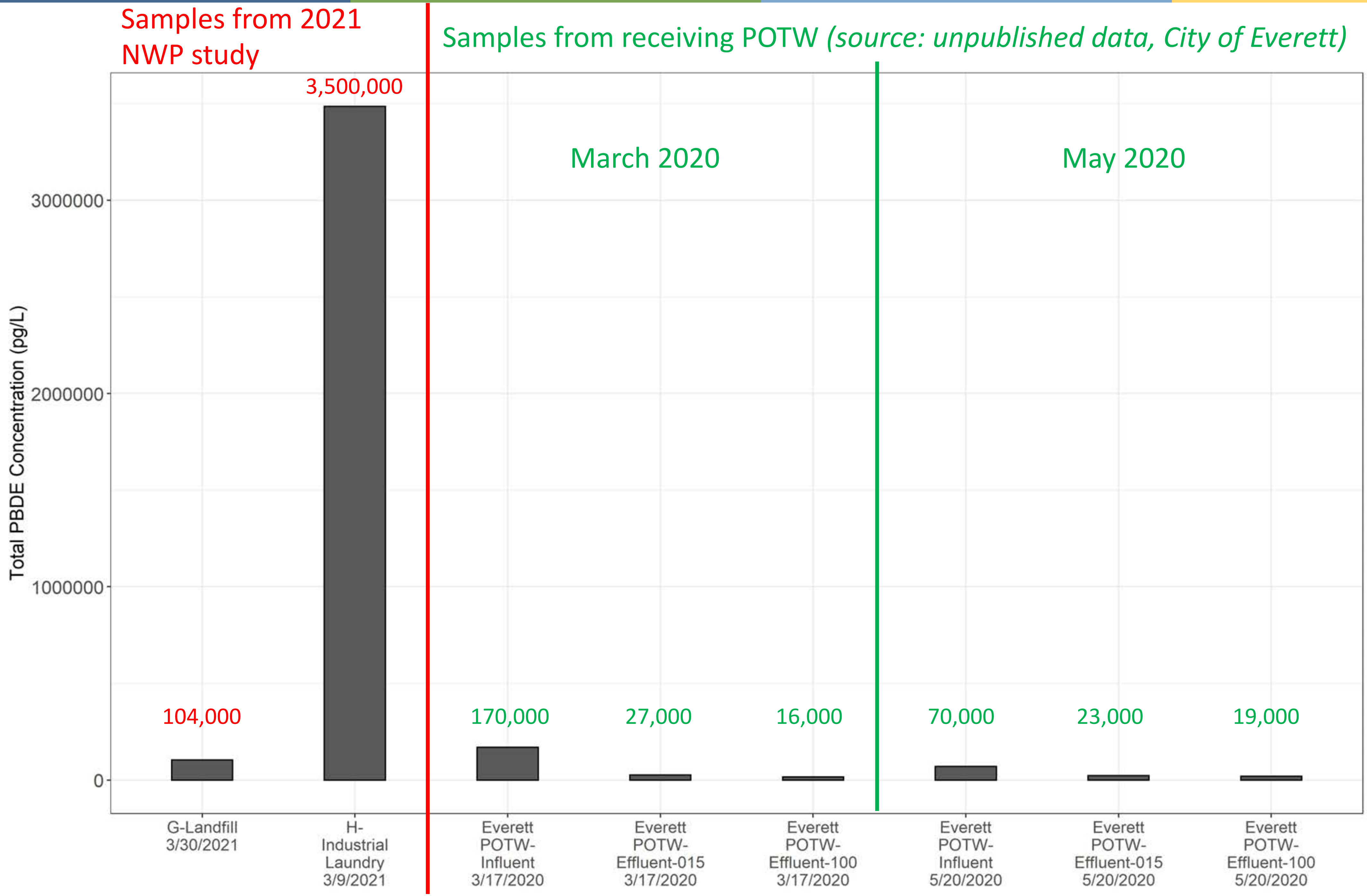
- One grab sample collected from each facility to measure various analytes
- 1 field duplicate & 1 equipment blank collected for each analyte
- PBDE samples analyzed by SGS AXYS, Sidney, BC using USEPA Method 1614
- Laboratory QC samples included laboratory blank, ongoing precision & recovery, & surrogate recovery
- Level 2B data validation performed externally by Manchester Environmental Laboratory

Total PBDEs



Summary (N=9)	
Min	29 pg/L
Max	3,600,000 pg/L
Med	9,200 pg/L

Comparison to previous POTW samples



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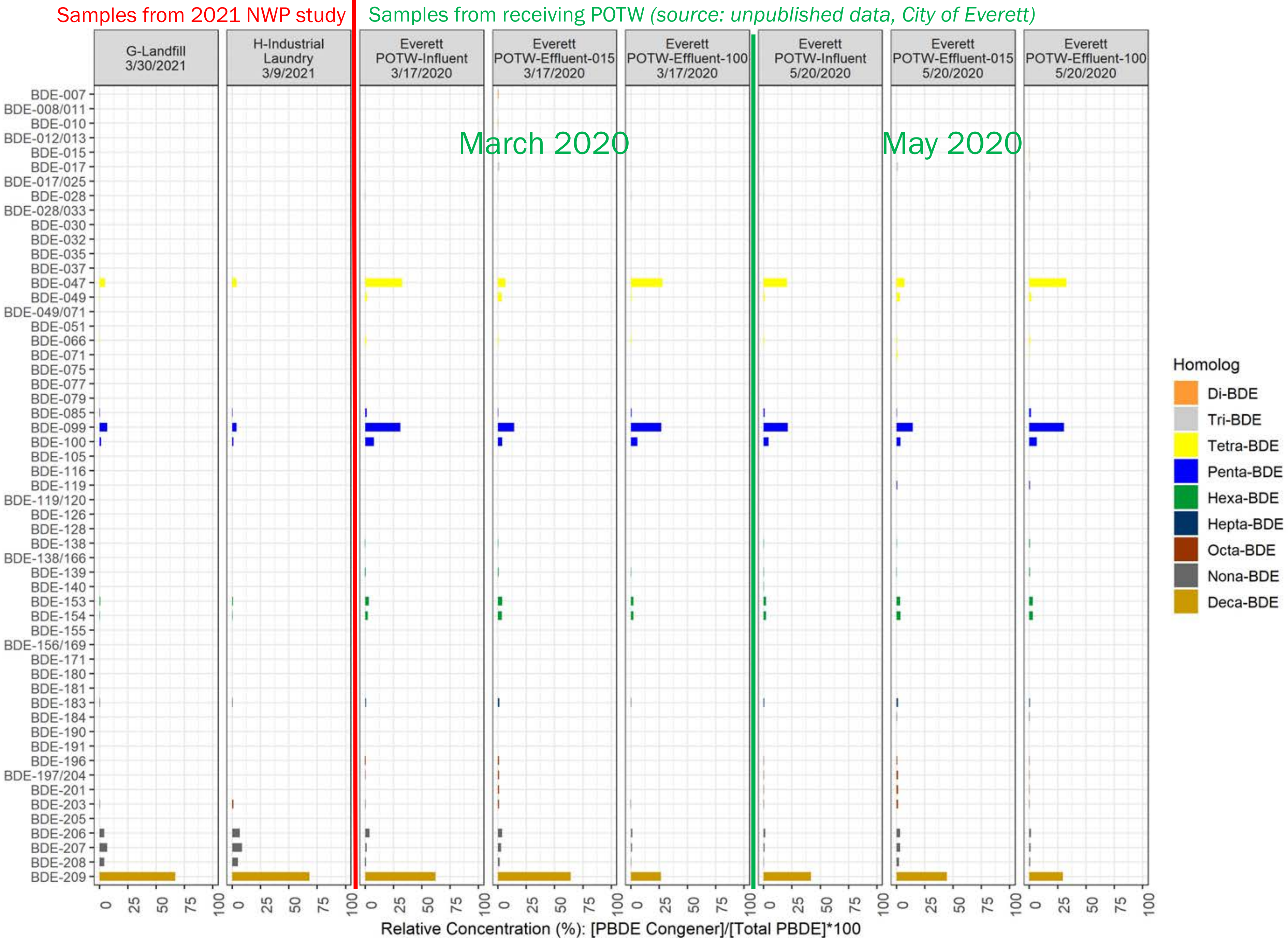

Summary

- PBDEs detected at all 9 sampled facilities

- Industrial Laundry had total PBDE concentration order of magnitude higher than the other sites (>3,000,000 pg/L)

- Aerospace/Aircraft Modification & Landfill facilities had 2nd & 3rd highest total PBDE concentration (>100,000 pg/L)

- Specific congeners were present more frequently & at higher concentrations than other congeners among samples, esp. BDE-047, 099, 209

- BDE-209 dominated the samples

Questions?

Siana Wong

Chemical Action Plan Implementation Monitoring (EAP)

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Maia Hoffman

Pretreatment Engineer (WQ)

maia.hoffman@ecy.wa.gov

DEPARTMENT OF ECOLOGY
State of Washington

Earthjustice

Please see attached attachments to Earthjustice Comment Letter, part 2 of 3.

Source Assessment of PBDEs Impacting Juvenile Chinook in the Snohomish River System

Alex Gipe

EAP, Toxics Studies Unit

agip461@ECY.WA.GOV

DEPARTMENT OF ECOLOGY
State of Washington

Snohomish PBDE Source Assessment

- Ecology lead source assessment of PBDEs from 2019 to 2022 in Snohomish, Skykomish, Snoqualmie Rivers
- Assess and prioritize potential sources of PBDEs that may be impacting the health of outmigrating juvenile Chinook
- Identify potential pathways of PBDEs from source to juvenile Chinook
- Monitored PBDEs during <u>low</u> (late summer) and <u>high</u> (spring) river flow conditions
    - 6 sampling event, 4 low flow, 2 high flow

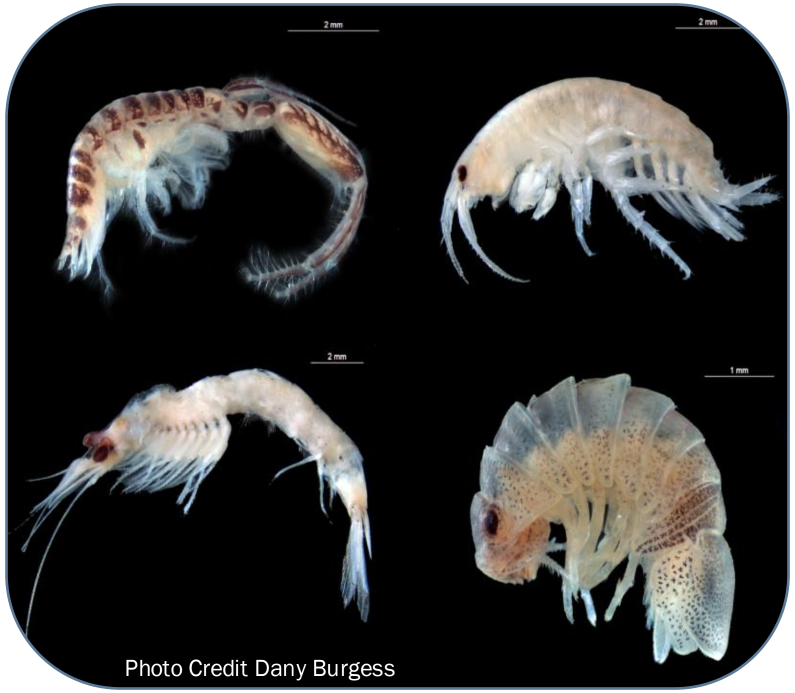
Methods

- Water – passive samplers (SPMDs), estimate water conc. integrated over ~30 days
- Biofilms – mixture of algae, cyanobacteria, detritus; collected from river substrates
- Sediment – benthic and suspended, collected throughout estuary
- Invertebrates – mixture of species; juvenile Chinook prey items; surface tows/algae mats
- Analyzed samples for 43 PBDE congeners by EPA Method 1614A

Passive Sampler

Biofilms

Sediments



Invertebrates

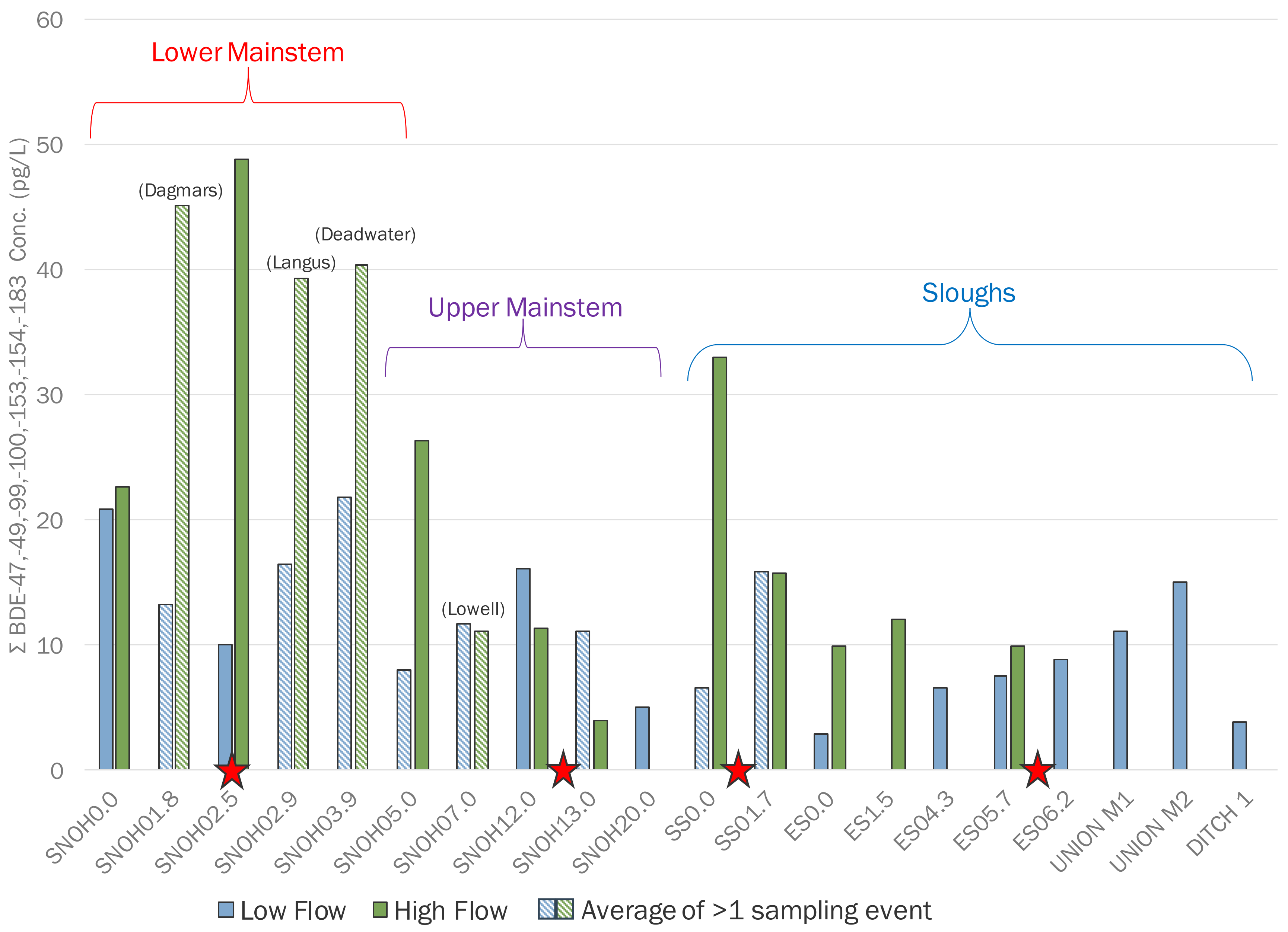
Study Results

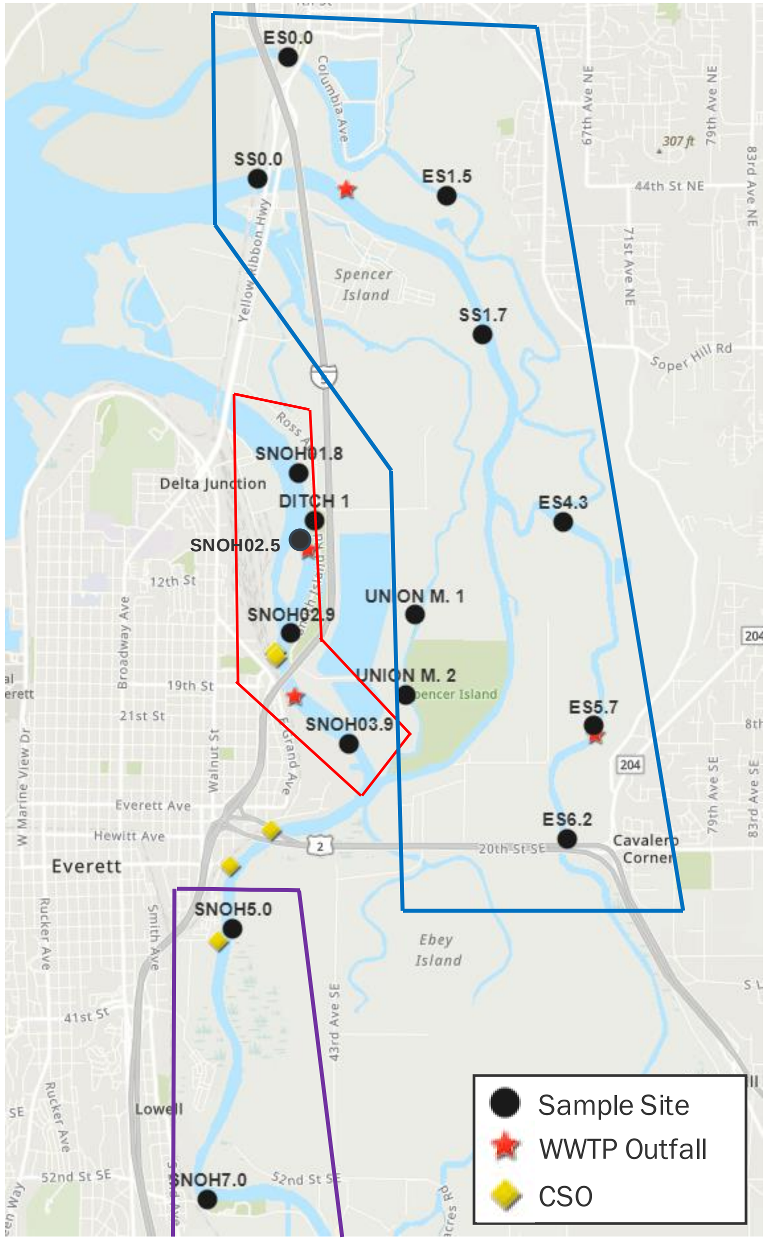
PBDEs in water & sediments

Prey Item Concentrations and Temporal Trends

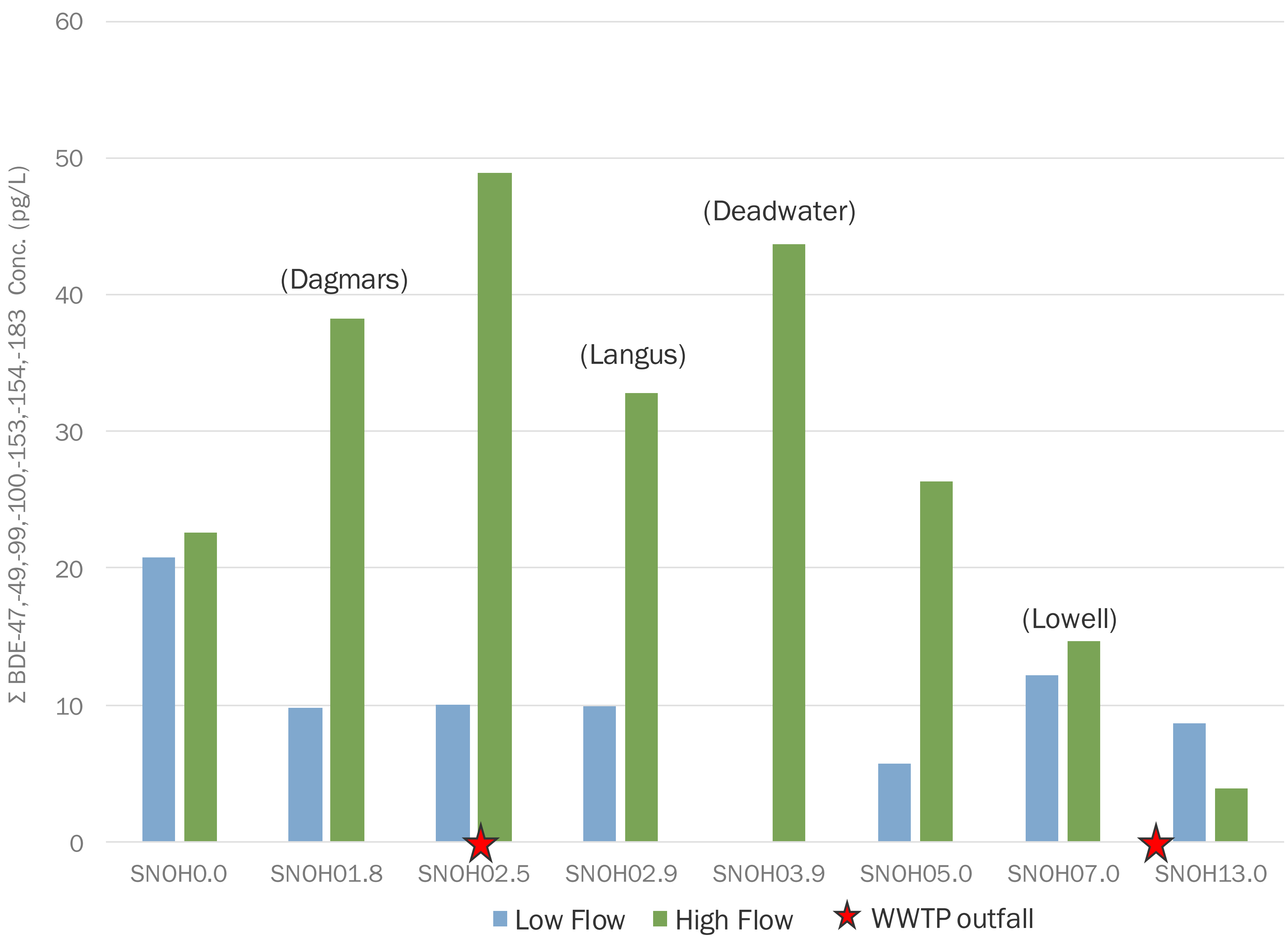
PBDE Accumulation and Concentration

2019-2022 PBDE Water Concentration in Snohomish River & Estuary



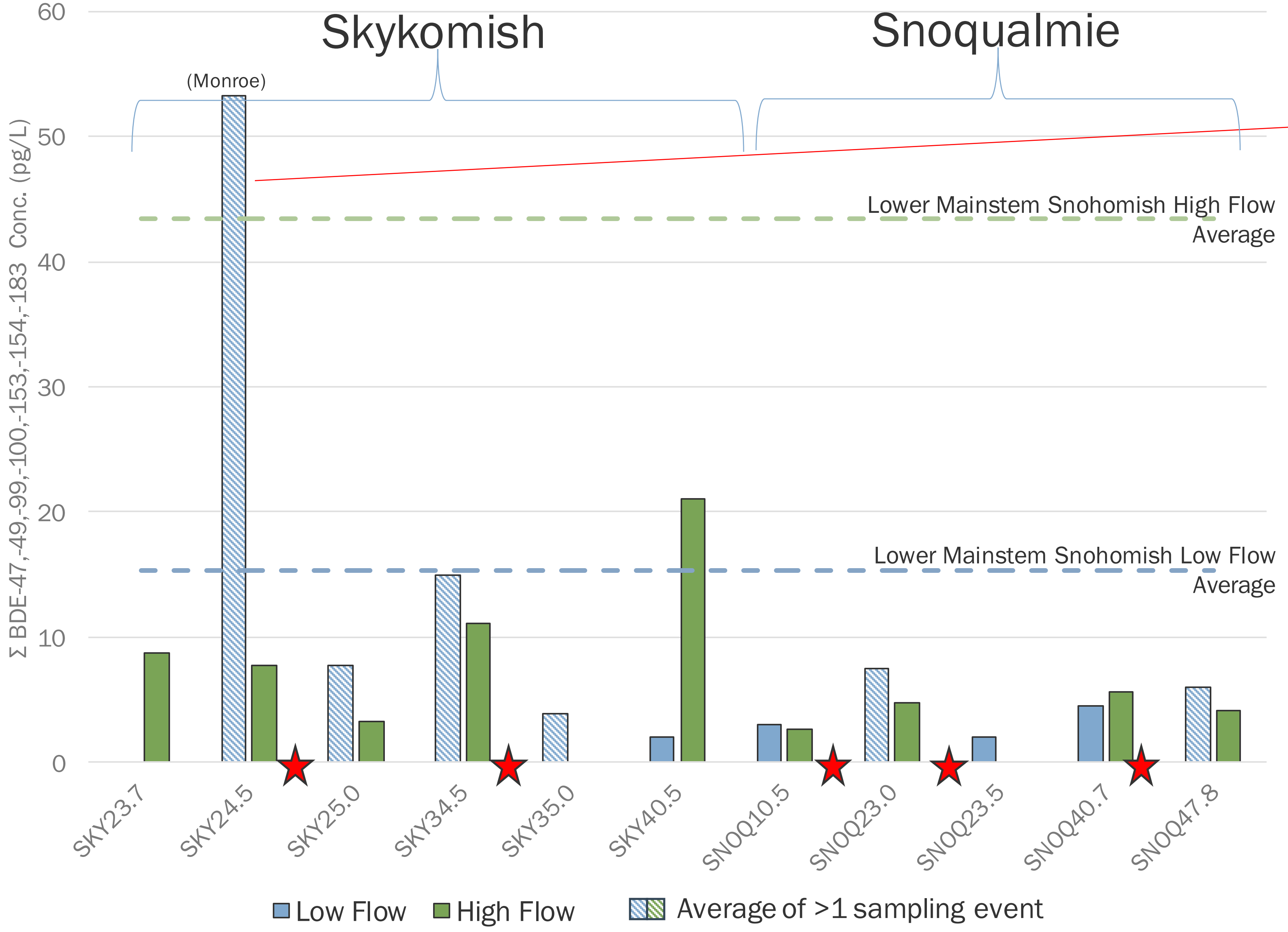


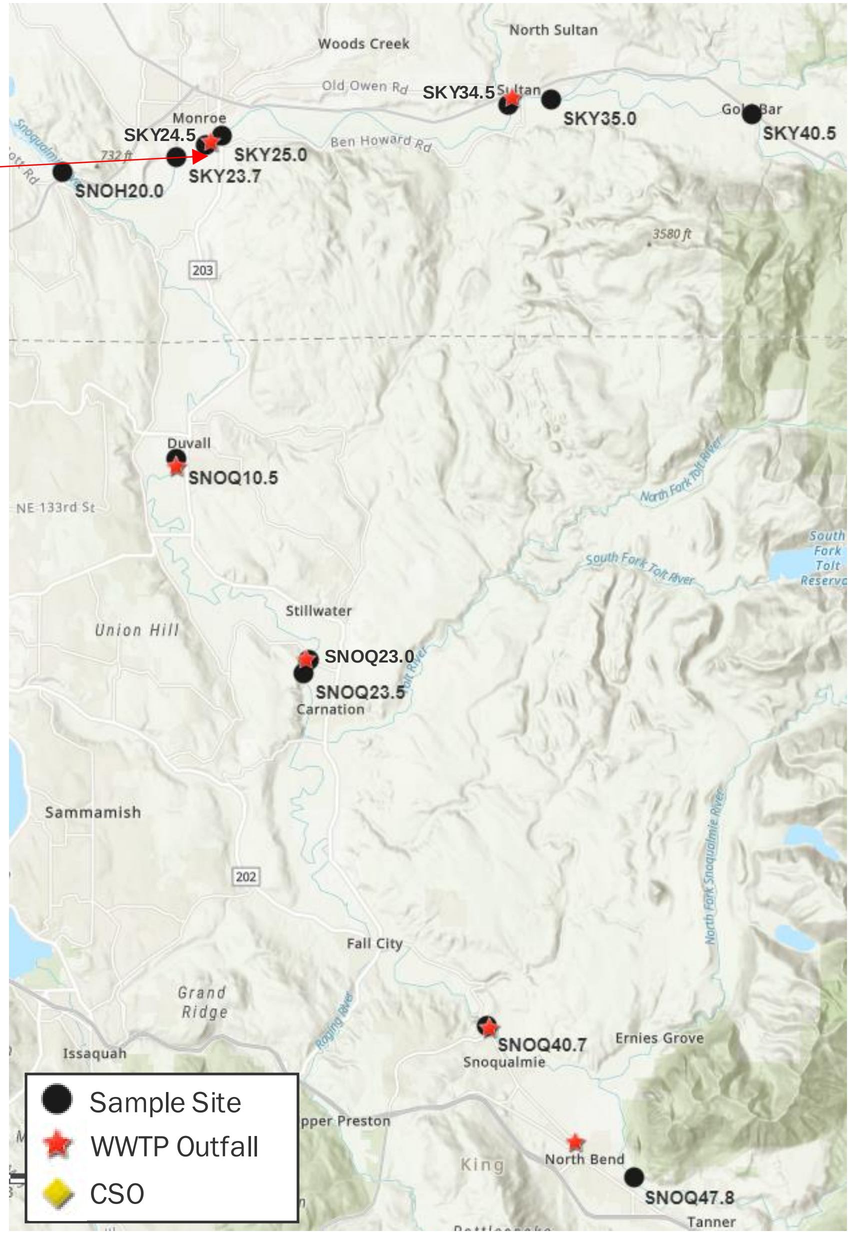
2022 Snohomish Main Stem High vs Low Flow PBDE Water Concentrations



- Everett WWTP Outfall 015 discharge
  - No Discharge during Low Flow Sampling period
  - Active Discharge during High Flow Sampling period

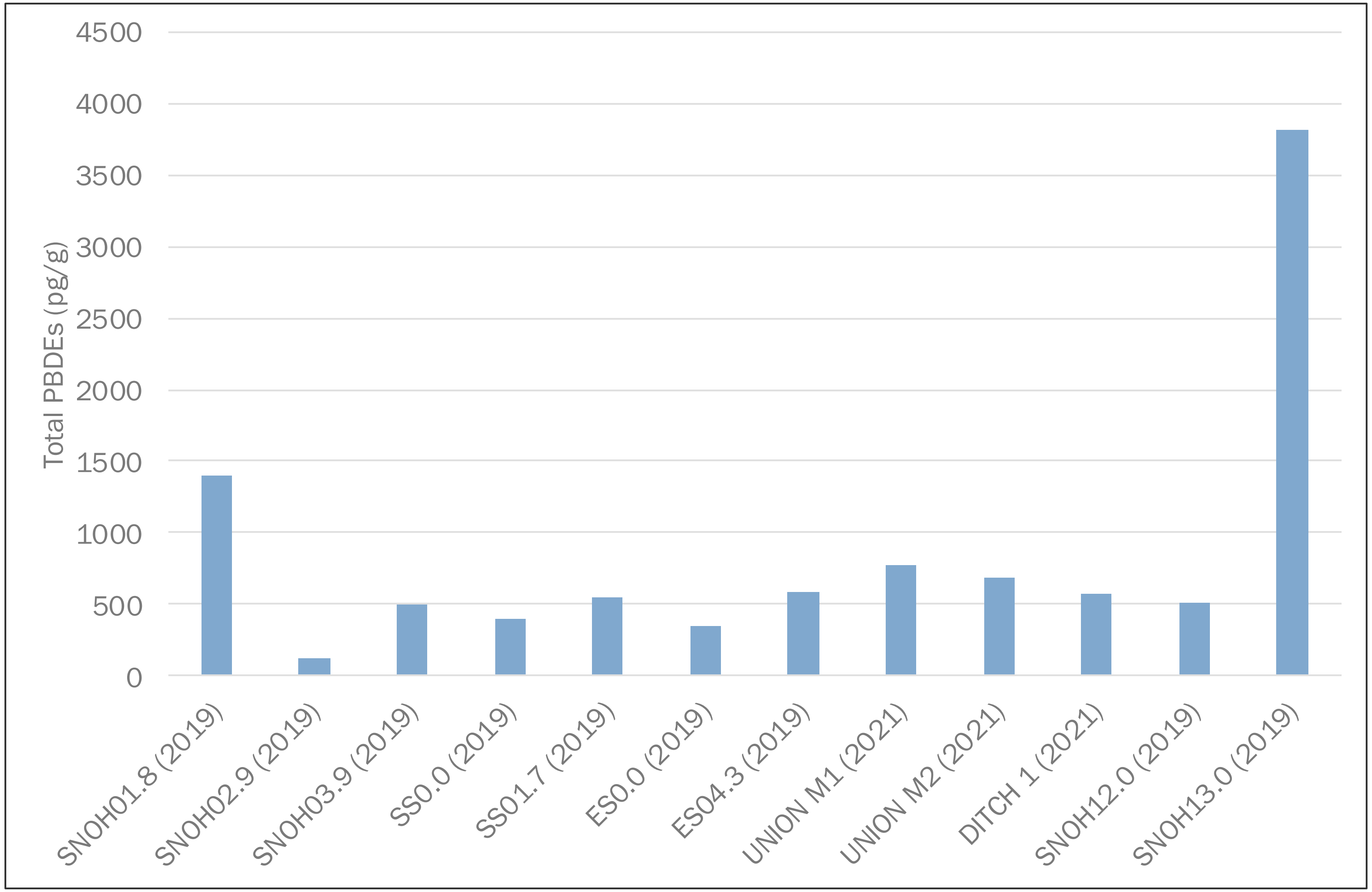
2019-2022 Total PBDE Water Concentration in Skykomish & Snoqualmie Rivers

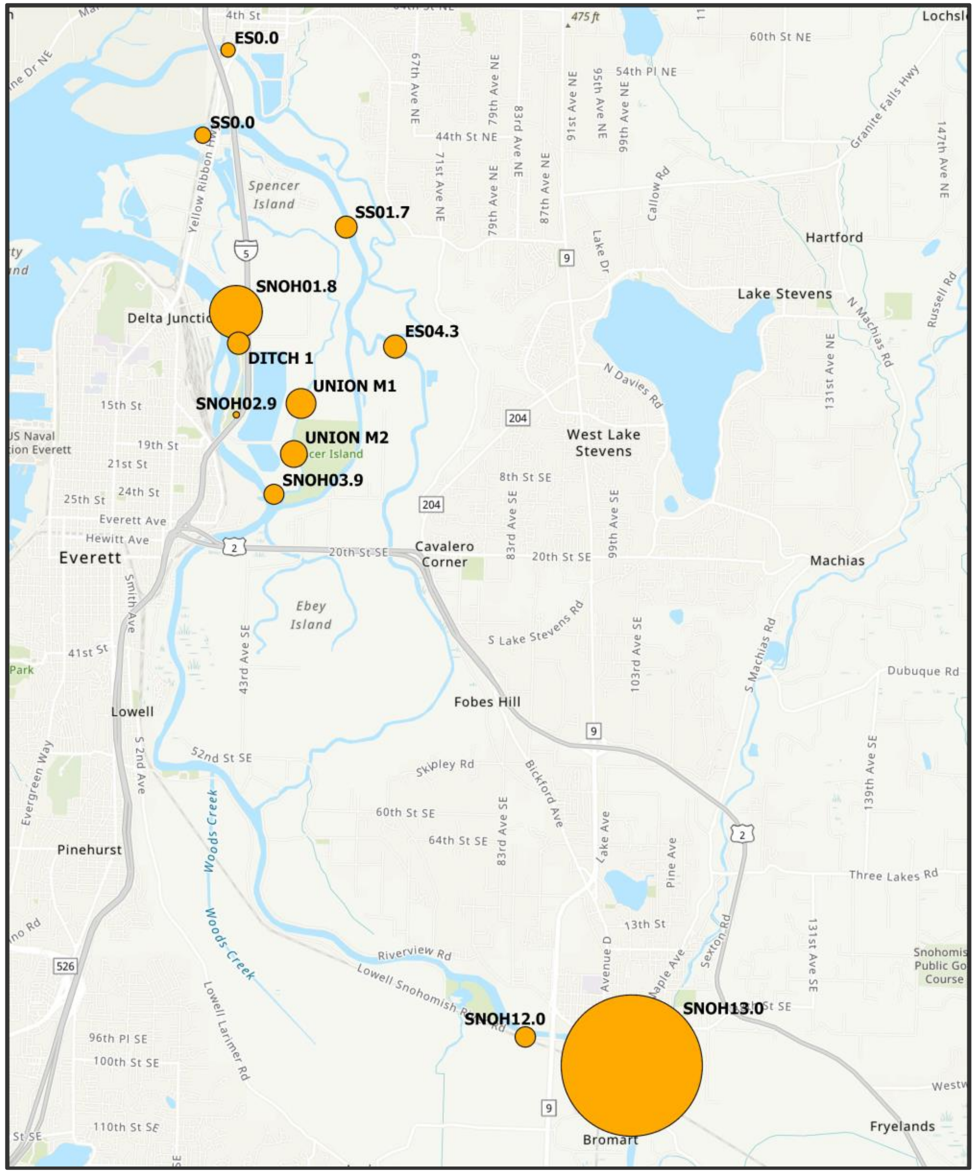




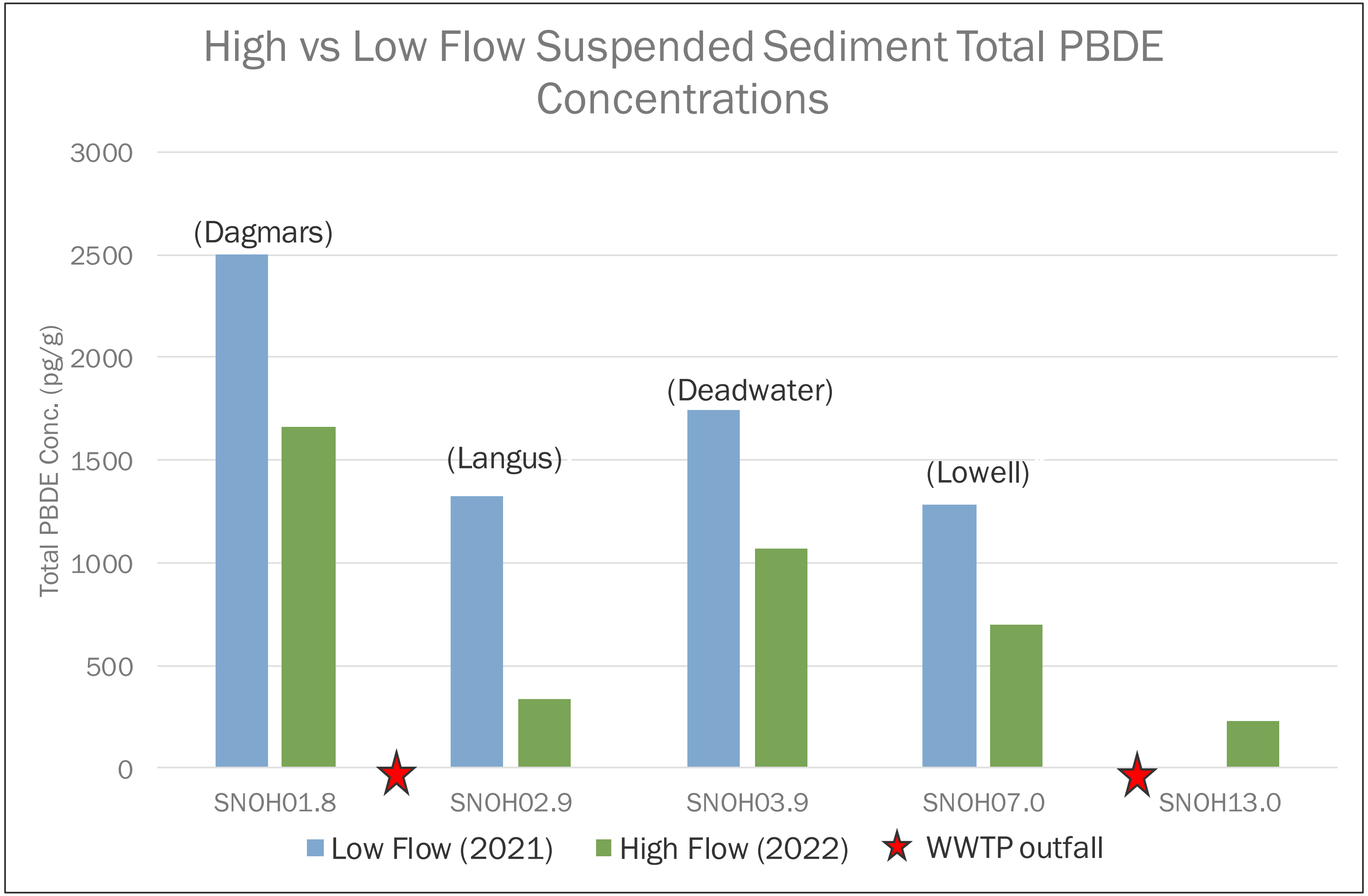
PBDEs in Bottom Sediments

- Concentration Range from 130 to 3800 pg/g
- Highest concentrations at SNOH01.8 & 13
- Similar concentration across sloughs





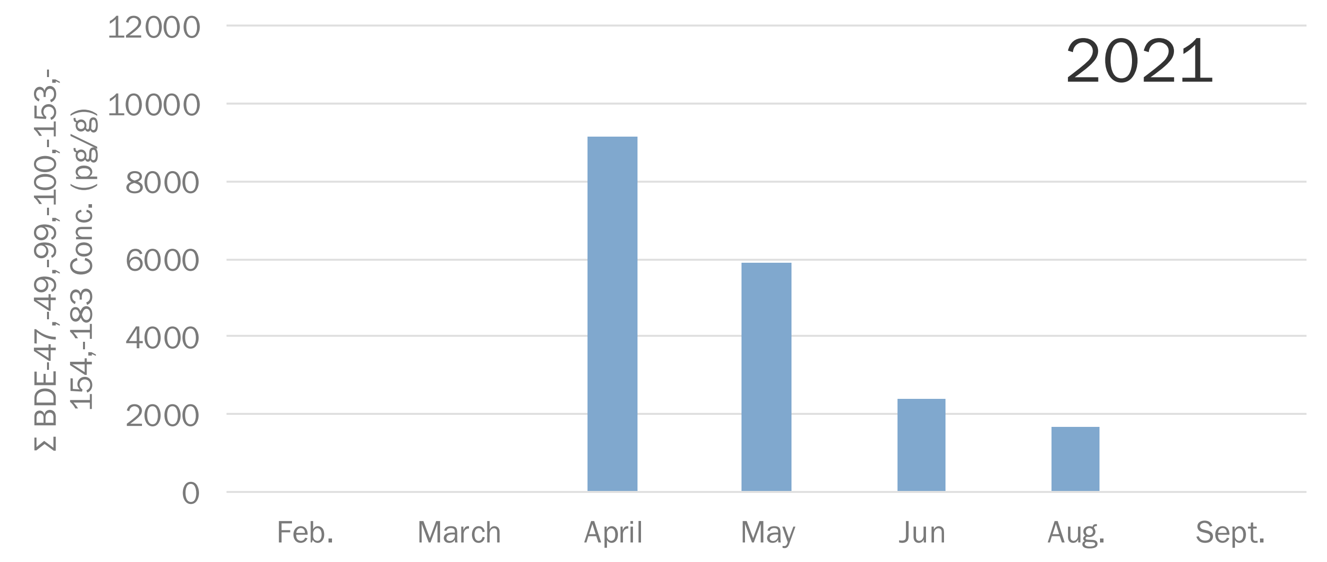
Suspended Sediments

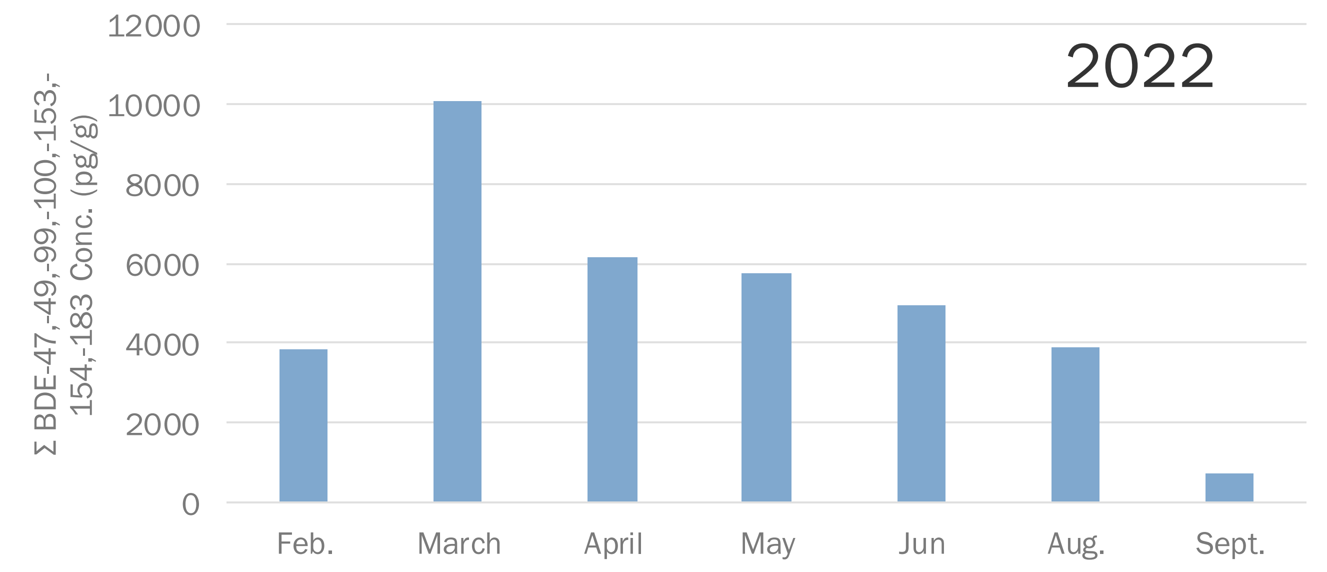


- Low Flow- similar concentration of PBDEs along main stem
- High Flow- varying PBDE concentrations
- Active WWTP discharge during both events

Temporal Variations in Invertebrate PBDE Concentrations

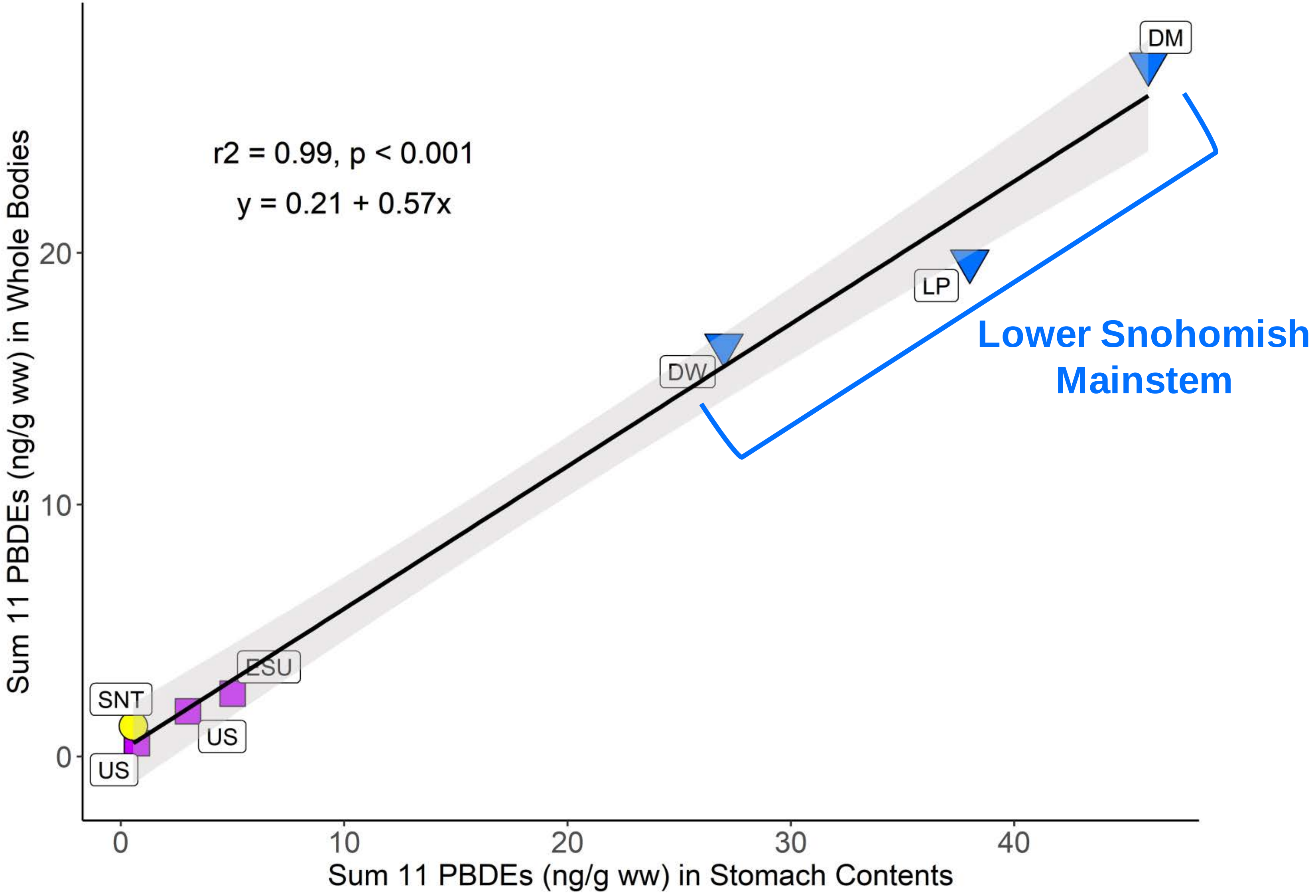
- Highest PBDE concentrations occur in spring
  - Coincides with occurrence of juvenile Chinook in Snohomish estuary
- Declining trend in concentrations over summer
- Similar temporal pattern in 2021 & 2022
- Max 2021-2022 PBDE concentration ~7x greater than 2019 low flow event invertebrates





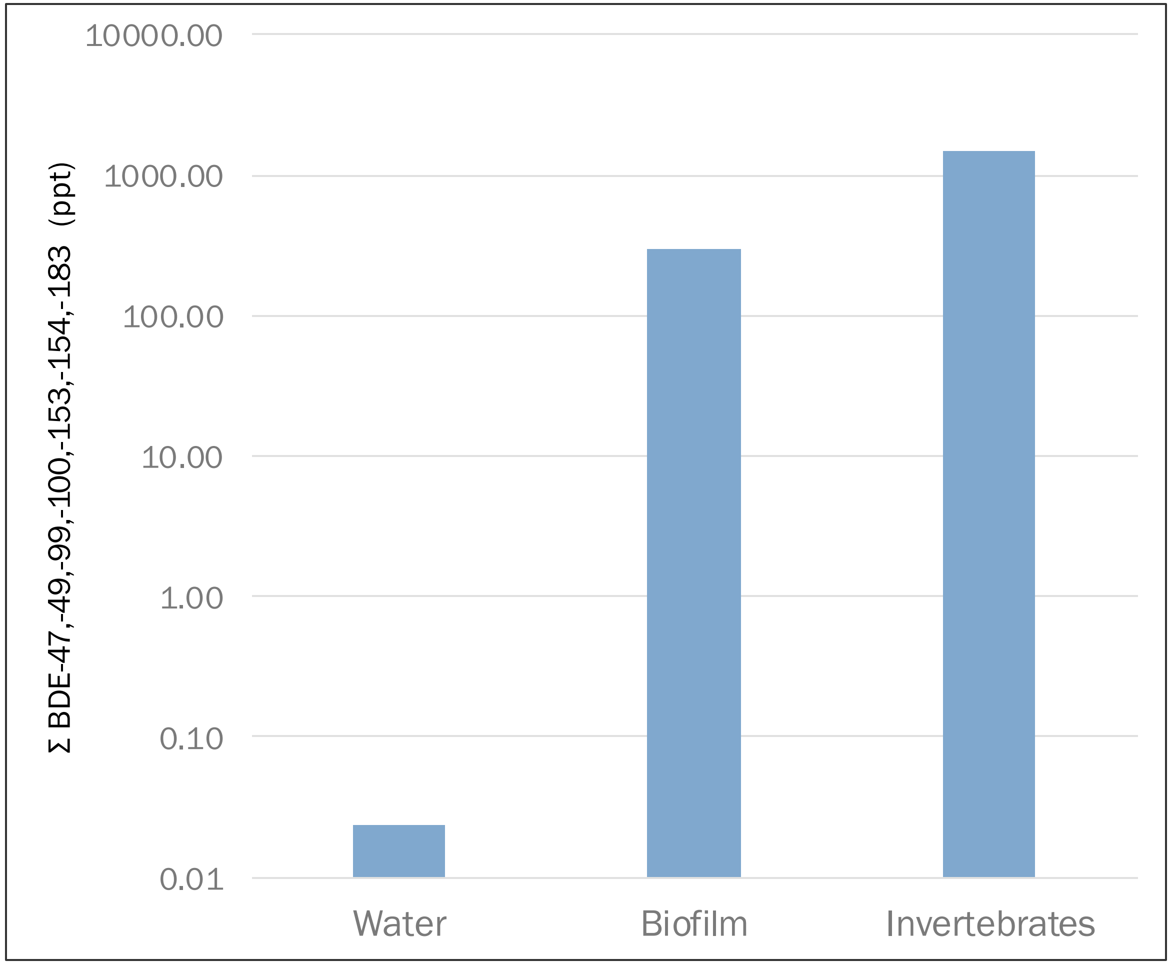
PBDEs in Juvenile Chinook Stomach Contents

Juvenile Chinook are accumulating the PBDEs from their food source



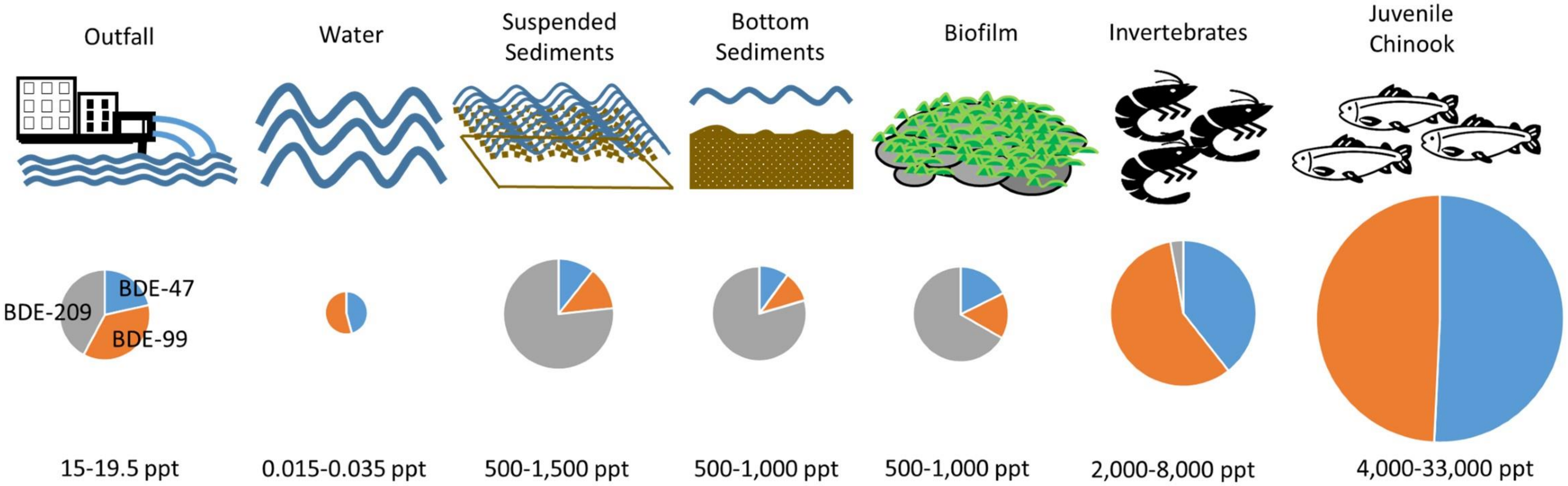
Slide credit: Andrea Carey, WDFW
TBiOS

PBDE Accumulation & Concentration



- Water conc. average = 0.024 ppt
- Biofilm conc. average = 297.1 ppt
  - ~12,500x increase from water
- Invertebrate conc. average = 1477.3 ppt
  - ~5x increase from biofilms
- Primary producers (biofilms) and invertebrates concentrate and accumulate PBDEs
- Calculated from average conc. measured during 2019 low flow sampling event

PBDEs in the Snohomish Estuary



Results Summary

- Elevated PBDE concentrations in lower Snohomish main stem & near city of Monroe
  - Elevated PBDEs in water, sediment, biofilms, & inverts.
  - Associated with WWTP discharges
- Bioconcentration and bioaccumulation of PBDEs from water to biofilms and invertebrates
- Temporal trend of invertebrate PBDE concentrations in Snohomish mainstem
  - Highest in spring, declining through summer
  - Juvenile Chinook prey contain high levels of PBDEs
- PBDE congener accumulation differs across environmental media

Study Conclusions

- WWTP discharges of PBDEs impact localized areas surrounding the discharge zone in the Snohomish mainstem an near the city of Monroe

- Uptake and transformation of PBDEs in the food web concentrates and increases potential impacts on outmigrating juvenile Chinook salmon in the Snohomish estuary

Acknowledgements

WDFW

Sandie O'Neill

Andrea Carey

Andrew Beckman

NOAA

Josh Chamberlin

Tulalip Tribes

Todd Zackey

City of Everett

John Rabenow

Dept. of Ecology

Will Hobbs

Rachel McCrea

Jessica Huybregts

Tonya Lane

Kevin Leung

Jakub Bednarek

Elisa Rauschl

Susan Smith

Long Live the Kings

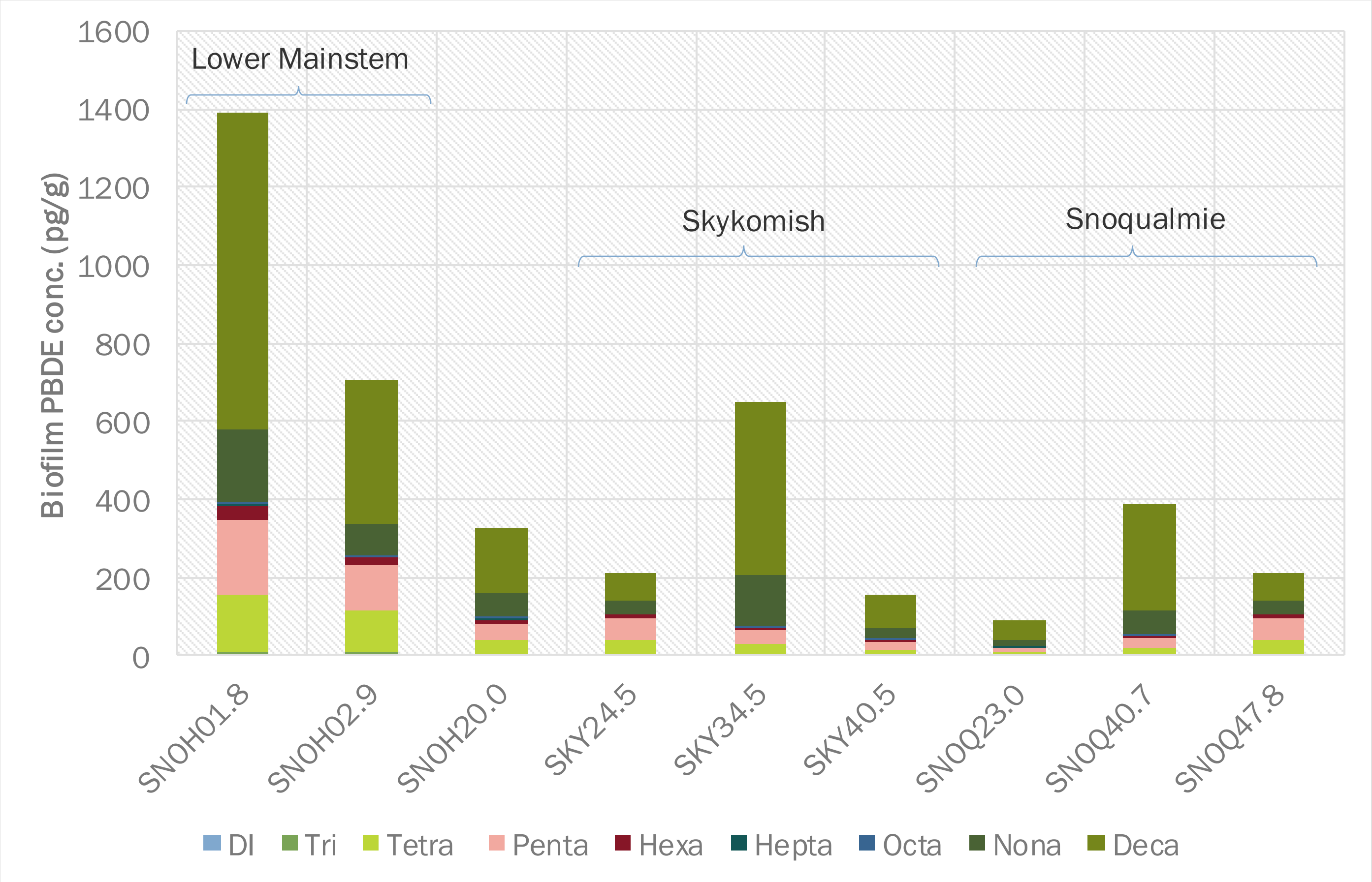
Lucas Hall

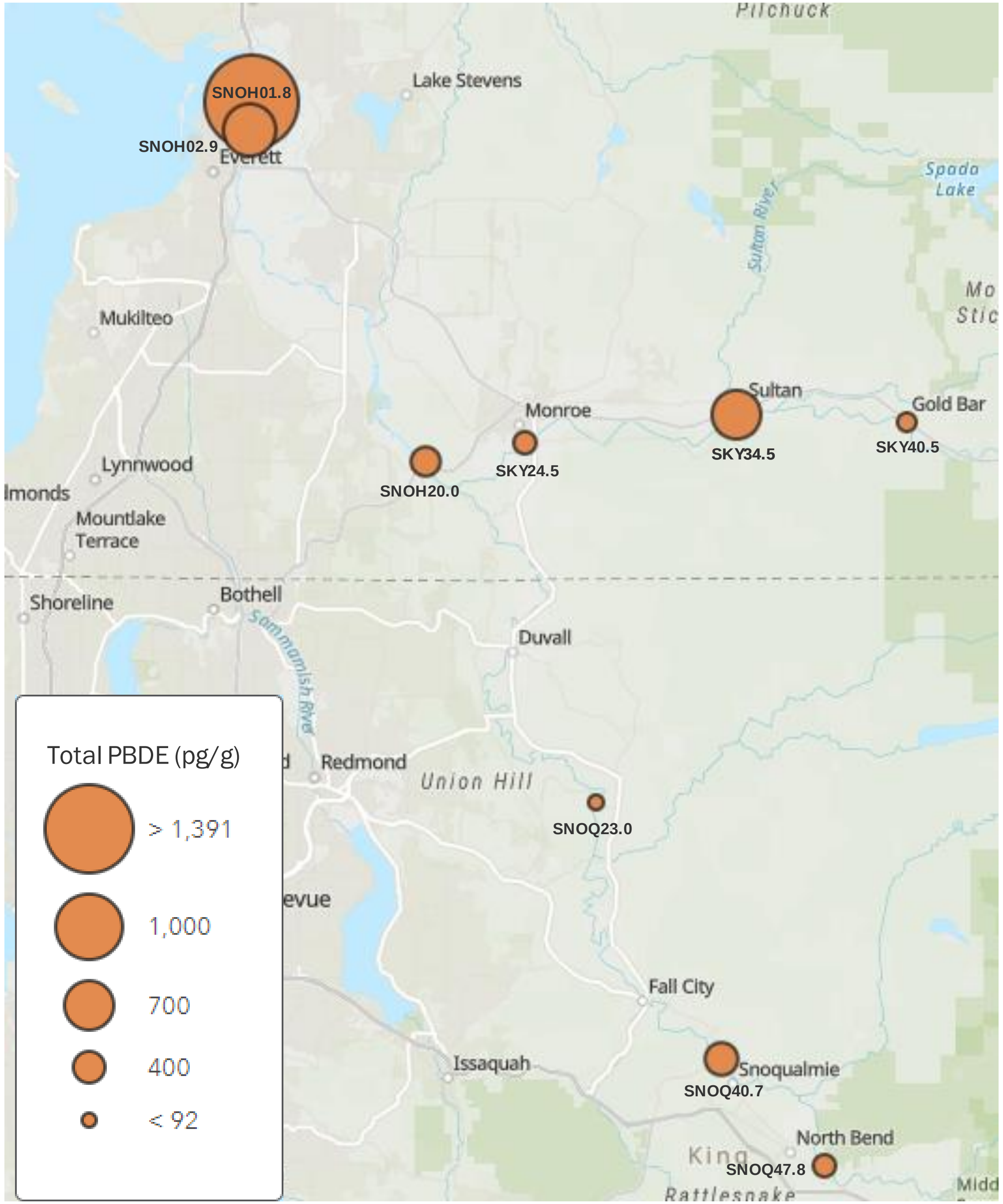
Questions?

Email: agip461@ECY.WA.GOV

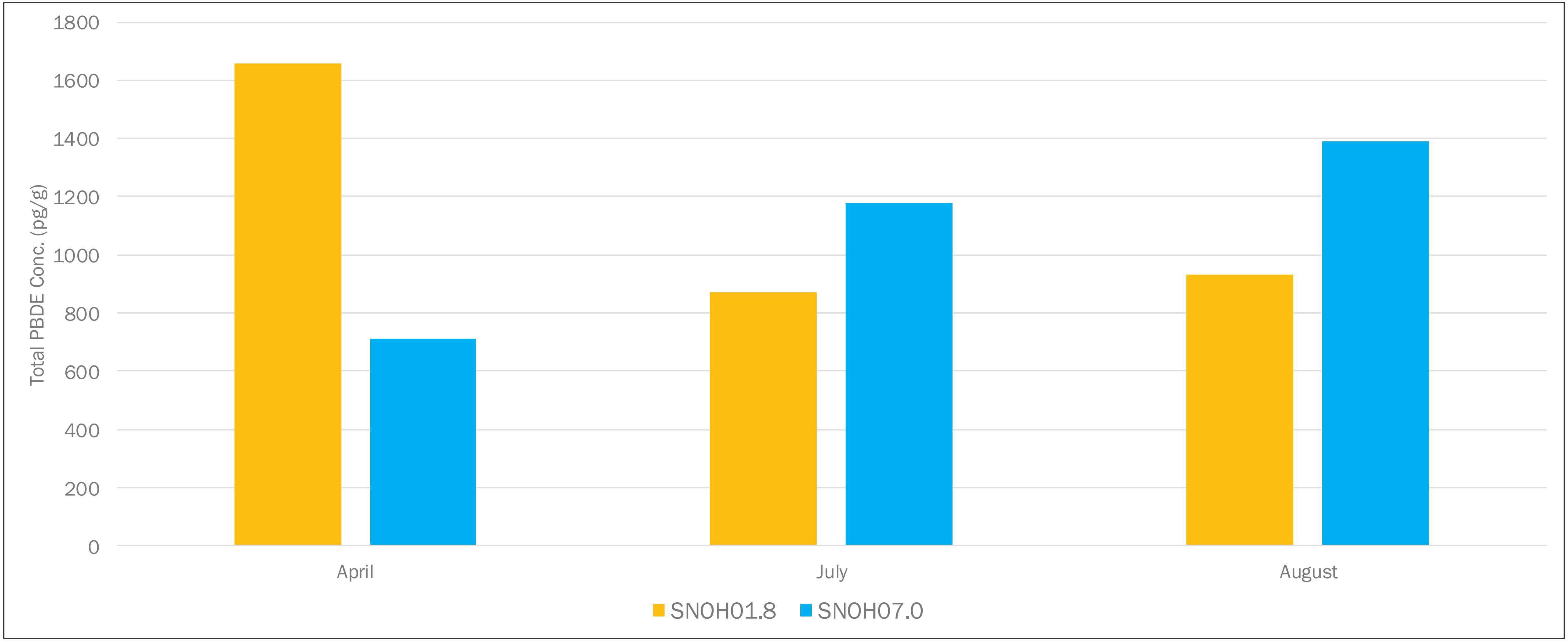
PBDEs in Biofilms

- Collected during 2019 low flow event
- Highest concentrations located in mainstem of Snohomish
- Elevated concentrations near city of Sultan and Snoqualmie





2022 Temporal Trends of Suspended Sediment Total PBDE Concentrations



Everett Water Pollution Control Facility

Everett Public Works

November 30, 2023

EVERETT
WASHINGTON

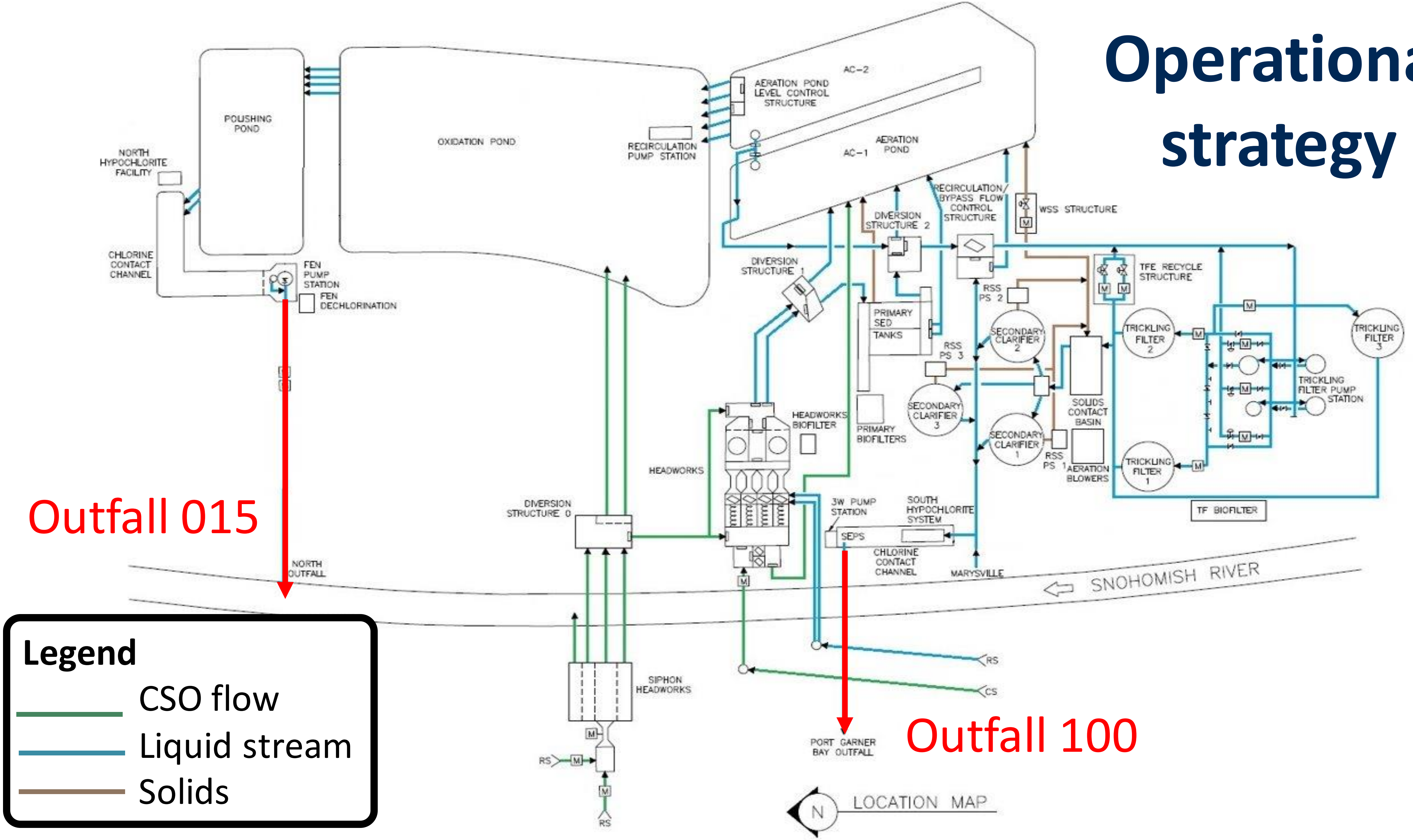
Agenda

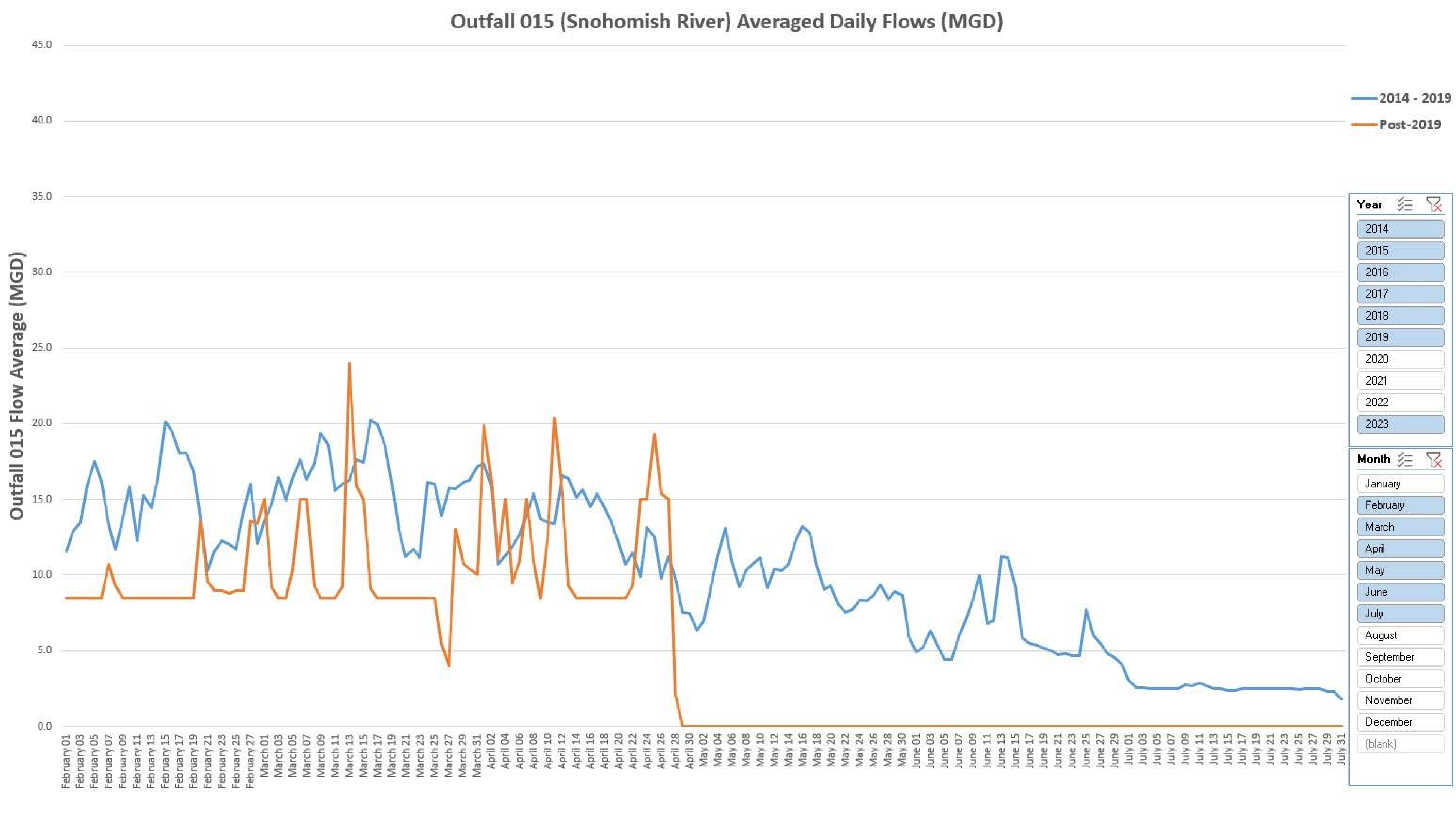
- Plant overview
- Operational strategy
- Industrial pre-treatment control: PBDE

Homolog summary

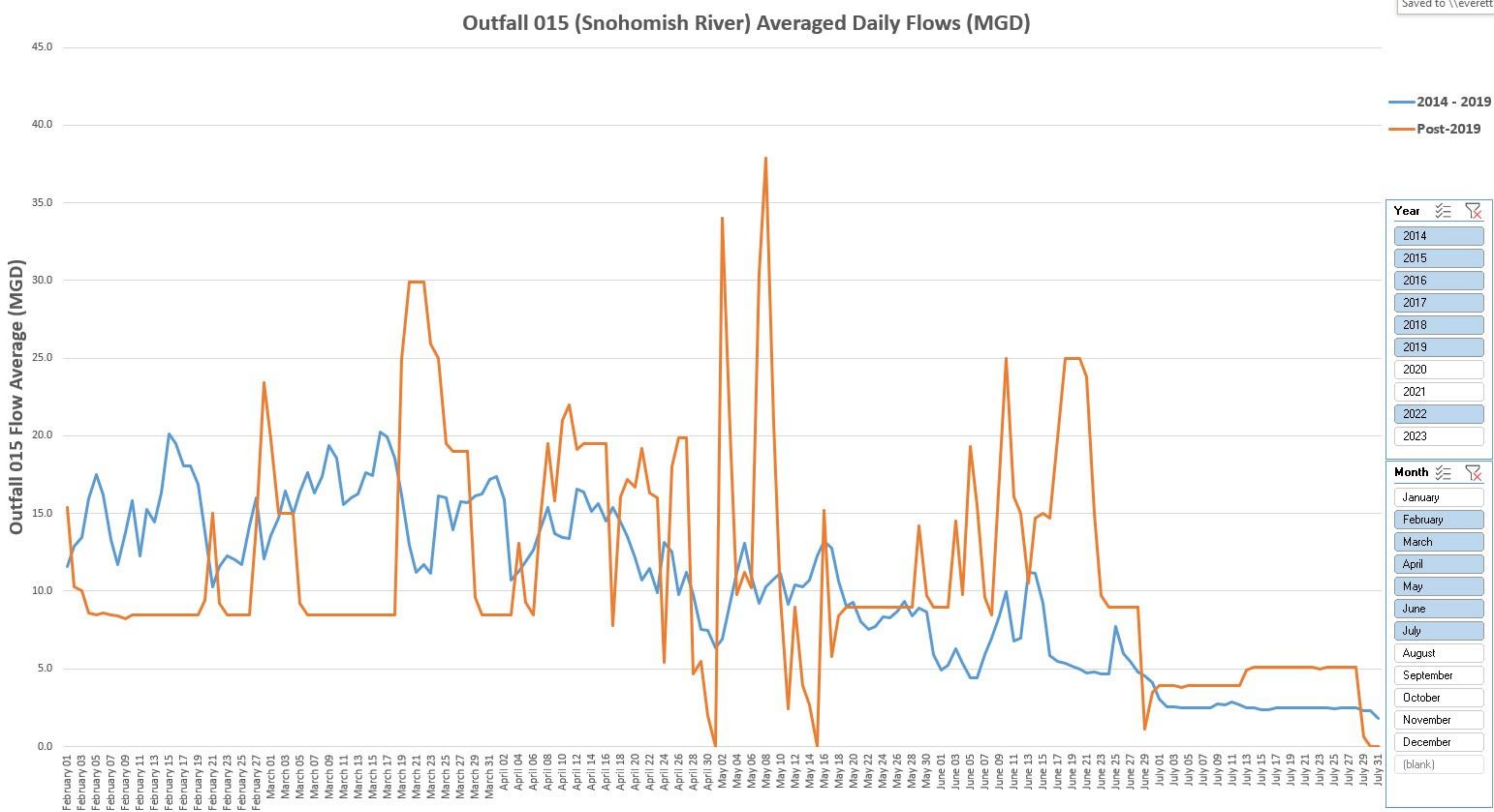
Chemical of concern	Units	2020 Q1	2020 Q2	2020 Q4	2021 Q2	2022 Q3
		INFLUENT				
Polybrominated Diphenyl Ethers (Homologs)						
Dibromodiphenyl ethers	pg/L	23	22	16	0	41.3
Tribromodiphenyl ethers	pg/L	588	321	221	324	563.0
Tetrabromodiphenyl ethers	pg/L	24999	15464	12119	14293	32092
Pentabromodiphenyl ethers	pg/L	28186	18857	13418	17735	37398
Hexabromodiphenyl ethers	pg/L	4655	3369	2323	2949	5124.8
Heptabromodiphenyl ethers	pg/L	620	403	218	315	694
Octabromodiphenyl ethers	pg/L	799	454	363	731	1448
Nonabromodiphenyl ethers	pg/L	4347	1988	1584	2753	2848
Decabromodiphenyl ether	pg/L	105500	29500	22100	46900	34900
		SCE-100				
Dibromodiphenyl ethers	pg/L	0.0	31.2	37.6	0.0	25.6
Tribromodiphenyl ethers	pg/L	159.6	236.0	211.2	124.4	150.1
Tetrabromodiphenyl ethers	pg/L	4769	5836	4154	2449	5496
Pentabromodiphenyl ethers	pg/L	5506	6399	4889	3119	5975
Hexabromodiphenyl ethers	pg/L	864.0	1157.3	973.2	559.0	773.0
Heptabromodiphenyl ethers	pg/L	83	96	92	54	97
Octabromodiphenyl ethers	pg/L	72	165	163	112	165
Nonabromodiphenyl ethers	pg/L	505	565	606	204	329
Decabromodiphenyl ether	pg/L	4360	4830	5640	2580	2490
		FEN-015				
Dibromodiphenyl ethers	pg/L	210.8	49.9	109.0	206.4	349.8
Tribromodiphenyl ethers	pg/L	389.9	378.8	597.0	482.9	719.0
Tetrabromodiphenyl ethers	pg/L	2434	2638	5436	4868	4925
Pentabromodiphenyl ethers	pg/L	4200	4373	10799	8242	6622
Hexabromodiphenyl ethers	pg/L	1823.1	1734.1	4648.0	1666.0	1803.0
Heptabromodiphenyl ethers	pg/L	285	441	928	328	410
Octabromodiphenyl ethers	pg/L	880	998	2452	982	1420
Nonabromodiphenyl ethers	pg/L	1947	2049	5860	1655	2827
Decabromodiphenyl ether	pg/L	14700	10200	61300	7600	18900

Operational strategy





Outfall 015 (Snohomish River) Averaged Daily Flows (MGD)
Outfall 015 Flow Average (MGD)
2014 - 2019
Post-2019
Year
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Month
January
February
March
April
May
June
July
August
September
October
November
December
(blank)



Outfall 015 (Snohomish River) Averaged Daily Flows (MGD)
Outfall 015 Flow Average (MGD)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
2014 - 2019
Post-2019
Year
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Month
January
February
March
April
May
June
July
August
September
October
November
December
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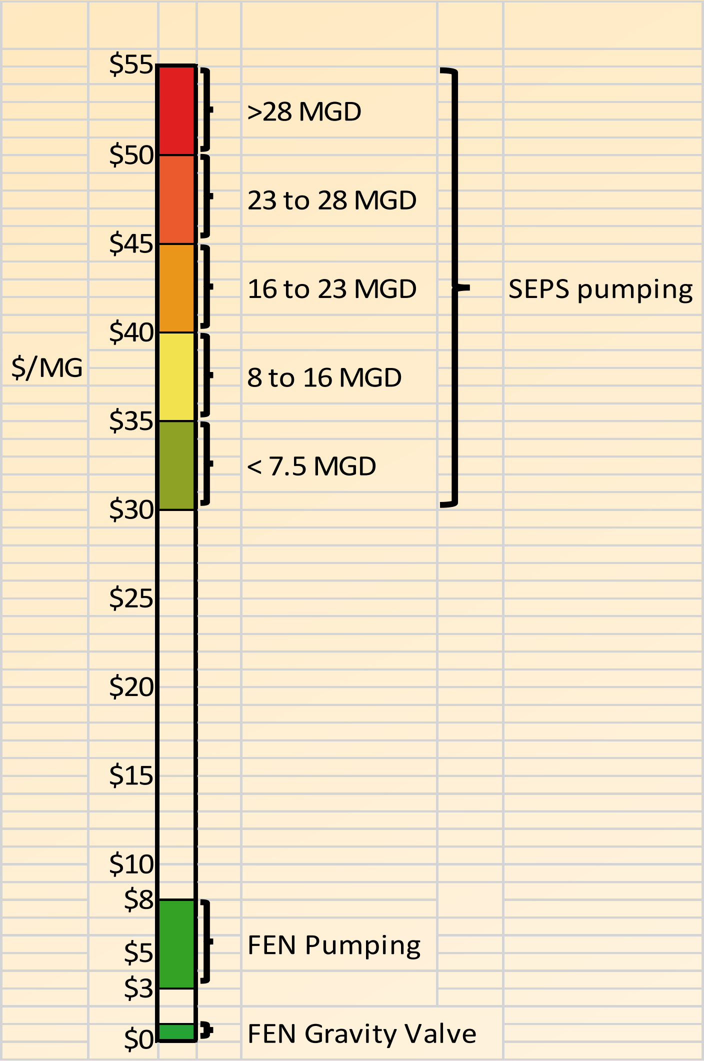
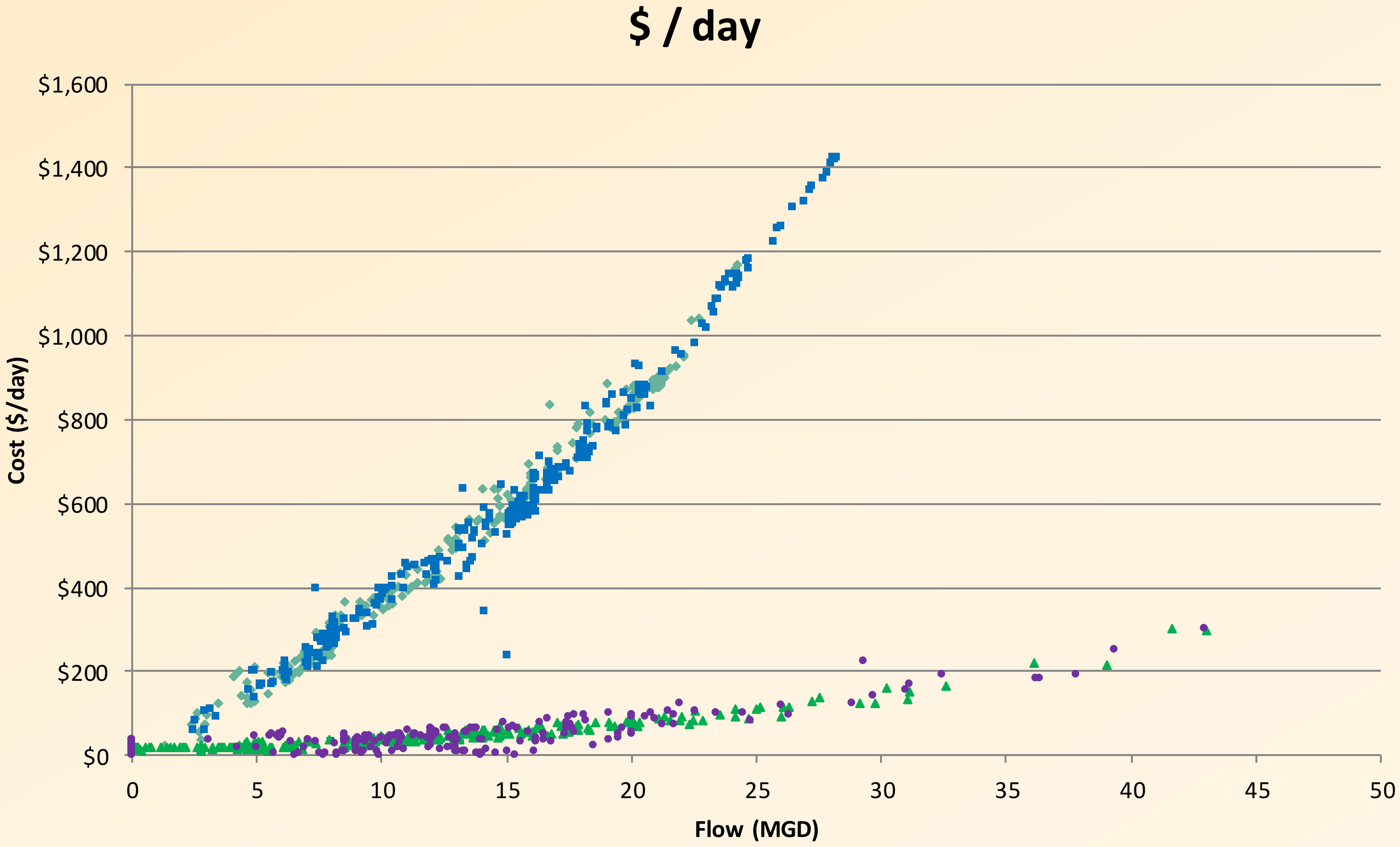
Operational cost comparison – Deepwater vs river outfall





Pretreatment identification of PBDE

Existing PBDE data

- Quarterly Sampling 2020-2022
- 5 total samples covering all four quarters
- 3 sample sites
  - Final Effluent North
  - Secondary Effluent
  - Primary Influent

Industrial survey

- Update IU Inventory to include industry categories known or suspected to discharge PBDEs
- Will be performed through a survey of the entire industrial community
- Due with the annual report on April 1, 2025

Pretreatment control of PBDEs

Modify permits

- Legacy pollutant
- Historical usage / Current usage
- Contamination reduced or eliminated?
- Action Plan

Best Management Practices (BMPs)

- Evaluate BMPs and pollution prevention practices for use in permits to control PBDE discharge
- Product or equipment substitution
- Good housekeeping practices

Monitoring for PBDEs

- Monitor influent PBDE concentrations semiannually
- 2026 and 2027
- Results reported on semiannual DMRs
- Evaluate the results relative to previous sampling 2020-2022
- Evaluate effectiveness of Pretreatment Control Efforts

Contact us:

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Wastewater Quality Process Analyst

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dkerlee@everettwa.gov

Shane Sinclair

Industrial Pre-Treatment Manager

425.257.8247

SSinclair@everettwa.gov

2609 North River Road, Port Allen, Louisiana 70767
(800) 401-4277 -- FAX (225) 381-2996

ARS Aleut Analytical

ARS International, LLC

Laboratory Analysis Report

ARSI-18-00516

USACE COC #72

Prepared for:

Seattle USACE
Marlowe Laubach/Ember Korver/Karah Haskins
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Seattle, WA 98134
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ember.e.korver@usace.armv.mil; karah.a.haskins@usace.armv.mil
Phone: 206-764-4480

Project Manager Review

Contact Person: Questions regarding this analytical report should be addressed to:

Project Manager
ProjectManagers@amrad.com Phone: 225.381.2991
Fax: 225.381.2996

ANAB ACCREDITED DOD ELAP

LELAP cert# 01949

ARS Aleut Analytical

2609 North River Road • Port Allen, Louisiana 70767
1 (800) 401-4277 • Fax (225) 381-2996

March 7, 2018

Ember Korver
Karah Haskins
USACE-Seattle
206-764-4480
ember.e.korver@usace.army.mil
karah.a.haskins@usace.army.mil

ARS SDG: **ARS1-18-00516**
Task Order: **3**
USACE COC: **#72**

Dear Ember & Karah,

On February 20, 2018, JBLM submitted six (6) samples to be analyzed for Metals, TPH-DRO, TPH-GRO, Total Recoverable Phenolics, and Cyanide, which were subcontracted to TestAmerica Laboratories. The samples were also subcontracted to GEL Laboratories for analysis of Low Level Mercury and Vista Analytical Laboratory for analysis of PBDE Congeners. Results of all the analyses are attached in the data package from the subcontracted lab.

If you have any questions, please do not hesitate to call at 255.381.2991 or email ProjectManagers@amrad.com.

Sincerely,

Susan Leese

Susan Leese
Project Management
ARS International

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-75225-1
Client Project/Site: COC # 72/JBLM WWTP

For:
ARS International, LLC
2609 North River Road
Port Allen, Louisiana 70767

Attn: Susan Leese

Authorized for release by:
3/6/2018 9:46:56 AM

Kayse Zalmai, Project Manager I
(253)922-2310
kayse.zalmai@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Case Narrative

Job ID: 580-75225-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-75225-1

Receipt
The samples were received on 2/20/2018 4:10 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.1º C.

Receipt Exceptions
A trip blank was submitted for analysis with these samples; however, it was not listed on the Chain of Custody (COC).

GC/MS VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC Semi VOA
Method(s) NWTPH-Dx: Continuing calibration verification (CCV) standard associated with batch 580-268152 recovered outside %Drift acceptance criteria for o-Terphenyl surrogate. The %Recovery is within acceptance criteria for the surrogate in the CCV and associated samples; therefore, the data are qualified and reported. The following samples are affected: Effluent Grab 1 (580-75225-5), (CCV 580-268152/14), (CCV 580-268152/25) and (CCVRT 580-268152/3).

Method(s) NWTPH-Dx: The following sample contained a hydrocarbon pattern in the diesel range; however, the elution pattern was later than the typical diesel fuel pattern used by the laboratory for quantitative purposes: Effluent Grab 1 (580-75225-5).

Method(s) NWTPH-Dx: The peak profile present in this sample Influent Grab 1 (580-75225-2) is atypical of a hydrocarbon pattern and consists of discrete peaks.

Method(s) NWTPH-Dx: The following sample was diluted to bring the concentration of target analytes within the calibration range: Influent Grab 1 (580-75225-2). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample Results

Client: ARS International, LLC
Project/Site: COC # 72/JBLM WWTP

TestAmerica Job ID: 580-75225-1

Client Sample ID: Influent Composite
Date Collected: 02/19/18 11:20
Date Received: 02/20/18 16:10

Lab Sample ID: 580-75225-1
Matrix: Water

Method: 200.8 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		02/23/18 09:25	02/26/18 16:19	1
Cadmium	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 16:19	1
Chromium	**0.00084**		0.00040		mg/L		02/23/18 09:25	02/26/18 16:19	1
Copper	**0.050**		0.0020		mg/L		02/23/18 09:25	02/26/18 16:19	1
Lead	ND		0.00080		mg/L		02/23/18 09:25	02/26/18 16:19	1
Molybdenum	ND		0.00080		mg/L		02/23/18 09:25	02/26/18 16:19	1
Nickel	ND		0.0030		mg/L		02/23/18 09:25	02/26/18 16:19	1
Selenium	ND		0.0080		mg/L		02/23/18 09:25	02/26/18 16:19	1
Silver	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 16:19	1
Zinc	**0.057**		0.0070		mg/L		02/23/18 09:25	02/26/18 16:19	1

Client Sample Results

Client Sample ID: Influent Grab 1

Lab Sample ID: 580-75225-2

Date Collected: 02/19/18 16:05
Matrix: Water
Date Received: 02/20/18 16:10

Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		0.25		mg/L			02/23/18 19:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*86*		*58 - 133*		*02/23/18 19:53*	*1*
Trifluorotoluene (Surr)	*120*		*77 - 128*		*02/23/18 19:53*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**5.1**		0.55		mg/L		02/28/18 09:43	03/05/18 13:04	5
Motor Oil (>C24-C36)	**5.4**		1.8		mg/L		02/28/18 09:43	03/05/18 13:04	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*51*		*50 - 150*	*02/28/18 09:43*	*03/05/18 13:04*	*5*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phenolics, Total Recoverable	ND		0.050		mg/L		02/27/18 16:38	03/01/18 15:28	1
Cyanide, Total	ND		0.060		mg/L		02/22/18 11:49	02/22/18 15:20	1

Client: ARS International, LLC
Project/Site: COC # 72/JBLM WWTP

TestAmerica Job ID: 580-75225-1

Client Sample ID: Influent Grab 2
Date Collected: 02/19/18 17:10
Date Received: 02/20/18 16:10

Lab Sample ID: 580-75225-3
Matrix: Water

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phenolics, Total Recoverable	ND		0.050		mg/L		02/27/18 16:38	03/01/18 15:29	1
Cyanide, Total	ND		0.060		mg/L		02/22/18 11:49	02/22/18 15:20	1

Client Sample Results

Client: ARS International, LLC
Project/Site: COC # 72/JBLM WWTP

TestAmerica Job ID: 580-75225-1

Client Sample ID: Effluent Composite
Date Collected: 02/19/18 11:15
Date Received: 02/20/18 16:10

Lab Sample ID: 580-75225-4
Matrix: Water

Method: 200.8 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		02/23/18 09:25	02/26/18 16:23	1
Cadmium	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 16:23	1
Chromium	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 16:23	1
Copper	**0.017**		0.0020		mg/L		02/23/18 09:25	02/26/18 16:23	1
Lead	ND		0.00080		mg/L		02/23/18 09:25	02/26/18 16:23	1
Molybdenum	ND		0.00080		mg/L		02/23/18 09:25	02/26/18 16:23	1
Nickel	ND		0.0030		mg/L		02/23/18 09:25	02/26/18 16:23	1
Selenium	ND		0.0080		mg/L		02/23/18 09:25	02/26/18 16:23	1
Silver	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 16:23	1
Zinc	**0.029**		0.0070		mg/L		02/23/18 09:25	02/26/18 16:23	1

Client Sample ID: Effluent Grab 1

Date Collected: 02/19/18 16:10
Date Received: 02/20/18 16:10

Lab Sample ID: 580-75225-5
Matrix: Water

Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		0.25		mg/L			02/23/18 20:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*85*		*58 - 133*		*02/23/18 20:55*	*1*
Trifluorotoluene (Surr)	*122*		*77 - 128*		*02/23/18 20:55*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.26**		0.11		mg/L		02/28/18 09:43	03/01/18 03:44	1
Motor Oil (>C24-C36)	ND		0.35		mg/L		02/28/18 09:43	03/01/18 03:44	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*63*		*50 - 150*	*02/28/18 09:43*	*03/01/18 03:44*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phenolics, Total Recoverable	ND		0.050		mg/L		02/27/18 16:38	03/01/18 15:31	1
Cyanide, Total	ND		0.060		mg/L		02/22/18 11:49	02/22/18 15:20	1

Client Sample ID: Effluent Grab 2
Date Collected: 02/19/18 17:15
Date Received: 02/20/18 16:10

Lab Sample ID: 580-75225-6
Matrix: Water

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phenolics, Total Recoverable	ND		0.050		mg/L		02/27/18 16:38	03/01/18 15:48	1
Cyanide, Total	ND		0.060		mg/L		02/22/18 11:49	02/22/18 15:20	1

Client: ARS International, LLC
Project/Site: COC # 72/JBLM WWTP

TestAmerica Job ID: 580-75225-1

Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC)

Lab Sample ID: MB 580-267913/6
Matrix: Water
Analysis Batch: 267913

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		0.25		mg/L			02/23/18 14:40	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*87*		*58 - 133*		*02/23/18 14:40*	*1*
Trifluorotoluene (Surr)	*110*		*77 - 128*		*02/23/18 14:40*	*1*

Lab Sample ID: LCS 580-267913/7
Matrix: Water
Analysis Batch: 267913

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Gasoline	1.00	0.905		mg/L		90	79 - 110

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*89*		*58 - 133*
Trifluorotoluene (Surr)	*99*		*77 - 128*

Lab Sample ID: LCSD 580-267913/8
Matrix: Water
Analysis Batch: 267913

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Gasoline	1.00	0.954		mg/L		95	79 - 110	5	10

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene (Surr)	*91*		*58 - 133*
Trifluorotoluene (Surr)	*102*		*77 - 128*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 580-268098/1-A
Matrix: Water
Analysis Batch: 268257

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268098

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		0.11		mg/L		02/28/18 09:43	03/02/18 20:46	1
Motor Oil (>C24-C36)	ND		0.35		mg/L		02/28/18 09:43	03/02/18 20:46	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*68*		*50 - 150*	*02/28/18 09:43*	*03/02/18 20:46*	*1*

Lab Sample ID: LCS 580-268098/2-A
Matrix: Water
Analysis Batch: 268257

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268098

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
#2 Diesel (C10-C24)	2.00	1.60		mg/L		80	59 - 112

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC) (Continued)

Lab Sample ID: LCS 580-268098/2-A
Matrix: Water
Analysis Batch: 268257

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268098

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Motor Oil (>C24-C36)	2.00	1.81		mg/L		90	64 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*83*		*50 - 150*

Lab Sample ID: LCSD 580-268098/3-A
Matrix: Water
Analysis Batch: 268257

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 268098

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)	2.00	1.63		mg/L		82	59 - 112	2	16
Motor Oil (>C24-C36)	2.00	1.84		mg/L		92	64 - 120	2	17

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*84*		*50 - 150*

Method: 200.8 - Metals (ICP/MS)

Lab Sample ID: MB 580-267859/14-A
Matrix: Water
Analysis Batch: 268009

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 267859

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		02/23/18 09:25	02/26/18 15:29	1
Cadmium	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 15:29	1
Chromium	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 15:29	1
Copper	ND		0.0020		mg/L		02/23/18 09:25	02/26/18 15:29	1
Lead	ND		0.00080		mg/L		02/23/18 09:25	02/26/18 15:29	1
Molybdenum	ND		0.00080		mg/L		02/23/18 09:25	02/26/18 15:29	1
Nickel	ND		0.0030		mg/L		02/23/18 09:25	02/26/18 15:29	1
Selenium	ND		0.0080		mg/L		02/23/18 09:25	02/26/18 15:29	1
Silver	ND		0.00040		mg/L		02/23/18 09:25	02/26/18 15:29	1
Zinc	ND		0.0070		mg/L		02/23/18 09:25	02/26/18 15:29	1

Lab Sample ID: LCS 580-267859/15-A
Matrix: Water
Analysis Batch: 268009

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 267859

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	0.100	0.101		mg/L		101	85 - 115
Cadmium	0.100	0.0986		mg/L		99	85 - 115
Chromium	0.100	0.0991		mg/L		99	85 - 115
Copper	0.100	0.0985		mg/L		98	85 - 115
Lead	0.100	0.0997		mg/L		100	85 - 115
Molybdenum	0.100	0.0984		mg/L		98	85 - 115
Nickel	0.100	0.0964		mg/L		96	85 - 115
Selenium	0.100	0.0952		mg/L		95	85 - 115
Silver	0.100	0.101		mg/L		101	85 - 115

Method: 200.8 - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 580-267859/15-A
Matrix: Water
Analysis Batch: 268009

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 267859

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Zinc	0.100	0.0984		mg/L		98	85 - 115

Lab Sample ID: LCSD 580-267859/16-A
Matrix: Water
Analysis Batch: 268009

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 267859

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	0.100	0.0985		mg/L		98	85 - 115	3	20
Cadmium	0.100	0.0949		mg/L		95	85 - 115	4	20
Chromium	0.100	0.0961		mg/L		96	85 - 115	3	20
Copper	0.100	0.0945		mg/L		94	85 - 115	4	20
Lead	0.100	0.0958		mg/L		96	85 - 115	4	20
Molybdenum	0.100	0.0960		mg/L		96	85 - 115	2	20
Nickel	0.100	0.0927		mg/L		93	85 - 115	4	20
Selenium	0.100	0.0915		mg/L		92	85 - 115	4	20
Silver	0.100	0.0970		mg/L		97	85 - 115	4	20
Zinc	0.100	0.0957		mg/L		96	85 - 115	3	20

Method: 420.4 - Phenolics, Total Recoverable

Lab Sample ID: MB 490-498179/1-A
Matrix: Water
Analysis Batch: 498792

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 498179

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phenolics, Total Recoverable	ND		0.050		mg/L		02/27/18 16:38	03/01/18 15:19	1

Lab Sample ID: LCS 490-498179/2-A
Matrix: Water
Analysis Batch: 498792

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 498179

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Phenolics, Total Recoverable	0.760	0.720		mg/L		95	90 - 110

Method: SM 4500 CN E - Cyanide, Total

Lab Sample ID: MB 580-267814/1-A
Matrix: Water
Analysis Batch: 267836

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 267814

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cyanide, Total	ND		0.060		mg/L		02/22/18 11:49	02/22/18 15:20	1

Lab Sample ID: LCS 580-267814/2-A
Matrix: Water
Analysis Batch: 267836

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 267814

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cyanide, Total	0.500	0.481		mg/L		96	90 - 110

Lab Sample ID: LCSD 580-267814/3-A
Matrix: Water
Analysis Batch: 267836

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 267814

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cyanide, Total			0.500	0.504		mg/L		101	90 - 110	5	10

Lab Sample ID: 580-75225-2 MS
Matrix: Water
Analysis Batch: 267836

Client Sample ID: Influent Grab 1
Prep Type: Total/NA
Prep Batch: 267814

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Cyanide, Total	ND		0.500	0.463		mg/L		93	90 - 110		

Lab Sample ID: 580-75225-2 MSD
Matrix: Water
Analysis Batch: 267836

Client Sample ID: Influent Grab 1
Prep Type: Total/NA
Prep Batch: 267814

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cyanide, Total	ND		0.500	0.455		mg/L		91	90 - 110	2	10

Client Sample ID: Influent Composite — Lab Sample ID: 580-75225-1

Date Collected: 02/19/18 11:20 — **Matrix: Water**
Date Received: 02/20/18 16:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.8			267859	02/23/18 09:25	ASJ	TAL SEA
Total/NA	Analysis	200.8		1	268009	02/26/18 16:19	FCW	TAL SEA

Client Sample ID: Influent Grab 1 — Lab Sample ID: 580-75225-2

Date Collected: 02/19/18 16:05 — **Matrix: Water**
Date Received: 02/20/18 16:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	NWTPH-Gx		1	267913	02/23/18 19:53	JCV	TAL SEA
Total/NA	Prep	3510C			268098	02/28/18 09:43	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		5	268301	03/05/18 13:04	ADB	TAL SEA
Total/NA	Prep	Distill/Phenol			498179	02/27/18 16:38	RSB	TAL NSH
Total/NA	Analysis	420.4		1	498792	03/01/18 15:28	SDL	TAL NSH
Total/NA	Prep	Distill/CN			267814	02/22/18 11:49	SPP	TAL SEA
Total/NA	Analysis	SM 4500 CN E		1	267836	02/22/18 15:20	SPP	TAL SEA

Client Sample ID: Influent Grab 2 — Lab Sample ID: 580-75225-3

Date Collected: 02/19/18 17:10 — **Matrix: Water**
Date Received: 02/20/18 16:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Distill/Phenol			498179	02/27/18 16:38	RSB	TAL NSH
Total/NA	Analysis	420.4		1	498792	03/01/18 15:29	SDL	TAL NSH
Total/NA	Prep	Distill/CN			267814	02/22/18 11:49	SPP	TAL SEA
Total/NA	Analysis	SM 4500 CN E		1	267836	02/22/18 15:20	SPP	TAL SEA

Client Sample ID: Effluent Composite — Lab Sample ID: 580-75225-4

Date Collected: 02/19/18 11:15 — **Matrix: Water**
Date Received: 02/20/18 16:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.8			267859	02/23/18 09:25	ASJ	TAL SEA
Total/NA	Analysis	200.8		1	268009	02/26/18 16:23	FCW	TAL SEA

Client Sample ID: Effluent Grab 1 — Lab Sample ID: 580-75225-5

Date Collected: 02/19/18 16:10 — **Matrix: Water**
Date Received: 02/20/18 16:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	NWTPH-Gx		1	267913	02/23/18 20:55	JCV	TAL SEA
Total/NA	Prep	3510C			268098	02/28/18 09:43	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	268152	03/01/18 03:44	ADB	TAL SEA

Lab Chronicle

Client: ARS International, LLC
Project/Site: COC # 72/JBLM WWTP

TestAmerica Job ID: 580-75225-1

Client Sample ID: Effluent Grab 1

Lab Sample ID: 580-75225-5

Date Collected: 02/19/18 16:10
Date Received: 02/20/18 16:10

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Distill/Phenol			498179	02/27/18 16:38	RSB	TAL NSH
Total/NA	Analysis	420.4		1	498792	03/01/18 15:31	SDL	TAL NSH
Total/NA	Prep	Distill/CN			267814	02/22/18 11:49	SPP	TAL SEA
Total/NA	Analysis	SM 4500 CN E		1	267836	02/22/18 15:20	SPP	TAL SEA

Client Sample ID: Effluent Grab 2

Lab Sample ID: 580-75225-6

Date Collected: 02/19/18 17:15
Date Received: 02/20/18 16:10

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Distill/Phenol			498179	02/27/18 16:38	RSB	TAL NSH
Total/NA	Analysis	420.4		1	498792	03/01/18 15:48	SDL	TAL NSH
Total/NA	Prep	Distill/CN			267814	02/22/18 11:49	SPP	TAL SEA
Total/NA	Analysis	SM 4500 CN E		1	267836	02/22/18 15:20	SPP	TAL SEA

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: ARS International, LLC
Project/Site: COC # 72/JBLM WWTP

TestAmerica Job ID: 580-75225-1

Laboratory: TestAmerica Seattle

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska (UST)	State Program	10	17-024	01-19-19
ANAB	DoD ELAP		L2236	01-19-19
ANAB	ISO/IEC 17025		L2236	01-19-19
California	State Program	9	2901	11-05-18
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-05-18
US Fish & Wildlife	Federal		LE058448-0	10-31-18
USDA	Federal		P330-14-00126	02-10-20
Washington	State Program	10	C553	02-17-19

Laboratory: TestAmerica Nashville

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
A2LA	A2LA		NA: NELAP & A2LA	12-31-19
A2LA	ISO/IEC 17025		0453.07	12-31-19
Alaska (UST)	State Program	10	UST-087	06-30-18
Arizona	State Program	9	AZ0473	05-05-18
Arkansas DEQ	State Program	6	88-0737	04-25-18
California	State Program	9	2938	10-31-18
Connecticut	State Program	1	PH-0220	12-31-19
Florida	NELAP	4	E87358	06-30-18
Georgia	State Program	4	E87358(FL)/453.07(A2LA)	06-30-18
Illinois	NELAP	5	200010	12-09-18
Iowa	State Program	7	131	04-01-18
Kansas	NELAP	7	E-10229	10-31-18
Kentucky (UST)	State Program	4	19	06-30-18
Kentucky (WW)	State Program	4	90038	12-31-18
Louisiana	NELAP	6	30613	06-30-18
Maine	State Program	1	TN00032	11-03-19
Maryland	State Program	3	316	03-31-19
Massachusetts	State Program	1	M-TN032	06-30-18
Minnesota	NELAP	5	047-999-345	12-31-18
Mississippi	State Program	4	N/A	06-30-18
Montana (UST)	State Program	8	NA	02-24-20
Nevada	State Program	9	TN00032	07-31-18
New Hampshire	NELAP	1	2963	10-09-18
New Jersey	NELAP	2	TN965	06-30-18
New York	NELAP	2	11342	03-31-18
North Carolina (WW/SW)	State Program	4	387	12-31-18
North Dakota	State Program	8	R-146	06-30-18
Ohio VAP	State Program	5	CL0033	07-06-19
Oklahoma	State Program	6	9412	08-31-18
Oregon	NELAP	10	TN200001	04-27-18
Pennsylvania	NELAP	3	68-00585	06-30-18
Rhode Island	State Program	1	LAO00268	12-30-17 *
South Carolina	State Program	4	84009 (001)	02-28-18 *
Tennessee	State Program	4	2008	02-23-20
Texas	NELAP	6	T104704077	08-31-18
USDA	Federal		P330-13-00306	12-01-19

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Client: ARS International, LLC
TestAmerica Job ID: 580-75225-1
Project/Site: COC # 72/JBLM WWTP

Laboratory: TestAmerica Nashville (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Utah	NELAP	8	TN00032	07-31-18
Virginia	NELAP	3	460152	06-14-18
Washington	State Program	10	C789	07-19-18
West Virginia DEP	State Program	3	219	02-28-19
Wisconsin	State Program	5	998020430	08-31-18
Wyoming (UST)	A2LA	8	453.07	12-31-19

Sample Summary

Client: ARS International, LLC
Project/Site: COC # 72/JBLM WWTP

TestAmerica Job ID: 580-75225-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-75225-1	Influent Composite	Water	02/19/18 11:20	02/20/18 16:10
580-75225-2	Influent Grab 1	Water	02/19/18 16:05	02/20/18 16:10
580-75225-3	Influent Grab 2	Water	02/19/18 17:10	02/20/18 16:10
580-75225-4	Effluent Composite	Water	02/19/18 11:15	02/20/18 16:10
580-75225-5	Effluent Grab 1	Water	02/19/18 16:10	02/20/18 16:10
580-75225-6	Effluent Grab 2	Water	02/19/18 17:15	02/20/18 16:10

Loc: 580

75225

Chain of Custody Record

ARS International

Client Contact: USACE Marlowe Laubach
Phone#: (206) 764-4480
Contract #: W912DW-17-D-1012
Task Order#: W912DW18F5005

Program/Samplers Name: JBLM-WWTP
Address: 2012 Liggett Ave
JBLM, WA 98433
Phone# 253-966-1768 (Cindy Trout)
Cell # 253-967-2837 (Becky Kowalski)
Email: usarmy.jblm.imcom.list.dpw-wwtp@mail.mil

Lab Sent To: Test America-Seattle/Tacoma
Contact: Kathy Kreps (Kathy.kreps@testamericainc.com)
Address: 5755 8th Street East
Tacoma, WA 98424
Phone: 253.248.4964
Cell: 253.380.6574

Lab performing analysis

Analytical Method and Preparation/Extraction Procedure

	Date	Time	Sample ID	Type *	# of Cont	[0004M] Cyanide, Total	[0004AK] Phenolics, Manual Distillation	[0003B] GRO NWTPH-Gx	[0003F] DRO NWTPH-Dx	[0005P] Mercury, Cold Vapor, low level (20 ng/L)	[0005B] *Metals	[0007T] **PBDE Congeners (SW8082)		
1	2/15/18	1120	Influent Composite	AQ	4					X	X	X		NOT USED
2	2/14/18	1605	Influent Grab 1	AQ	7	X	X	X	X					
3	2/19/18	1710	Influent Grab 2	AQ	2	X	X							
4	2/15/18	1115	Effluent Composite	AQ	4					X	X	X		
5	2/19/18	1610	Effluent Grab 1	AQ	7	X	X	X	X					
6	2/19/18	1715	Effluent Grab 2	AQ	2	X	X							
7	////////// - NOTHING AUTHORIZED BELOW THIS LINE - //////////													
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

Turnaround Time (business days):

Notes/Special Instructions: *Metals - As, Cd, Cr, Cu, Mo, Ni, Pb, Se, Ag, Zn
****PBDE Congeners - 15, 28/33, 46, 47, 66, 57, 99, 100, 119, 153, 154, 155, 209**

Send Results To:
JBLM, usarmy.jblm.imcom.list.dpw-wwtp@mail.mil
Susan Leese, ARS, sleese@amrad.com
Karah Haskins, USACE, karah.a.haskins@usace.army.mil
Ember Korver, USACE, Ember.E.Korver@usace.army.mil
Marlowe Laubach, USACE, Marlowe.D.Laubach@usace.army.mil

COC NUMBER
USACE COC 72

HASKINS.KARA H.A.1393620923
Digitally signed by HASKINS.KARAH.A.1393620923
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=HASKINS.KARAH.A.1393620923
Date: 2018.01.10 13:22:24 -08'00'

Possible Hazard Identification:
☐ *Low-Level Contaminants* ☐ *Skin Irritant* ☐ *Unknown*

Sample Disposal Options:
☐ *Disposal By Lab* ☐ *Archive For ________ Months*

Additional Notes: 2018.01.01 Solo Point WWTP Quarterly

FEDEX TRACKING#:

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
[signature]	2/20/18 1610	[signature] SEA TA	2-20-18 1400

* **Types of samples:** S - solids, AQ - aqueous, DW - drinking water, SM - smear, LT - leak test, AF - air filters, SI - Silica gel, VG - vegetation, BIO - Bioassay

Therm. ID A2 Cor 1.1° Unc 2.0°
Cooler Dsc: Lrg Blue
Wet/Packs Packing: bubble
Cl: clo
Custody Seal: Yes X No __

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

580-75225 Chain of Custody

COOLER RECEIPT FORM

Cooler Received/Opened On 2/22/2018 @ 10:15

Time Samples Removed From Cooler__________ Time Samples Placed In Storage__________ (2 Hour Window)

1. Tracking # 7536 (last 4 digits, FedEx) Courier: FedEx

   IR Gun ID 97310166 pH Strip Lot__________ Chlorine Strip Lot__________

2. Temperature of rep. sample or temp blank when opened: 3.5 Degrees Celsius
3. If item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO..NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES..NO..NA

I certify that I opened the cooler and answered questions 1-6 (intial) es

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO..NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES..NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO..NA

● ← Larger than this.

14. Was there a Trip Blank in this cooler? YES...NO..NA If multiple coolers, sequence #______

I certify that I unloaded the cooler and answered questions 7-14 (intial) es

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES...NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO..NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) es

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) es

I certify that I attached a label with the unique LIMS number to each container (intial) es

21. Were there Non-Conformance issues at login? YES..NO Was a NCM generated? YES...NO..# es

BIS = Broken in shipment

Cooler Receipt Form.doc

LF-1

End of Form

Revised 8/23/17

TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Phone (253) 922-2310 Fax (253) 922-5047

Chain of Custody Record

580-75225

TestAmerica
LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Zalmai, Kayse 1		56.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: kayse.zalmai@testamericainc.com	State of Origin: Washington	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc		Accreditations Required (See note):		Job #: 580-75225-1
Address: 2960 Foster Creighton Drive,	Due Date Requested: 3/2/2018			Preservation Codes:
City: Nashville	TAT Requested (days):			
State, Zip: TN, 37204				
Phone: 615-726-0177(Tel) 615-726-3404(Fax)	PO #:			
Email:	WO #:			
Project Name: Seattle Army Corp of Engineers Task III	Project #: 58012000			
Site:	SSOW#:			

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)
Other:

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	420.4/Distill_Phenol Total Recoverable Phenolics	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
Influent Grab 1 (580-75225-2)	2/19/18	16:05 Pacific		Water			X	1	
Influent Grab 2 (580-75225-)	2/19/18	17:10 Pacific		Water			X	1	
Effluent Grab 1 (580-75225-5)	2/19/18	16:10 Pacific		Water			X	1	
Effluent Grab 2 (580-75225-6)	2/19/18	17:15 Pacific		Water			X	1	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to TestAmerica Laboratories, Inc.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Return To Client *Disposal By Lab* *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Primary Deliverable Rank: 2
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by: [signature]	Date/Time: 2-21-18 1245	Company: TASea	Received by: [signature]	Date/Time: 2-22-18 10:15	Company: TANAS
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks: 3.5

Ver: 09/20/2016

Login Sample Receipt Checklist

Client: ARS International, LLC

Job Number: 580-75225-1

Login Number: 75225
List Number: 1
Creator: Gall, Brandon A

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	Lab does not accept radioactive samples.
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	False	Received Trip Blank(s) not listed on COC.
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

GEL Laboratories LLC
a member of The GEL Group INC

PO Box 30712 Charleston, SC 29417
2040 Savage Road Charleston, SC 29407
P 843.556.8171
F 843.766.1178

gel.com

March 06, 2018

Ms. Susan Leese
ARS International, LLC
2609 North River Road
Port Allen, Louisiana 70767

Re: JBLM - Pretreatment
Work Order: 444796

Dear Ms. Leese:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on February 28, 2018. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4485.

Sincerely,

Valerie Davis

Valerie Davis
Project Manager

Purchase Order: USACE COC 72
Chain of Custody: 72
Enclosures

Case Narrative

Receipt Narrative
for
ARS International
SDG: 444796

March 06, 2018

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary:

Sample receipt: The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on February 28, 2018 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification: The laboratory received the following samples:

Laboratory ID	Client ID
444796001	Influent Composite
444796002	Effluent Composite

Case Narrative:

Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Metals.

Valerie Davis

Valerie Davis
Project Manager

Chain of Custody and Supporting Documentation

444796

Chain of Custody Record

Client Contact: USACE Marlowe Laubach
Phone#: (206) 764-4480
Contract #: W912DW-17-D-1012
Task Order#: W912DW18F5005

Program/Samplers Name: JBLM-WWTP
Address: 2012 Liggett Ave, JBLM, WA 98433
Phone# 253-966-1768 (Cindy Trout)
Cell # 253-967-2837 (Becky Kowalski)
Email: usarmy.jblm.imcom.list.dpw-wwtp@mail.mil

Lab Sent To: Test America-Seattle/Tacoma
Contact: Kathy Kreps (Kathy.kreps@testamericainc.com)
Address: 5755 8th Street East, Tacoma, WA 98424
Phone: 253.248.4964
Cell: 253.380.6574

Analytical Method and Preparation/Extraction Procedure — Lab performing analysis

	Date	Time	Sample ID	Type *	# of Cont	[0004M] Cyanide, Total	[0004AK] Phenolics, Manual Distillation	[0003B] GRO NWTPH-Gx	[0003F] DRO NWTPH-Dx	[0005P] Mercury, Cold Vapor, low level (20 ng/L)	[0005B] *Metals	[0007T] **PBDE Congeners (SW8082)		
1	2/15/18	1120	Influent Composite 152835	AQ	4					X	X	X	NOT USED	
2	2/19/18	1605	Influent Grab 1	AQ	7	X	X	X	X					
3	2/19/18	1710	Influent Grab 2	AQ	2	X	X							
4	2/19/18	1115	Effluent Composite 151915	AQ	4					X	X	X		
5	2/19/18	1610	Effluent Grab 1	AQ	7	X	X	X	X					
6	2/19/18	1715	Effluent Grab 2	AQ	2	X	X							
7	// - NOTHING AUTHORIZED BELOW THIS LINE - //													
8														
9														
10														
11			PRESERVED											
12			Date: 2-28-18											
13			Time: 1137											
14			Analyst: BCD											
15			BrCl: 2653461-BrCl											
16			Volume: 5mL											
17														
18														
19														
20														

Turnaround Time (business days):

Notes/Special Instructions: *Metals - As, Cd, Cr, Cu, Mo, Ni, Pb, Se, Ag, Zn
**PBDE Congeners - 15, 28/33, 46, 47, 66, 57, 99, 100, 119, 153, 154, 155, 209

Send Results To:
JBLM, usarmy.jblm.imcom.list.dpw-wwtp@mail.mil
Susan Leese, ARS, sleese@amrad.com
Karah Haskins, USACE, karah.a.haskins@usace.army.mil
Ember Korver, USACE, Ember.E.Korver@usace.army.mil
Marlowe Laubach, USACE, Marlowe.D.Laubach@usace.army.mil

COC NUMBER
USACE COC 72

HASKINS.KARA H.A.1393620923

Digitally signed by HASKINS.KARA.H.A.1393620923 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=HASKINS.KARA.H.A.1393620923 Date: 2018.01.10 13:22:24 -08'00'

Possible Hazard Identification:
☐ Low-Level Contaminants ☐ Skin Irritant ☐ Unknown

Sample Disposal Options:
☐ Disposal By Lab ☐ Archive For ______ Months

Additional Notes: 2018.01.01 Solo Point WWTP Quarterly

FEDEX TRACKING#:

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
[signature]	2/20/18 1610	[signature] SEA TA	2-20-18 1400
		[signature] Davis	2/28/18 0950

* Types of samples: S - solids, AQ - aqueous, DW - drinking water, SM - smear, LT - leak test, AF - air filters, SI - Silica gel, VG - vegetation, BIO - Bioassay

Therm. ID A2 Cor 1.1 ° Unc 2.0 °
Cooler Dsc: Lrg Blue
Wet/Packs Packing: Bubble
Cl: ed Custody Seal: Yes X No

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: ARSI	**SDG/AR/COC/Work Order:** 444796
Received By: Bryan Davis	**Date Received:** 2-28-18
Carrier and Tracking Number	Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other Tracking # 1Z A21 3W7 13 9721 2110

Suspected Hazard Information	**Yes**	**No**	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
Shipped as a DOT Hazardous?		✔	Hazard Class Shipped: UN#:
COC/Samples marked or classified as radioactive?		✔	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): 0 **CPM / mR/Hr** **Classified as: Rad 1 Rad 2 Rad 3**
Is package, COC, and/or Samples marked HAZ?		✔	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other:

	Sample Receipt Criteria	**Yes**	**NA**	**No**	**Comments/Qualifiers (Required for Non-Conforming Items)**
1	Shipping containers received intact and sealed?	✔			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	✔			
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*		✔		Preservation Method: Wet Ice Ice Packs Dry ice None Other: *all temperatures are recorded in Celsius **TEMP:** 17.3°C
4	Daily check performed and passed on IR temperature gun?	✔			**Temperature Device Serial #:** LLHG001 Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?	✔			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?	✔			Sample ID's and Containers Affected: If Preservation added, Lot#:
7	Do any samples require Volatile Analysis?			✔	If Yes, Are Encores or Soil Kits present? Yes___ No___ (If yes, take to VOA Freezer) Do VOA vials contain acid preservation? Yes ___ No___ N/A___ (If unknown, select No) VOA vials free of headspace? Yes___ No___ N/A___ Sample ID's and containers affected:
8	Samples received within holding time?	✔			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✔			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✔			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✔			Sample ID's affected:
12	Are sample containers identifiable as GEL provided?	✔			
13	COC form is properly signed in relinquished/received sections?	✔			

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials VSO Date 2/28/18 Page 1 of 1

GL-CHL-SR-001 Rev 5

Laboratory Certifications

List of current GEL Certifications as of 06 March 2018

State	Certification
Alaska	17−018
Arkansas	88−0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH−0169
Delaware	SC00012
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330−15−00283, P330−15−00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C−SC−01
Kansas NELAP	E−10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M−SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE−OS−26−13
Nevada	SC000122018−1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R−158
Oklahoma	9904
Pennsylvania NELAP	68−00485
Puerto Rico	SC00012
S.Carolina Radchem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235−18−13
Utah NELAP	SC000122017−25
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
West Virginia	997404

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 − (843) 556−8171 − www.gel.com

Certificate of Analysis Report
for

ARSI003 ARS International

Client SDG: 444796 GEL Work Order: 444796

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria
** Analyte is a Tracer compound
** Analyte is a surrogate compound
U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis.

Valerie Davis

Reviewed by ______________________

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 6, 2018

Company : ARS International, LLC
Address : 2609 North River Road

Port Allen, Louisiana 70767
Contact: Ms. Susan Leese
Project: JBLM - Pretreatment

Client Sample ID:	Influent Composite	Project:	ARSI00118
Sample ID:	444796001	Client ID:	ARSI003
Matrix:	Water		
Collect Date:	19-FEB-18 11:20		
Receive Date:	28-FEB-18		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA												
EPA 1631 Low Level Mercury Analysis "As Received"												
Mercury		12.8	1.00	2.50	ng/L		5	BCD1	03/02/18	0647	1743093	1

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 1631E	

Notes:

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lc/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 6, 2018

Company :	ARS International, LLC
Address :	2609 North River Road
	Port Allen, Louisiana 70767
Contact:	Ms. Susan Leese
Project:	JBLM - Pretreatment

Client Sample ID:	Effluent Composite	Project:	ARSI00118
Sample ID:	444796002	Client ID:	ARSI003
Matrix:	Water		
Collect Date:	19-FEB-18 11:15		
Receive Date:	28-FEB-18		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA												
EPA 1631 Low Level Mercury Analysis "As Received"												
Mercury		6.91	0.200	0.500	ng/L		1	BCD1	03/02/18	0640	1743093	1

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 1631E	

Notes:

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: March 6, 2018

ARS International, LLC
2609 North River Road
Port Allen, Louisiana

Contact: **Ms. Susan Leese**

Workorder: **444796**

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date Time
Metals Analysis-Mercury										
Batch 1743093										
QC1203980928 LCS										
Mercury	5.00			5.03	ng/L		101	(77%-123%)	BCD1	03/02/18 06:20
QC1203980927 MB										
Mercury			U	<0.2	ng/L					03/02/18 06:13
QC1203980929 444796001 MS										
Mercury	50.0	12.8		62.9	ng/L		100	(71%-125%)		03/02/18 06:54
QC1203980930 444796001 MSD										
Mercury	50.0	12.8		62.4	ng/L	0.902	99.2	(0%-24%)		03/02/18 07:01

Notes:

The Qualifiers in this report are defined as follows:

- < Result is less than value reported
- > Result is greater than value reported
- E %difference of sample and SD is >10%. Sample concentration must meet flagging criteria
- FB Mercury was found present at quantifiable concentrations in field blanks received with these samples. Data associated with the blank are deemed invalid for reporting to regulatory agencies
- H Analytical holding time was exceeded
- J Value is estimated
- N Metals--The Matrix spike sample recovery is not within specified control limits
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Other specific qualifiers were required to properly define the results. Consult case narrative.
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.

QC Summary

Workorder: **444796**

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time

h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
* Indicates that a Quality Control parameter was not within specifications.
For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

March 02, 2018

Vista Work Order No. 1800352

Ms. Susan Leese
ARS International, LLC
2609 North River Road
Port Allen, LA 70767

Dear Ms. Leese,

Enclosed are the results for the sample set received at Vista Analytical Laboratory on February 22, 2018. This sample set was analyzed on a rush turn-around time, under your Project Name 'USACE Region X PBDEs'.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier
Laboratory Director

Vista Analytical Laboratory certifies that the report herein meets all the requirements set forth by NELAP for those applicable test methods. Results relate only to the samples as received by the laboratory. This report should not be reproduced except in full without the written approval of Vista.

Vista Work Order No. 1800352
Case Narrative

Sample Condition on Receipt:

Two aqueous samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology.

Analytical Notes:

EPA Method 1614

These samples were extracted and analyzed for selected PBDE congeners by EPA Method 1614 using a ZB-5MS GC column.

Holding Times

The samples were extracted and analyzed within the method hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above the method quantitation limit. The OPR recoveries were within the method acceptance criteria.

The labeled standard recoveries outside of the method acceptance criteria are listed in the table below.

QC Anomalies

LabNumber	SampleName	Analysis	Analyte	Flag	%Rec
1800352-01	Influent Composite	EPA Method 1614	13C-BDE-15	H	154
1800352-01	Influent Composite	EPA Method 1614	13C-BDE-28	H	162
1800352-01	Influent Composite	EPA Method 1614	13C-BDE-100	H	169
1800352-01	Influent Composite	EPA Method 1614	13C-BDE-126	H	140
B8B0144-BS1	B8B0144-BS1	EPA Method 1614	13C-BDE-28	H	141

H = Recovery was outside laboratory acceptance criteria.

TABLE OF CONTENTS

Sample Inventory Report

Vista Sample ID	Client Sample ID	Sampled	Received	Components/Containers
1800352-01	Influent Composite	19-Feb-18 11:20	22-Feb-18 10:48	Amber Glass NM Bottle, 1L
				Amber Glass NM Bottle, 1L
1800352-02	Enfluent Composite	19-Feb-18 11:15	22-Feb-18 10:48	Amber Glass NM Bottle, 1L
				Amber Glass NM Bottle, 1L

ANALYTICAL RESULTS

Sample ID:	**Method Blank**	**EPA Method 1614**

Matrix:	Aqueous	QC Batch:	B8B0144	Lab Sample:	B8B0144-BLK1
Sample Size:	1.00 L	Date Extracted:	23-Feb-2018 7:07	Date Analyzed:	26-Feb-18 18:50 Column: ZB-5MS

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers
BDE-15	ND	0.245		
BDE-28/33	ND		0.859	
BDE-75/51	ND	0.323		
BDE-47	8.88			J
BDE-66	ND	0.555		
BDE-100	ND		1.05	
BDE-119/120	ND	1.87		
BDE-99	ND		4.51	
BDE-155	ND	0.680		
BDE-128/154	ND		1.10	
BDE-153	ND		2.15	
BDE-209	ND		150	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C-BDE-15	125	25 - 150	
IS	13C-BDE-28	138	25 - 150	
IS	13C-BDE-47	105	30 - 140	
IS	13C-BDE-100	123	25 - 150	
IS	13C-BDE-99	119	25 - 150	
IS	13C-BDE-155	104	25 - 150	
IS	13C-BDE-154	99.8	25 - 150	
IS	13C-BDE-153	101	25 - 150	
IS	13C-BDE-209	131	20 - 200	
CRS	13C-BDE-126	107	30 - 135	

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Sample ID: OPR

EPA Method 1614

Matrix:	Aqueous	QC Batch:	B8B0144	Lab Sample:	B8B0144-BS1
Sample Size:	1.00 L	Date Extracted:	23-Feb-2018 7:07	Date Analyzed:	26-Feb-18 16:51 Column: ZB-5MS

Analyte	Amt Found (pg/L)	Spike Amt	%R	Limits
BDE-15	552	500	110	50 - 150
BDE-28/33	1100	1000	110	50 - 150
BDE-75/51	2030	2000	102	50 - 150
BDE-47	1020	1000	102	50 - 150
BDE-66	1060	1000	106	50 - 150
BDE-100	1020	1000	102	50 - 150
BDE-119/120	2080	2000	104	50 - 150
BDE-99	1030	1000	103	50 - 150
BDE-155	1010	1000	101	50 - 150
BDE-128/154	2020	2000	101	50 - 150
BDE-153	995	1000	99.5	50 - 150
BDE-209	4980	5000	99.6	50 - 150

	Labeled Standard	%R	LCL-UCL
IS	13C-BDE-15	125	30 - 140
IS	13C-BDE-28	141	30 - 140
IS	13C-BDE-47	107	30 - 140
IS	13C-BDE-100	119	30 - 140
IS	13C-BDE-99	120	30 - 140
IS	13C-BDE-155	102	30 - 140
IS	13C-BDE-154	99.6	30 - 140
IS	13C-BDE-153	102	30 - 140
IS	13C-BDE-209	121	20 - 200
CRS	13C-BDE-126	112	40 - 125

LCL-UCL - Lower control limit - upper control limit

Sample ID: Influent Composite — EPA Method 1614

Client Data		Sample Data		Laboratory Data			
Name:	ARS International, LLC	Matrix:	Aqueous	Lab Sample:	1800352-01	Date Received:	22-Feb-2018 10:48
Project:	USACE Region X PBDEs	Sample Size:	0.976 L	QC Batch:	B8B0144	Date Extracted:	23-Feb-2018 7:07
Date Collected:	19-Feb-2018 11:20			Date Analyzed:	26-Feb-18 20:49 Column: ZB-5MS		
					26-Feb-18 23:47 Column: ZB-5MS		

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers
BDE-15	6.84			J
BDE-28/33	111			
BDE-75/51	ND		27.7	
BDE-47	7540			B, D
BDE-66	165			
BDE-100	1530			
BDE-119/120	9.78			J
BDE-99	7440			D
BDE-155	21.6			J
BDE-128/154	579			
BDE-153	552			
BDE-209	37100			D

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C-BDE-15	154	25 - 150	H
IS	13C-BDE-28	162	25 - 150	H
IS	13C-BDE-47	104	30 - 140	D
IS	13C-BDE-100	169	25 - 150	H
IS	13C-BDE-99	142	25 - 150	D
IS	13C-BDE-155	110	25 - 150	
IS	13C-BDE-154	107	25 - 150	
IS	13C-BDE-153	107	25 - 150	
IS	13C-BDE-209	166	20 - 200	D
CRS	13C-BDE-126	140	30 - 135	H

DL - Sample specifc estimated detection limit

EMPC - Estimated maximum possible concentration

LCL-UCL - Lower control limit - upper control limit

Sample ID: Enfluent Composite		EPA Method 1614

Client Data
Name: ARS International, LLC
Project: USACE Region X PBDEs
Date Collected: 19-Feb-2018 11:15

Sample Data
Matrix: Aqueous
Sample Size: 1.00 L

Laboratory Data
Lab Sample: 1800352-02
Date Received: 22-Feb-2018 10:48
QC Batch: B8B0144
Date Extracted: 23-Feb-2018 7:07
Date Analyzed: 26-Feb-18 19:49 Column: ZB-5MS

Analyte	Conc. (pg/L)	DL	EMPC	Qualifiers
BDE-15	18.1			J
BDE-28/33	122			
BDE-75/51	10.5			J
BDE-47	448			B
BDE-66	32.7			J
BDE-100	80.1			J
BDE-119/120	3.35			J
BDE-99	316			
BDE-155	1.60			J
BDE-128/154	34.8			J
BDE-153	23.5			J
BDE-209	3890			

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C-BDE-15	128	25 - 150	
IS	13C-BDE-28	144	25 - 150	
IS	13C-BDE-47	106	30 - 140	
IS	13C-BDE-100	125	25 - 150	
IS	13C-BDE-99	123	25 - 150	
IS	13C-BDE-155	102	25 - 150	
IS	13C-BDE-154	98.8	25 - 150	
IS	13C-BDE-153	100	25 - 150	
IS	13C-BDE-209	147	20 - 200	
CRS	13C-BDE-126	115	30 - 135	

DL - Sample specifc estimated detection limit

LCL-UCL - Lower control limit - upper control limit

EMPC - Estimated maximum possible concentration

DATA QUALIFIERS & ABBREVIATIONS

B	**This compound was also detected in the method blank.**
D	**Dilution**
E	**The associated compound concentration exceeded the calibration range of the instrument.**
H	**Recovery and/or RPD was outside laboratory acceptance limits.**
I	**Chemical Interference**
J	**The amount detected is below the Reporting Limit/LOQ.**
M	**Estimated Maximum Possible Concentration. (CA Region 2 projects only)**
*****	**See Cover Letter**
Conc.	**Concentration**
NA	**Not applicable**
ND	**Not Detected**
TEQ	**Toxic Equivalency**
U	**Not Detected (specific projects only)**

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

CERTIFICATIONS

Accrediting Authority	Certificate Number
Alaska Department of Environmental Conservation	17-013
Arkansas Department of Environmental Quality	17-015-0
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777-18
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2016026
Minnesota Department of Health	1322288
New Hampshire Environmental Accreditation Program	207717
New Jersey Department of Environmental Protection	CA003
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-008
Pennsylvania Department of Environmental Protection	014
Texas Commission on Environmental Quality	T104704189-17-8
Virginia Department of General Services	9077
Washington Department of Ecology	C584
Wisconsin Department of Natural Resources	998036160

Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.

1800352 0.2°C

Chain of Custody Record

Client Contact: USACE Marlowe Laubach
Phone#: (206) 764-4480
Contract #: W912DW-17-D-1012
Task Order#: W912DW18F5005

Program/Samplers Name: JBLM-WWTP
Address: 2012 Liggett Ave, JBLM, WA 98433
Phone# 253-966-1768 (Cindy Trout)
Cell # 253-967-2837 (Becky Kowalski)
Email: usarmy.jblm.imcom.list.dpw-wwtp@mail.mil

Lab Sent To: Test America-Seattle/Tacoma
Contact: Kathy Kreps (Kathy.kreps@testamericainc.com)
Address: 5755 8th Street East, Tacoma, WA 98424
Phone: 253.248.4964
Cell: 253.380.6574

Lab performing analysis — Analytical Method and Preparation/Extraction Procedure

	Date	Time	Sample ID	Type *	# of Cont	[0004M] Cyanide, Total	[0004AK] Phenolics, Manual Distillation	[0003B] GRO NWTPH-Gx	[0003F] DRO NWTPH-Dx	[0005P] Mercury, Cold Vapor, low level (20 ng/L)	[0005B] *Metals	[0007T] **PBDE Congeners (SW8082)		
1	2/19/18	1120	Influent Composite	AQ	4					X	X	X		
2	2/19/18	1605	Influent Grab 1	AQ	7	X	X	X	X				NOT USED	
3	2/19/18	1710	Influent Grab 2	AQ	2	X	X							
4	2/19/18	1115	Effluent Composite	AQ	4					X	X	X		
5	2/19/18	1610	Effluent Grab 1	AQ	7	X	X	X	X					
6	2/19/18	1715	Effluent Grab 2	AQ	2	X	X							
7	///////// - NOTHING AUTHORIZED BELOW THIS LINE - /////////													
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

Turnaround Time (business days):

Notes/Special Instructions: *Metals - As, Cd, Cr, Cu, Mo, Ni, Pb, Se, Ag, Zn
****PBDE Congeners - 15, 28/33, 46, 47, 66, 57, 99, 100, 119, 153, 154, 155, 209**

Send Results To:
JBLM, usarmy.jblm.imcom.list.dpw-wwtp@mail.mil
Susan Leese, ARS, sleese@amrad.com
Karah Haskins, USACE, karah.a.haskins@usace.army.mil
Ember Korver, USACE, Ember.E.Korver@usace.army.mil
Marlowe Laubach, USACE, Marlowe.D.Laubach@usace.army.mil

COC NUMBER
USACE COC 72

HASKINS.KARA H.A.1393620923 — Digitally signed by HASKINS.KARAH.A.1393620923 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=HASKINS.KARAH.A.1393620923 Date: 2018.01.10 13:22:24 -08'00'

Possible Hazard Identification:
☐ *Low-Level Contaminants* ☐ *Skin Irritant* ☐ *Unknown*

Sample Disposal Options:
☐ *Disposal By Lab* ☐ *Archive For ________ Months*

Additional Notes: **2018.01.01 Solo Point WWTP Quarterly**

FEDEX TRACKING#:

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
[signature]	2/20/18 1610	B. [signature] SEA TA	2-20-18 1400
B. [signature] SEA TA	2.21.18 1045	[signature] VAL	2/22/18 1254

* Types of samples: S - solids, AQ - aqueous, DW - drinking water, SM - smear, LT - leak test, AF - air filters, SI - Silica gel, VG - vegetation, BIO - Bioassay

Vista Analytical Laboratory

Sample Log-in Checklist

Vista Work Order #: 1800 352 **TAT** 12

Samples Arrival:	**Date/Time** 02/22/18 1048	**Initials:** BSB	**Location:** WR-2 **Shelf/Rack:** NA
Logged In:	**Date/Time** 02/22/18 1120	**Initials:** BSB	**Location:** WR-2 **Shelf/Rack:** B3

Delivered By:	FedEx	UPS	On Trac	GSO	DHL	Hand Delivered	Other
Preservation:	Ice		Blue Ice		Dry Ice		None

Temp °C: 0.2 **(uncorrected)**	**Time:** 1102	**Thermometer ID: DT-3**
Temp °C: 0.2 **(corrected)**	**Probe used: Yes☑ No☐**	

	YES	NO	NA
Adequate Sample Volume Received?	✓		
Holding Time Acceptable?	✓		
Shipping Container(s) Intact?	✓		
Shipping Custody Seals Intact?	✓		
Shipping Documentation Present?	✓		
Airbill — Trk # 1ZA21 3W7019061 9270	✓		
Sample Container Intact?	✓		
Sample Custody Seals Intact?			✓
Chain of Custody / Sample Documentation Present?	✓		
COC Anomaly/Sample Acceptance Form completed?		✓	

If Chlorinated or Drinking Water Samples, Acceptable Preservation?						✓
Preservation Documented:	$Na_2S_2O_3$	Trizma	None	Yes	No	NA
Shipping Container	Vista	Client	Retain	Return	Dispose	

Comments:

Sample label ID's	Date/time	# Containers
Effluent Composite	2/19/18 1115	A/B
Influent Composite	↓ 1120	↓

Note: COC list 6 samples only received 2 sample of the 6 listed.

ID.: LR – SLC Rev No.: 0 Rev Date: 05/18/2017 Page: 1 of 1

Earthjustice

Please see attached attachments to Earthjustice Comment Letter, part 3 of 3.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

August 3, 2016

Cynthia Trout
Department of the Army
Directoret of Public Works
2012 Liggett Avenue, Box 339500 M/S-17
Joint Base Lewis McChord, WA 98433

RE: Client Project: Solo Point WWTP NPDES Quarterly
ARI Job Nos. BDK7 eu

Dear Cynthia:

Please find enclosed the original Chain-of-Custody record (COC), sample receipt documentation, and the final data for the project referenced above. Analytical Resources, Inc. (ARI) accepted six samples in good condition on July 14, 2016. For further details regarding sample receipt please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for Total Metals, Cyanide, Phenol, PBDE, NWTPH-Gx and NWTPH-Dx, as requested. The Low Level Mercury was reported under ARI SDG BDM6.

The TPHD surrogate recovery for Influent Grab 1 dilution is out of control low.

An electronic copy of this report and all supporting raw data will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Respectfully,
ANALYTICAL RESOURCES, INC.

Amanda Volgardsen
-for-
Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com
www.arilabs.com

eFile: BDK7

Enclosures

1 of 34

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: BDK7	Turn-around Requested: Standard
Joint Base Lewis-McChord	Phone:
Cynthia Trout 253-966-1768 Raul Nino 253-477-2806	
Client Project Name: Solo Point WWTP NPDES Quarterly	
Client Project #:	Samplers: Raul Nino

Date:
Page: 1 of 1
No. of Coolers: Cooler Temps: 5.7

Analysis Requested

Sample ID	Date	Time	Matrix	No. Containers	3004L Total Cyanide	3004AH Phenol	3003B NWTPH-Gx	3003F NWTPH-Dx	3005AB Low Level Mercury	3005M *Metals	5003C PDBE Congeners		Notes/Comments
													*Metals - As, Cd, Cr, Cu, Mo, Ni, Pb, Se, Ag, Zn
Influent Composite	7/14/16	1145	W	1	-----	-----	-----	-----	X	X	-----	not	Use TO-39 for 3005M
Influent Grab 1		1630	W	8	X	X	X	X	-----	-----	X	used	sample, all others use
Influent Grab 2		1645	W	2	X	X	-----	-----	-----	-----	-----	not	TO-38 - LR
Effluent Composite		1155	W	1	-----	-----	-----	-----	X	X	-----	used	
Effluent Grab 1		1650	W	8	X	X	X	X	-----	-----	X	not	
Effluent Grab 2		~~1610~~ 1710	W	2	X	X	-----	-----	-----	-----	-----	used	

Nothing Approved Below this Line

Comments/Special Instructions	Relinquished by	Received by	Relinquished by	Received by
	(Signature) [signature]	(Signature) [signature]	(Signature)	(Signature)
	Printed Name: Raul J. Nino	Printed Name: Justin Meyd	Printed Name:	Printed Name:
	Company: Versar	Company: ARI	Company:	Company:
	Date & Time: 7/14/16 1830	Date & Time: 7-14-16 1830	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: Unless specified by workorder or contract, all water/soil samples submitted to ARI will be discarded or returned, no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer. Sediment samples submitted under PSDDA/PSEP/SMS protocol will be stored frozen for up to one year and then discarded.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: JBLM

Project Name: Solo Point WWTP NPDES Quarterly

COC No(s): ____ NA

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: ____

Assigned ARI Job No: BDK7

Tracking No: ____ NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	NO
Were custody papers included with the cooler?	YES	NO
Were custody papers properly filled out (ink, signed, etc.)	YES	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 5.7
Time: ____

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: D005276

Cooler Accepted by: JM Date: 7-14-16 Time: 1830

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	NO
What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: ____			
Was sufficient ice used (if appropriate)?	NA	YES	NO
Were all bottles sealed in individual plastic bags?		YES	NO
Did all bottles arrive in good condition (unbroken)?		YES	NO
Were all bottle labels complete and legible?		YES	NO
Did the number of containers listed on COC match with the number of containers received?		YES	NO
Did all bottle labels and tags agree with custody papers?		YES	NO
Were all bottles used correct for the requested analyses?		YES	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	NA	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	NO
Was sufficient amount of sample sent in each bottle?		YES	NO
Date VOC Trip Blank was made at ARI	NA	____	

Was Sample Split by ARI : NA YES Date/Time: ____ Equipment: ____ Split by: ____

Samples Logged by: TR Date: 7-18-16 Time: 1006

*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:

Small Air Bubbles ~2mm	Peabubbles 2-4 mm	LARGE Air Bubbles > 4 mm

Small → "sm" (< 2 mm)
Peabubbles → "pb" (2 to < 4 mm)
Large → "lg" (4 to < 6 mm)
Headspace → "hs" (> 6 mm)

PRESERVATION VERIFICATION 07/18/16
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **BDK7**

PC: Kelly
VTSR: 07/14/16

Inquiry Number: NONE
Analysis Requested: 07/18/16
Contact: Trout, Cynthia
Client: Joint Base Lewis McChord
Logged by: TR
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

Project #: #
Project: Solo Point WWTP NPDES Quarterly
Sample Site:
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	TPHD <2	BT <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
16-10711 **BDK7A**	Influent Composite						TOT pass																
16-10712 **BDK7B**	Effluent Composite						TOT pass																
16-10713 **BDK7C**	Influent Grab 1	pass						pass															
16-10714 **BDK7D**	Effluent Grab 1	pass						pass															
16-10715 **BDK7E**	Influent Grab 2	pass						pass															
16-10716 **BDK7F**	Effluent Grab 2	pass						pass															

Checked By TR Date 7-18-16

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: BDK7
Client: Joint Base Lewis McChord
Project Event: N/A
Project Name: Solo Point WWTP NPDES Quarterly

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	Influent Composite	BDK7A	16-10711	Water	07/14/16 11:45	07/14/16 18:30
2.	Effluent Composite	BDK7B	16-10712	Water	07/14/16 11:55	07/14/16 18:30
3.	Influent Grab 1	BDK7C	16-10713	Water	07/14/16 16:30	07/14/16 18:30
4.	Effluent Grab 1	BDK7D	16-10714	Water	07/14/16 16:50	07/14/16 18:30
5.	Influent Grab 2	BDK7E	16-10715	Water	07/14/16 16:45	07/14/16 18:30
6.	Effluent Grab 2	BDK7F	16-10716	Water	07/14/16 17:10	07/14/16 18:30

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 12/31/13

Inorganic Data

U — Indicates that the target analyte was not detected at the reported concentration

* — Duplicate RPD is not within established control limits

B — Reported value is less than the CRDL but ≥ the Reporting Limit

N — Matrix Spike recovery not within established control limits

NA — Not Applicable, analyte not spiked

H — The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible

L — Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U — Indicates that the target analyte was not detected at the reported concentration

* — Flagged value is not within established control limits

B — Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.

J — Estimated concentration when the value is less than ARI's established reporting limits

D — The spiked compound was not detected due to sample extract dilution

E — Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).
S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
NA	The flagged analyte was not analyzed for
NR	Spiked compound recovery is not reported due to chromatographic interference
NS	The flagged analyte was not spiked into the sample
M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
EMPC	Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference
X	Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**
Z	Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.

F Samples were frozen prior to particle size determination

SM Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations

SS Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis

W Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by P&T GC/MS-Method SW8260C/NWTPHG
Page 1 of 1

Sample ID: Influent Grab 1
SAMPLE

Lab Sample ID: BDK7C
LIMS ID: 16-10713
Matrix: Water
Data Release Authorized:
Reported: 07/27/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly #
Date Sampled: 07/14/16
Date Received: 07/14/16

Instrument/Analyst: NT2/LH
Date Analyzed: 07/23/16 13:45

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	LOQ	Result	Q	TPHG ID
86290-81-5	Gasoline Range Hydrocarbons	0.10	0.12		GRO

Reported in mg/L (ppm)

Volatile Surrogate Recovery

d8-Toluene	98.8%
Bromofluorobenzene	104%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by P&T GC/MS-Method SW8260C/NWTPHG
Page 1 of 1

Sample ID: Effluent Grab 1
SAMPLE

Lab Sample ID: BDK7D
LIMS ID: 16-10714
Matrix: Water
Data Release Authorized:
Reported: 07/27/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: 07/14/16
Date Received: 07/14/16

Instrument/Analyst: NT2/LH
Date Analyzed: 07/23/16 14:06

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	LOQ	Result	Q	TPHG ID
86290-81-5	Gasoline Range Hydrocarbons	0.10	< 0.10	U	---

Reported in mg/L (ppm)

Volatile Surrogate Recovery	
d8-Toluene	97.0%
Bromofluorobenzene	98.2%

ANALYTICAL RESOURCES INCORPORATED

VOA SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#

ARI ID	Client ID	PV	DCE	TOL	BFB	DCB	TOT OUT
MB-072316A	Method Blank	10	NA	97.6%	96.6%	NA	0
LCS-072316A	Lab Control	10	NA	97.6%	98.4%	NA	0
LCSD-072316A	Lab Control Dup	10	NA	97.0%	100%	NA	0
BDK7C	Influent Grab 1	10	NA	98.8%	104%	NA	0
BDK7D	Effluent Grab 1	10	NA	97.0%	98.2%	NA	0

SW8260C	LCS/MB LIMITS	QC LIMITS
(DCE) = d4-1,2-Dichloroethane	(80-129)	(80-129)
(TOL) = d8-Toluene	(80-120)	(80-120)
(BFB) = Bromofluorobenzene	(80-120)	(80-120)
(DCB) = d4-1,2-Dichlorobenzene	(80-120)	(80-120)

Prep Method: SW5030B
Log Number Range: 16-10713 to 16-10714

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by P&T GC/MS-Method SW8260C/NWTPHG

Sample ID: LCS-072316A
LAB CONTROL SAMPLE

Lab Sample ID: LCS-072316A
LIMS ID: 16-10713
Matrix: Water
Data Release Authorized:
Reported: 07/27/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: NT2/LH
LCSD: NT2/LH
Date Analyzed LCS: 07/23/16 10:21
LCSD: 07/23/16 10:42

Sample Amount LCS: 10.0 mL
LCSD: 10.0 mL
Purge Volume LCS: 10.0 mL
LCSD: 10.0 mL

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	0.90	1.00	90.0%	0.82	1.00	82.0%	9.3%

Reported in mg/L (ppm)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	LCSD
d8-Toluene	97.6%	97.0%
Bromofluorobenzene	98.4%	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by P&T GC/MS-Method SW8260C/NWTPHG **Sample ID: MB-072316A**
Page 11

Lab Sample ID: MB-072316A
LIMS ID: 16-10713
Matrix: Water
Data Release Authorized:
Reported: 07/27/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: NA
Date Received: NA

Instrument/Analyst: NT2/LH
Date Analyzed: 07/23/16 11:43

Sample Amount: 10.0 mL
Purge Volume: 10.0 mL

CAS Number	Analyte	LOQ	Result	Q	TPHG ID
86290-81-5	Gasoline Range Hydrocarbons	0.10	< 0.10	U	---

Reported in mg/L (ppm)

Volatile Surrogate Recovery	
d8-Toluene	97.6%
Bromofluorobenzene	96.6%

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID
Extraction Method: SW3510C

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#

Matrix: Water

Date Received: 07/14/16

Data Release Authorized:
Reported: 08/01/16

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DF	Range/Surrogate	RL	Result
MB-072116 16-10713	Method Blank HC ID: ---	07/21/16	07/29/16 FID4A	1.00 1.0	Diesel Range	0.10	< 0.10 U
					Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		94.0%
BDK7C 16-10713	Influent Grab 1 HC ID: **DRO/RRO**	07/21/16	07/29/16 FID4A	1.00 1.0	**Diesel Range**	**0.10**	**20 E**
					Motor Oil Range	**0.20**	**8.6**
					o-Terphenyl		55.5%
BDK7C DL 16-10713	Influent Grab 1 HC ID: **DRO/RRO**	07/21/16	07/29/16 FID4A	1.00 10	**Diesel Range**	**1.0**	**18**
					Motor Oil Range	**2.0**	**8.9**
					o-Terphenyl		49.6%
BDK7D 16-10714	Effluent Grab 1 HC ID: **DRO/RRO**	07/21/16	07/29/16 FID4A	1.00 1.0	**Diesel Range**	**0.10**	**0.41**
					Motor Oil Range	**0.20**	**1.1**
					o-Terphenyl		58.9%

Reported in mg/L (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicates results of organics or additional hydrocarbons in ranges are not identifiable.

TPHD SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#

Client ID	OTER	TOT OUT
MB-072116	94.0%	0
LCS-072116	91.0%	0
Influent Grab 1	55.5%	0
Influent Grab 1 DL	49.6%*	1
Effluent Grab 1	58.9%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3510C
Log Number Range: 16-10713 to 16-10714

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID

Sample ID: LCS-072116
LAB CONTROL

Lab Sample ID: LCS-072116
LIMS ID: 16-10713
Matrix: Water
Data Release Authorized:
Reported: 08/01/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: NA
Date Received: NA

Date Extracted: 07/21/16
Date Analyzed: 07/29/16 13:32
Instrument/Analyst: FID4A/ML

Sample Amount: 500 mL
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00

Range	Lab Control	Spike Added	Recovery
Diesel	2.28	3.00	76.0%

TPHD Surrogate Recovery	
o-Terphenyl	91.0%

Results reported in mg/L

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

Matrix: Water
Date Received: 07/14/16

ARI Job: BDK7
Project: Solo Point WWTP NPDES Quarterly
#

ARI ID	Client ID	Samp Amt	Final Vol	Prep Date
16-10713-072116MB1	Method Blank	500 mL	1.00 mL	07/21/16
16-10713-072116LCS1	Lab Control	500 mL	1.00 mL	07/21/16
16-10713-BDK7C	Influent Grab 1	500 mL	1.00 mL	07/21/16
16-10714-BDK7D	Effluent Grab 1	500 mL	1.00 mL	07/21/16

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: Influent Composite
SAMPLE

Lab Sample ID: BDK7A
LIMS ID: 16-10711
Matrix: Water
Data Release Authorized:
Reported: 07/29/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: 07/14/16
Date Received: 07/14/16

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	07/19/16	200.8	07/28/16	**7440-38-2**	**Arsenic**	0.2	**1.2**	
200.8	07/19/16	200.8	07/28/16	**7440-43-9**	**Cadmium**	0.1	**0.3**	
200.8	07/19/16	200.8	07/28/16	**7440-47-3**	**Chromium**	0.5	**1.3**	
200.8	07/19/16	200.8	07/28/16	**7440-50-8**	**Copper**	0.5	**63.0**	
200.8	07/19/16	200.8	07/28/16	**7439-92-1**	**Lead**	0.1	**1.3**	
200.8	07/19/16	200.8	07/28/16	**7439-98-7**	**Molybdenum**	0.2	**1.1**	
200.8	07/19/16	200.8	07/28/16	**7440-02-0**	**Nickel**	0.5	**2.2**	
200.8	07/19/16	200.8	07/28/16	7782-49-2	Selenium	0.5	0.5	U
200.8	07/19/16	200.8	07/28/16	7440-22-4	Silver	0.2	0.2	U
200.8	07/19/16	200.8	07/28/16	**7440-66-6**	**Zinc**	4	**97**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: Effluent Composite
SAMPLE

Lab Sample ID: BDK7B
LIMS ID: 16-10712
Matrix: Water
Data Release Authorized:
Reported: 07/29/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: 07/14/16
Date Received: 07/14/16

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	07/19/16	200.8	07/28/16	**7440-38-2**	**Arsenic**	0.2	**1.0**	
200.8	07/19/16	200.8	07/28/16	7440-43-9	Cadmium	0.1	0.1	U
200.8	07/19/16	200.8	07/28/16	**7440-47-3**	**Chromium**	0.5	**0.6**	
200.8	07/19/16	200.8	07/28/16	**7440-50-8**	**Copper**	0.5	**30.8**	
200.8	07/19/16	200.8	07/28/16	**7439-92-1**	**Lead**	0.1	**0.4**	
200.8	07/19/16	200.8	07/28/16	**7439-98-7**	**Molybdenum**	0.2	**0.7**	
200.8	07/19/16	200.8	07/28/16	**7440-02-0**	**Nickel**	0.5	**1.8**	
200.8	07/19/16	200.8	07/28/16	7782-49-2	Selenium	0.5	0.5	U
200.8	07/19/16	200.8	07/28/16	7440-22-4	Silver	0.2	0.2	U
200.8	07/19/16	200.8	07/28/16	**7440-66-6**	**Zinc**	4	**45**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: METHOD BLANK

Lab Sample ID: BDK7MB
LIMS ID: 16-10712
Matrix: Water
Data Release Authorized:
Reported: 07/29/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	07/19/16	200.8	07/28/16	7440-38-2	Arsenic	0.2	0.2	U
200.8	07/19/16	200.8	07/28/16	7440-43-9	Cadmium	0.1	0.1	U
200.8	07/19/16	200.8	07/28/16	7440-47-3	Chromium	0.5	0.5	U
200.8	07/19/16	200.8	07/28/16	7440-50-8	Copper	0.5	0.5	U
200.8	07/19/16	200.8	07/28/16	7439-92-1	Lead	0.1	0.1	U
200.8	07/19/16	200.8	07/28/16	7439-98-7	Molybdenum	0.2	0.2	U
200.8	07/19/16	200.8	07/28/16	7440-02-0	Nickel	0.5	0.5	U
200.8	07/19/16	200.8	07/28/16	7782-49-2	Selenium	0.5	0.5	U
200.8	07/19/16	200.8	07/28/16	7440-22-4	Silver	0.2	0.2	U
200.8	07/19/16	200.8	07/28/16	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: BDK7LCS
LIMS ID: 16-10712
Matrix: Water
Data Release Authorized:
Reported: 07/29/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	24.4	25.0	97.6%	
Cadmium	200.8	25.6	25.0	102%	
Chromium	200.8	25.4	25.0	102%	
Copper	200.8	26.5	25.0	106%	
Lead	200.8	28.3	25.0	113%	
Molybdenum	200.8	24.5	25.0	98.0%	
Nickel	200.8	25.8	25.0	103%	
Selenium	200.8	77.3	80.0	96.6%	
Silver	200.8	27.0	25.0	108%	
Zinc	200.8	81	80	101%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PBDE by GC/ECD Method SW8082
Extraction Method: SW3510C

Sample ID: Influent Grab 1
SAMPLE

Lab Sample ID: BDK7C
LIMS ID: 16-10713
Matrix: Water
Data Release Authorized: MDG
Reported: 08/04/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: 07/14/16
Date Received: 07/14/16

Date Extracted: 07/21/16
Date Analyzed: 07/29/16 04:11
Instrument/Analyst: ECD9/JGR
GPC Cleanup: No
Silica Gel: Yes
Acid Cleanup: No

Sample Amount: 500 mL
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Sulfur Cleanup: Yes

CAS Number	Analyte	LOQ	Result
5436-43-1	PBDE-47	0.010	< 0.010 U
189084-64-8	PBDE-100	0.010	< 0.010 U
60348-60-9	**PBDE-99**	**0.010**	**0.024 P**
207122-15-4	PBDE-154	0.010	< 0.010 U
68631-49-2	PBDE-153	0.010	< 0.010 U
41318-75-6	PBDE-28	0.010	< 0.010 U
189084-61-5	PBDE-66	0.010	< 0.010 U
1163-19-5	PBDE-209	0.050	< 0.050 U
2050-47-7	PBDE-15	0.010	< 0.010 U
189084-66-0	PBDE-119	0.010	< 0.010 U
147217-78-5	PBDE-33	0.010	< 0.010 U
446254-22-4	PBDE-46	0.010	< 0.010 U
189084-63-7	PBDE-75	0.010	< 0.010 U
35854-94-5	PBDE-155	0.010	< 0.010 U

Reported in µg/l (ppb)

PBDE Surrogate Recovery

2,2',3,3',4,4',5,6-Octachlorob 69.0%

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PBDE by GC/ECD Method SW8082
Extraction Method: SW3510C
Page 1 of 1

Sample ID: Effluent Grab 1
SAMPLE

Lab Sample ID: BDK7D
LIMS ID: 16-10714
Matrix: Water
Data Release Authorized:
Reported: 08/03/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: 07/14/16
Date Received: 07/14/16

Date Extracted: 07/21/16
Date Analyzed: 07/29/16 04:42
Instrument/Analyst: ECD9/JGR
GPC Cleanup: No
Silica Gel: Yes
Acid Cleanup: No

Sample Amount: 500 mL
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Sulfur Cleanup: Yes

CAS Number	Analyte	LOQ	Result
5436-43-1	PBDE-47	0.010	< 0.010 U
189084-64-8	PBDE-100	0.010	< 0.010 U
60348-60-9	PBDE-99	0.010	< 0.010 U
207122-15-4	PBDE-154	0.010	< 0.010 U
68631-49-2	PBDE-153	0.010	< 0.010 U
41318-75-6	PBDE-28	0.010	< 0.010 U
189084-61-5	PBDE-66	0.010	< 0.010 U
1163-19-5	PBDE-209	0.050	< 0.050 U
2050-47-7	PBDE-15	0.010	< 0.010 U
189084-66-0	PBDE-119	0.010	< 0.010 U
147217-78-5	PBDE-33	0.010	< 0.010 U
446254-22-4	PBDE-46	0.010	< 0.010 U
189084-63-7	PBDE-75	0.010	< 0.010 U
35854-94-5	PBDE-155	0.010	< 0.010 U

Reported in µg/l (ppb)

PBDE Surrogate Recovery

2,2',3,3',4,4',5,6-Octachlorob	63.8%

FORM I

SW8082/PBDE SOIL/SOLID SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#

Client ID	PCB-195	TOT OUT
MB-072116	80.2%	0
LCS-072116	70.6%	0
Influent Grab 1	69.0%	0
Effluent Grab 1	63.8%	0

	LCS/MB LIMITS	QC LIMITS
(PCB-195) = 2,2',3,3',4,4',5,6-Octachlor	(30-160)	(30-160)

Prep Method: SW3510C
Log Number Range: 16-10713 to 16-10714

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PBDE by GC/ECD Method SW8082
Page 1 of 1

Sample ID: LCS-072116
LCS/LCSD

Lab Sample ID: LCS-072116
LIMS ID: 16-10713
Matrix: Water
Data Release Authorized:
Reported: 08/03/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: NA
Date Received: NA

Date Extracted LCS/LCSD: 07/21/16
Date Analyzed LCS: 07/29/16 00:36
Instrument/Analyst LCS: ECD9/JGR
GPC Cleanup: No
Acid Cleanup: No
Sulfur Cleanup: Yes

Sample Amount LCS: 500 mL
Final Extract Volume LCS: 1.0 mL
Dilution Factor LCS: 1.00
Silica Gel: Yes
Percent Moisture: NA

Analyte	Lab Control	Spike Added	Recovery
PBDE-209	0.286 P	0.250	114%
PBDE-28	0.074	0.100	74.0%
PBDE-47	0.071	0.100	71.0%
PBDE-66	0.073	0.100	73.0%
PBDE-99	0.092	0.100	92.0%
PBDE-100	0.075	0.100	75.0%
PBDE-153	0.072	0.100	72.0%
PBDE-154	0.077	0.100	77.0%

PBDE Surrogate Recovery

2,2',3,3',4,4',5,6-Octach 70.6%

Results reported in µg/l (ppb)
RPD calculated using sample concentrations per SW846.

FORM III

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PBDE by GC/ECD Method SW8082
Extraction Method: SW3510C

Sample ID: MB-072116
METHOD BLANK

Lab Sample ID: MB-072116
LIMS ID: 16-10713
Matrix: Water
Data Release Authorized:
Reported: 08/03/16

QC Report No: BDK7-Joint Base Lewis McChord
Project: Solo Point WWTP NPDES Quarterly
#
Date Sampled: NA
Date Received: NA

Date Extracted: 07/21/16
Date Analyzed: 07/29/16 00:06
Instrument/Analyst: ECD9/JGR
GPC Cleanup: No
Silica Gel: Yes
Acid Cleanup: No

Sample Amount: 500 mL
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00
Sulfur Cleanup: Yes

CAS Number	Analyte	LOQ	Result
5436-43-1	PBDE-47	0.010	< 0.010 U
189084-64-8	PBDE-100	0.010	< 0.010 U
60348-60-9	PBDE-99	0.010	< 0.010 U
207122-15-4	PBDE-154	0.010	< 0.010 U
68631-49-2	PBDE-153	0.010	< 0.010 U
41318-75-6	PBDE-28	0.010	< 0.010 U
189084-61-5	PBDE-66	0.010	< 0.010 U
1163-19-5	PBDE-209	0.050	< 0.050 U
2050-47-7	PBDE-15	0.010	< 0.010 U
189084-66-0	PBDE-119	0.010	< 0.010 U
147217-78-5	PBDE-33	0.010	< 0.010 U
446254-22-4	PBDE-46	0.010	< 0.010 U
189084-63-7	PBDE-75	0.010	< 0.010 U
35854-94-5	PBDE-155	0.010	< 0.010 U

Reported in µg/l (ppb)

PBDE Surrogate Recovery

2,2',3,3',4,4',5,6-Octachlorob 80.2%

FORM I

SAMPLE RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized: W
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: 07/14/16
Date Received: 07/14/16

Client ID: Influent Grab 1
ARI ID: 16-10713 BDK7C

Analyte	Date Batch	Method	Units	RL	Sample
Total Cyanide	07/21/16 072116#1	EPA 335.4	mg/L	0.005	< 0.005 U
Phenols	07/19/16 071916#1	EPA 420.1	mg/L	0.04	0.23

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized: W
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: 07/14/16
Date Received: 07/14/16

Client ID: Effluent Grab 1
ARI ID: 16-10714 BDK7D

Analyte	Date Batch	Method	Units	RL	Sample
Total Cyanide	07/21/16 072116#1	EPA 335.4	mg/L	0.005	0.013
Phenols	07/19/16 071916#1	EPA 420.1	mg/L	0.04	< 0.04 U

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized: w
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: 07/14/16
Date Received: 07/14/16

Client ID: Influent Grab 2
ARI ID: 16-10715 BDK7E

Analyte	Date Batch	Method	Units	RL	Sample
Total Cyanide	07/21/16 072116#1	EPA 335.4	mg/L	0.005	< 0.005 U
Phenols	07/19/16 071916#1	EPA 420.1	mg/L	0.04	0.08

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized: W
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: 07/14/16
Date Received: 07/14/16

Client ID: Effluent Grab 2
ARI ID: 16-10716 BDK7F

Analyte	Date Batch	Method	Units	RL	Sample
Total Cyanide	07/21/16 072116#1	EPA 335.4	mg/L	0.005	0.006
Phenols	07/19/16 071916#1	EPA 420.1	mg/L	0.04	< 0.04 U

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized: ω
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank	ID
Total Cyanide	EPA 335.4	07/21/16	mg/L	< 0.005 U	
Phenols	EPA 420.1	07/19/16	mg/L	< 0.04 U	

STANDARD REFERENCE RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Method	Date	Units	SRM	True Value	Recovery
Total Cyanide ERA 030314	EPA 335.4	07/21/16	mg/L	0.132	0.150	88.0%
Phenols ERA #160814	EPA 420.1	07/19/16	mg/L	0.51	0.50	102.0%

REPLICATE RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: 07/14/16
Date Received: 07/14/16

Analyte	Method	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: BDK7C	**Client ID: Influent Grab 1**					
Total Cyanide	EPA 335.4	07/21/16	mg/L	< 0.005	< 0.005	NA

MS/MSD RESULTS-CONVENTIONALS
BDK7-Joint Base Lewis McChord

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 07/25/16

Project: Solo Point WWTP NPDES Quarte
Event: NA
Date Sampled: 07/14/16
Date Received: 07/14/16

Analyte	Method	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: BDK7C	**Client ID: Influent Grab 1**						
Total Cyanide	EPA 335.4	07/21/16	mg/L	< 0.005	0.126	0.150	84.0%

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Chemical tracers guide identification of the location and source of persistent organic pollutants in juvenile Chinook salmon (*Oncorhynchus tshawytscha*), migrating seaward through an estuary with multiple contaminant inputs

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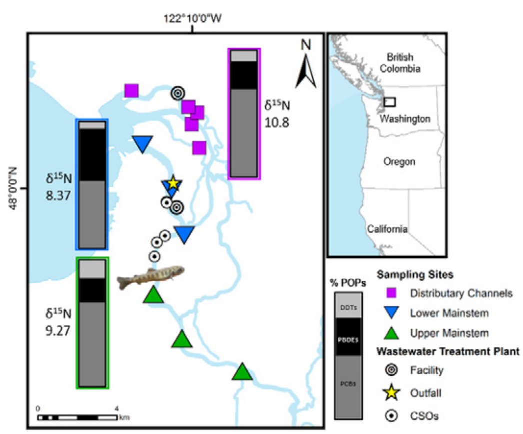
HIGHLIGHTS

- Three chemical tracers identified a contaminant source for seaward migrating salmon.
- Salmon collected near a wastewater outfall had higher contaminant concentrations.
- Salmon near the outfall had distinct combinations of contaminants (fingerprint).
- Altered $\delta^{15}N$ signatures were correlated with distinct contaminant fingerprints.
- Wastewater was the source for both distinct fingerprint and altered $\delta^{15}N$ signature.

GRAPHICAL ABSTRACT



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ABSTRACT

Understanding the spatial extent, magnitude, and source of contaminant exposure in biota is necessary to formulate appropriate conservation measures to reduce or remediate contaminant exposure. However, obtaining such information for migratory animals is challenging. Juvenile Chinook salmon (*Oncorhynchus tshawytscha*), a threatened species throughout the US Pacific Northwest, are exposed to persistent organic pollutants (POPs), including polybrominated diphenyl ether (PBDE) flame retardants and polychlorinated biphenyls (PCBs), in many developed rivers and estuaries. This study used three types of complementary chemical tracer data (contaminant concentrations, POP fingerprints, and stable isotopes), to determine the location and source of contaminant exposure for natural- and hatchery-origin Chinook salmon migrating seaward through a developed watershed with multiple contaminant sources. Concentration data revealed that salmon were exposed to and accumulated predominantly PBDEs and PCBs in the lower mainstem region of the river, with higher PBDEs in natural- than hatchery-origin fish but similar PCBs in both groups, associated with differences in contaminant inputs and/or habitat use. The POP fingerprints of the natural-origin-fish captured from this region were also distinct from other region and

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Wastewater
Stormwater

origin sample groups, with much higher proportions of PBDEs in the total POP concentration, indicating a different contaminant source or habitat use than the hatchery-origin fish. Stable isotopes, independent tracers of food sources and habitat use, revealed that natural-origin fish from this region also had depleted $\delta^{15}N$ signatures compared to other sample groups, associated with exposure to nutrient-rich wastewater. The PBDE-enhanced POP fingerprints in these salmon were correlated with the degree of depletion in nitrogen stable isotopes of the fish, suggesting a common wastewater source for both the PBDEs and the nitrogen. Identification of the location and source of contaminant exposure allows environmental managers to establish conservation measures to control contaminant inputs, necessary steps to improve the health of Chinook salmon and enhance their marine survival.

1. Introduction

An understanding of the spatial extent, magnitude, and source of contaminant exposure in biota is necessary to formulate appropriate conservation measures to reduce or remediate contaminant exposure. In some cases, there is an obvious point source of the contaminants, but in other instances the sources may be cryptic or dispersed, making them more difficult to identify and remediate. Obtaining such information for migratory animals is especially challenging because their routes may traverse habitats exposing them to different contaminants from multiple sources. Persistent organic pollutants (POPs) are contaminants of global concern because of their persistence, bioavailability, and toxicity (Jones and de Voogt, 1999). POPs include a wide variety of toxic chemicals, including polychlorinated biphenyls (PCBs), polybrominated diphenyl ether flame-retardants (PBDEs), and chlorinated pesticides such as dichlorodiphenyltrichloroethane and its metabolites (DDTs). All POPs are slowly metabolized, bioaccumulate in lipid-rich tissues, and biomagnify in the food web (Aguilar et al., 2002; Borrell et al., 2006; Jones and de Voogt, 1999; Tierney et al., 2014).

Proximity to contaminated habitats and the associated POPs in prey are the primary factors for determining the extent to which POPs are accumulated by fishes (Good et al., 2014; O'Neill and West, 2009; West et al., 2008) and marine mammals (Aguilar et al., 2002; Borrell et al., 2006). However, duration of exposure and body condition, including lipid content, reproductive status, and trophic position, can also affect accumulation (Aguilar et al., 1999; Burreau et al., 2006; Fisk et al., 2001; West et al., 2017). For migratory animals, the link between contaminated habitats and POP concentrations can be further obscured by multiple POP inputs (Borrell et al., 2006) as the animals move between habitats.

Although POPs can adversely affect animal health, the proportion of different types of POPs also serve as chemical tracers elucidating information about the trophic ecology, migration patterns, and population structure, for many migratory species (Ramos and González-Solís, 2012) including Atlantic salmon, *Salmo salar* (Svendsen et al., 2009), bluefin tuna, *Thunnus thynnus* (Deshpande et al., 2016a), harbor porpoise, *Phocoena phocoena* (Calambokidis and Barlow, 1991), beluga whales, *Delphinapterus leucas* (Krahn et al., 1999) and killer whales, *Orcinus orca* (Krahn et al., 2007). Additionally, the proportions of different types of POPs have been used to identify sources of POPs in Pacific herring, *Clupea pallasii* (West et al., 2008), bluefish *Pomatomus saltatrix* (Deshpande et al., 2016b), and bottlenose dolphins, *Tursiops truncatus* (Fair et al., 2010).

Current and historical inputs of POPs create environments with distinct chemical proportions or "fingerprints." Given sufficient foraging time, migratory animals accumulate POPs in proportion to their availability in the environments through which they migrate. Furthermore, unlike an individual POP concentration, POP fingerprints are less influenced by individual biological traits (Borrell et al., 2006; Dickhut et al., 2009; Svendsen et al., 2008), such that changes in POP fingerprints in animals along their migration route can indicate different inputs or sources of contaminants in prey along their migration route.

Naturally occurring stable isotopes of carbon, nitrogen, and sulfur also serve as chemical tracers, providing insights into ecological processes and patterns (Boecklen et al., 2011; Newsome et al., 2010; Peterson and Fry, 1987; Thompson et al., 2005). Stable isotopes of nitrogen are frequently used to indicate diet and trophic status (Caut et al., 2009; Olson et al., 2010; Ramos et al., 2011) because consumers accumulate higher levels of $\delta^{15}N$ than their prey. Nitrogen isotopes have also been used to assess exposure to sewage and wastewater inputs (Cabana and Rasmussen, 1996; Loomer et al., 2015; Schlacher et al., 2005), and they can reveal possible exposure to contaminants associated with the wastewater (Spies et al., 1989). Stable isotopes of sulfur and carbon are typically only slightly enriched between trophic levels. Instead, these stable isotopes are typically used as tracers of the types of food sources and have been used to assess habitat use (Connolly et al., 2004; Moore et al., 2016), and migratory patterns (Graham et al., 2010; Hobson, 1999). Sulfur stable isotopes are an especially good source indicator of terrestrial vs. marine producers, with more enrichment of heavier isotopes in marine systems (Thode, 1991; Willacker et al., 2017), and have been used to track residency in estuarine fishes (Fry and Chumchal, 2011) and movements of fish between freshwater and marine systems (Godbout et al., 2010; Moore et al., 2016). Moreover, when stable isotopes of sulfur, nitrogen and carbon are used together they can provide additional information on habitat use and trophic structure than stable isotopes of carbon and nitrogen alone (Connolly et al., 2004). Because stable isotopes fractionate with the organism's metabolism and change with its diet (Hobson, 1999), whereas POPs are not readily metabolized nor eliminated, they provide complementary information about the organism (Fisk et al., 2002; Herman et al., 2005; Ramos and González-Solís, 2012).

Pacific salmon of the genus *Oncorhynchus* exemplify organisms whose migrations take them through multiple habitats, including some where contaminants pose a concern (Johnson et al., 2007a; O'Neill and West, 2009; Ross et al., 2013). Spawned in cool, clear streams and other freshwater habitats, the juveniles feed for a period prior to seaward migration that varies among species, populations, and individuals (Quinn, 2018). Spawning typically takes place high in watersheds where contaminant concentrations are low, but their seaward migration may lead the juveniles through agricultural, industrial, and urbanized areas, each with different classes of contaminants.

In large parts of the southern portion of their native range, Pacific salmon species have experienced declines in abundance sufficient to limit fisheries, resulting in listings under the U.S. Endangered Species Act (ESA), and even lead to extinction. This loss of intra-specific diversity (Gustafson et al., 2007) has many causes, and the relative importance of each varies among watersheds (NRC, 1996) but chemical contaminants can contribute to poor survival of juveniles in populations migrating through contaminated habitats (Johnson et al., 2013; Meador, 2014).

Chinook salmon, *O. tshawytscha*, is listed as Threatened under the US ESA in Puget Sound, Washington, where individuals spawn in a number of large and medium-sized rivers (Myers et al., 1998; Ruckelshaus et al., 2006). The Snohomish River is typical of these, and is characterized by headwaters in forested land with few major sources of contaminants, with a transition to areas dominated by agriculture and increasingly suburban, urban and industrial areas where they flow into Puget Sound, Washington (Pess et al., 2002). Survival rates of juvenile salmon entering Puget Sound have been low for several decades (Quinn et al., 2005) but vary among rivers (Ruff et al., 2017), indicating that local as well as regional factors affect survival. Some of this variation has been linked to the extent to which the natal estuary has been modified from its natural condition (Magnusson and Hilborn, 2003), including chemical contamination (Meador, 2014). Moreover, natural-origin fish migrate more slowly and reside and feed in estuaries for longer periods than hatchery-origin fish (Levings et al., 1986; Rice et al., 2011), potentially resulting in greater contaminant exposure for natural-origin salmon.

Our goal was to use complementary data types to assess the location and source of contaminant exposure for juvenile Chinook salmon migrating through habitats with multiple contaminant sources, notably wastewater and stormwater. This study was conducted in the Snohomish River Washington, where two previous studies (O'Neill et al., 2015; Sloan et al., 2010) documented elevated levels of PBDEs (a POP class associated with wastewater; Osterberg and Pelletier, 2015) in juvenile Chinook salmon, at concentrations high enough to alter their immune response and increase their susceptibility to naturally occurring diseases, based on laboratory exposure studies (Arkoosh et al., 2010, 2018). The specific objectives were to determine where in their migratory pathway salmon become exposed to potentially harmful concentrations of PBDEs, and to identify potential sources so that corrective actions could be identified. We measured levels of PBDEs, other POPs, and stable isotopes of nitrogen, sulfur, and carbon in salmon collected along their migration routes in the estuarine portions of the Snohomish River. We hypothesized that Chinook salmon caught in the more developed reaches of the river, near wastewater inputs, would exhibit higher concentrations of PBDEs and that their POP fingerprints would have a higher proportion of PBDEs compared to other POPs, more indicative of a wastewater source. We further hypothesized that altered stable isotope ratios of nitrogen would be observed in fish captured in the vicinity of the wastewater inputs, and associated with the amount and type of nitrogen discharged. Additionally, this population includes Chinook salmon spawned naturally in the river and ones produced in a hatchery and we predicted that the natural-origin fish would exhibit higher POP concentrations associated with their higher residence time in the estuaries (Levings et al., 1986; Rice et al., 2011).

2. Material and methods

2.1. Study area

The Snohomish River watershed, in western Washington State, drains approximately 4600 km^2 into Puget Sound (USGS, 2011), and is formed by the confluence of the Skykomish and Snoqualmie rivers. It flows approximately 37 km to Puget Sound via a mainstem and a complex system of deltaic braided distributary channels through Union, Steamboat, and Ebey sloughs (Hall et al., 2018). The Snohomish River estuary's tidal influence extends throughout the distributary channels and up the mainstem to river kilometer (rkm) 27 (Collins and Sheikh, 2005). The maximum extent of saltwater (0.5 ppt) intrusion also extends throughout the distributary channels and to 15.9 rkm on the mainstem channel (Hall et al., 2018). Overall, 75% of the upland areas of Snohomish River basin is forested (Pess et al., 2002). In contrast, land cover in the floodplains and neighboring foothills along the major river channels are much more impacted by human activities, predominantly rural-residential, agricultural, and urban (Pess et al., 2002).

Modern human activities in the Snohomish River estuary have resulted in degradation and loss of juvenile salmonid habitat, considered the primary factor limiting Chinook salmon survival in the basin (Snohomish Basin Salmon Recovery Forum, 2005). Currently available wetland habitat area in the Snohomish estuary is estimated at 1389 ha; roughly 20% of the historical habitat extent in the delta (Beechie et al., 2017; Collins and Sheikh, 2005). The majority of the remaining available rearing habitat for juvenile Chinook salmon is located in the lower estuary (1238 ha) and distributed unevenly between the mainstem (88 ha) and the distributary (1150 ha) portions of the delta (Beechie et al., 2017).

Contaminant inputs likely coincide with the physical habitat loss in the Snohomish estuary. In particular, developed habitats with impervious surfaces adjacent to the river likely increase loadings of contaminants in stormwater to the river, as has been demonstrated for other aquatic systems (Brown and Peake, 2006; Lee et al., 2004; McCarthy et al., 2008). Indeed, stormwater was documented to be a major source of PCB loading to Puget Sound, with developed lands with more impervious surface contributing higher loads of PCBs to the watershed (Osterberg and Pelletier, 2015). Although specific inputs on PCBs to the Snohomish River were lacking, we used impervious surface and road area as proxies for urbanization in this study area and potential inputs of PCBs. The metric utilized for impervious surface was calculated by determining the "percent developed imperviousness", %IS (Fry et al., 2011; Wickham et al., 2013) within predefined watershed catchment areas called Assessment Units (AUs). The %IS values in our study ranged from 0 to 94%, with the most impervious surfaces (41–94%) in the City of Everett, located on the lower section of the mainstem, and the city of Marysville, located in the lower section of Ebey Slough (Fig. 1).

In addition to contaminant inputs from stormwater, the cities of Marysville and Everett primarily discharge treated wastewater, a potential source of PBDEs and other contaminants, into the estuarine portion of the Snohomish River. Specific levels of PBDEs discharged into the Snohomish River are unknown, as wastewater dischargers in WA State are not required to monitor PBDEs in their effluent. Everett's Water Pollution Control Facility (WPCF) is adjacent to the mainstem of the Snohomish River. The facility operates two outfalls and 13 combined sewer overflows (CSOs). One outfall and six CSOs discharge into the lower section of the river's mainstem and the others discharge into the marine waters of Port Gardner in Possession Sound (Fig. 1). The WPCF uses an aeration/oxidation pond (lagoon) system for treating the wastewater that discharges to the Snohomish River outfall (WA Dept. Ecology, 2015). Marysville's WWTP is located in the Distributary Channels, adjacent to Ebey Slough and uses an aerated lagoon with a filtration system to treat sewage prior to discharge into an outfall in Steamboat Slough or the marine waters of Port Gardner during the summer (WA Dept. Ecology, 2017). While most of the effluent discharged from these two facilities is treated, CSOs release untreated wastewater. CSOs occur on average, 1–2 times a year.

Discharges of dissolved inorganic nitrogen (DIN) in effluent from municipal WWTPs were used to assess the loads of nitrogen discharged from WWTPs. In total, Puget Sound has 78 municipal WWTPs discharging to Puget Sound – 70 discharge to marine waters and eight discharge to river estuaries. In the year of our study (2016), the Everett WPCF outfall in the Snohomish River had the highest DIN average daily discharge (average of February to July) of the eight facilities that discharge to the estuarine portion of Puget Sound rivers (Table 1). Additionally, the Everett WPCF outfall had the eight highest average daily discharge of DIN of all 78 municipal WWTPs discharging into Puget Sound (Table 1). WWTP loads were originally estimated for the years 1999–2008 using methods described in Mohamedali et al. (2011), and these inputs were updated through mid-2017 as described in Ahmed et al. (2019). During the 6-month migration window for juvenile Chinook salmon (February through July) in 2016, discharged DIN from the Everett WPCF averaged 1006 kg/day (Table 1). The Everett WPCF effluent, however, was atypical compared to other Puget Sound wastewater facilities, and contained a higher proportion of ammonium relative to nitrates and nitrites compared to the effluent from other facilities that discharge into similar waters frequented by juvenile salmon. The

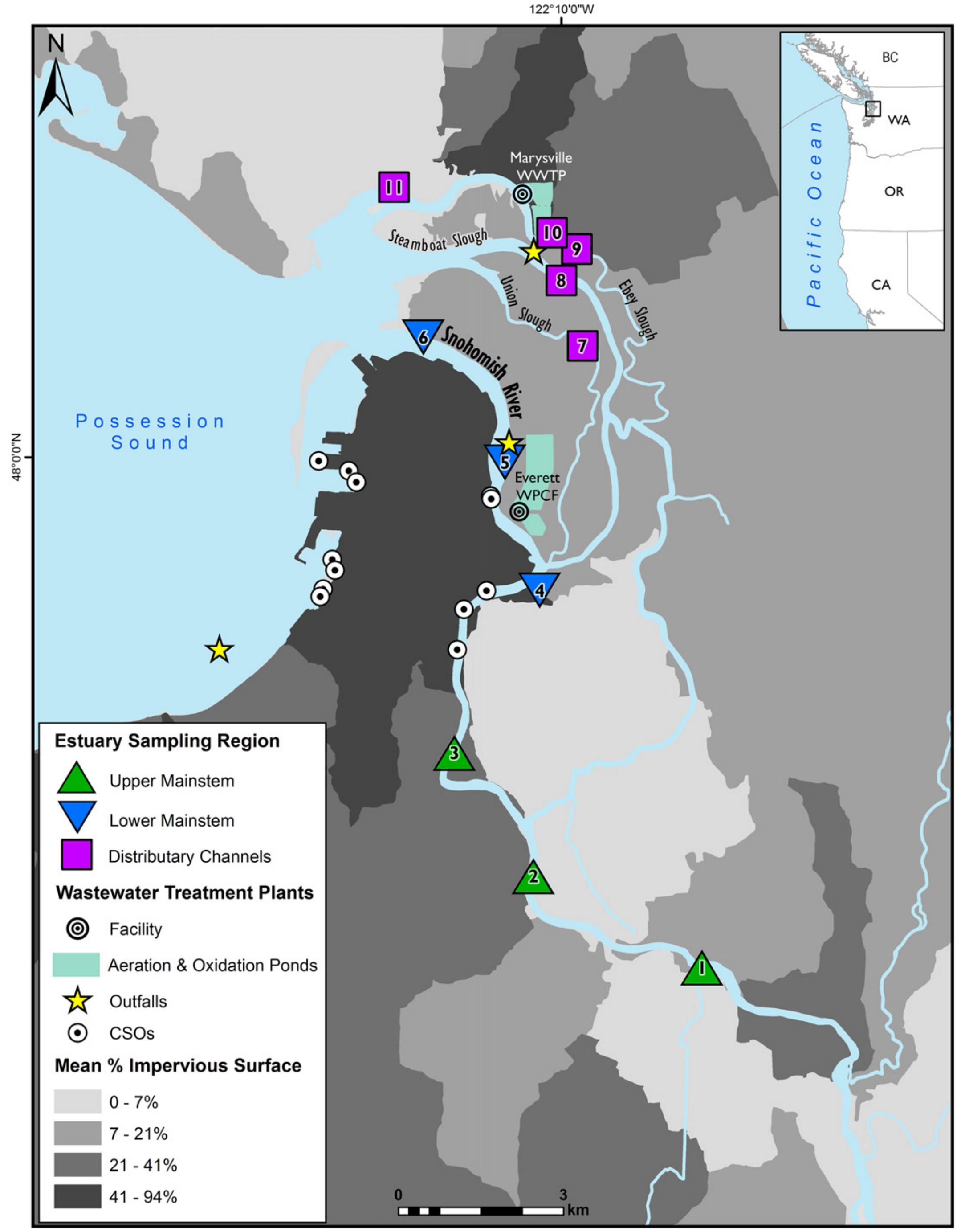

Fig. 1. Location of estuary sampling sites and sampling regions where juvenile Chinook salmon were collected for contaminant and stable isotope analyses (see Table 2 for additional site and sample data). Impervious land-surface is shown as grey scale gradations from <7% (lightest grey) to >40% (darkest grey). WPCF = Water Pollution Control Facility. WWTP = Wastewater Treatment Plant.

only other WWTP facilities discharging into Puget Sound with comparable or higher ammonium loads (>1000 kg/day) were high load facilities (≥250 DIN kg/day) that discharged in deep offshore marine waters, beyond habitats typically used by juvenile salmonids (Table 1).

2.2. Sampling design and fish collections

We sampled juvenile Chinook salmon for chemical tracers from 11 sites along their migration pathway in the estuarine portion of the Snohomish River in 2016. The sites were distributed in three regions: the Upper Mainstem, through which all the fish migrate, and two downstream regions, the Lower Mainstem and the Distributary Channels, that constitute alternative routes by which the fish can enter Puget Sound (Fig. 1). A minimum of three sites per region, distributed along the migration pathway within each region, were sampled to assess the range of stormwater and wastewater inputs that fish were potentially exposed to. Due to limitations on the number of ESA-listed Chinook salmon we were allowed to capture, our sampling design was intended to compare salmon among the three regions, rather than at specific sites. Our three sampling regions roughly represent the major bifurcation in the system based on hydrological properties of the rivers (Collins and Sheikh, 2005; Hall et al., 2018). The Upper Mainstem was the least developed of the three regions, with the most downstream site located 2 to 7 km upstream of the outfalls for the wastewater

Table 1
Mean and range (in parentheses) of daily loads of nitrogen types (DIN, ammonium, and nitrate + nitrite) and ratio of ammonium to nitrate + nitrite in municipal wastewater treatment plant effluent for facilities discharging into Puget Sound rivers and marine waters (Mohamedali et al., 2011; Ahmed et al., 2019), reported for each month from February through July of 2016. Effluent data for the Lower Mainstem and Distributary Channel regions of the Snohomish River sampled in this study are summarized separately from data for other facilities. Facilities discharging mean dissolved inorganic nitrogen (DIN) daily loads >250 kg/day for that six-month window were further categorized as either a freshwater, nearshore or offshore facility depending on the location of their effluent outfall in the receiving waters. All other facilities discharging into nearshore or offshore marine waters with a mean DIN <250 kg/day was placed in the "Other nearshore and offshore marine facilities" category. If load data was missing for a month, it was excluded from the average load calculation.

WWTP	n	DIN (kg/day)	Ammonium (kg/day)	Nitrate + Nitrite (kg/day)	Ratio of Ammonium (kg/day) to Nitrate + Nitrite (kg/day)
Lower Mainstem facility[a]	1	1006 (829–1162)	1002 (822–1161)	4.09 (1.71–6.97)	335 (118–678)
Distributary Channels facility[b]	1	649 (462–816)	628 (452–806)	20.4 (6.56–47.4)	48.3 (14.2–80.2)
Other river facilities (DIN ≥ 250 kg/day)	1	410 (203–583)	325 (126–462)	85.4 (33.2–158)	5.58 (1.64–13.9)
Other river facilities (DIN < 250 kg/day)	5	71.6 (1.61–257)	5.99 (0.005–58.0)	65.7 (1.60–256)	0.019 (0.002–2.14)
Nearshore marine facilities (DIN ≥ 250 kg/day)	3	658 (383–1177)	631 (365–1173)	27.0 (3.63–83.4)	84.7 (5.83–323)
Offshore marine facilities (DIN ≥ 250 kg/day)	13	2004 (229–9543)	1560 (7.87–8684)	445 (0.73–2794)	61.7 (0.0029–1385)
Other nearshore and offshore marine facilities (DIN < 250 kg/day)	54	32.9 (0.0077–352)	17.0 (0.0012–300)	15.9 (0.0012–236)	10.1 (0.00035–416)

[a] Everett Water Pollution Control Facility (see Fig. 1, Everett WPCF).
[b] Marysville Wastewater Treatment Plant (see Fig. 1, Marysville WWTP).

treatment facility and associated CSOs. We assumed that contaminants measured in seaward migrating salmon collected in the Upper Mainstem region represented cumulative exposure from all upstream sources. At each subsequent downstream site in the Lower Mainstem and the Distributary Channels, we assumed contaminant concentrations in salmon indicated additional inputs from stormwater and wastewater to which the salmon were exposed.

Juvenile Chinook salmon were collected in 2016 from April through July, primarily during the peak of downstream migration (April and May) to represent the average contaminant concentrations of the river system's fish populations. All fish were collected with beach seines or fyke nets, following procedures described in Roegner et al. (2009), euthanized, transferred to the laboratory on ice, assigned a unique number, and stored at −80 °C until tissue samples for chemistry and stable isotopes were prepared.

2.3. Sample processing

To process fish for analyses of contaminants and stable isotopes, fish were thawed slightly, fork length (mm) was recorded for each fish, and scales were removed for age determination (sub-yearling vs. yearling). To ensure the gut contents did not influence the contaminant and stable isotope data, they were removed from the stomach and intestine of fish and discarded to create gutted whole body fish samples. Additionally, the brain was removed from each fish for use in a separate study. Each fish was examined for presence of a clipped adipose fin, a coded wired tag (CWT), or thermally marked otoliths, any of which would indicate hatchery-origin fish. Based on thermally marked otoliths, we excluded from our study a few hatchery-origin fish that did not originate from within the Snohomish River, leaving 177 salmon for analyses (Table 2).

Forty-eight composite samples of gutted whole body fish, less the brain, were created by combining 1–8 similarly sized salmon in each sample (Table 2). The samples were homogenized, placed in pre-cleaned glass jars, and stored at −20 °C for subsequent chemical analyses. The proportion of natural-origin fish in each composite sample was used to classify the samples as either predominantly natural-origin (>65%) or hatchery-origin (<35%). In most cases, samples classified as predominantly natural- or hatchery-origin contained only fish of that designation (25 of 30 natural- and 15 of 18 hatchery-origin samples).

2.4. Contaminant analysis

Samples (approximately 2 g from each composite tissue sample) were analyzed for POPs, including 11 PBDEs, 46 PCBs, and six DDTs, using an established gas chromatography/mass spectrometry (GC/MS) method (Sloan et al., 2014). This method comprises three steps: (a) a dichloromethane extraction using an accelerated solvent extractor, (b) cleanup by gravity flow silica/aluminum columns and followed by

Table 2
Number (No.) of individual juvenile Chinook salmon and composite samples (Comps.) sampled in 2016 for contaminant analyses at multiple sites in the estuary habitat of the Snohomish River. Each composite sample is composed of 1–8 individual salmon of similar size and was classified as either natural- or hatchery–origin, based on the proportion of natural fish present. Site numbers refer to the sampling locations depicted in Fig. 1.

Sampling regions	Site No.	Site name	River km	Collection period	Natural origin		Hatchery origin	
					No. fish	No. Comps.	No. fish	No. Comps.
Upper Mainstem	1	Fields Riffle	18.7	April–July	16	5	3	1
	2	Big Tree	14.9	April–July	11	3		
	3	Old Bridge	11.5	April–July	15	4	4	2
Lower Mainstem	4	Old Barge	7.4	April–May	20	4	3	1
	5	Langus Pier	5.2	April–July	31	7	9	3
	6	Lower Mainstem	2.0	May–June			11	3
Distributary Channels	7	Union Slough	5.9	May June	8	2	3	1
	8	Steamboat Slough	4.8	April–May	6	2	3	1
	9	Ebey Slough 1	6.9	April–May	10	2	3	2
	10	Ebey Slough 2	6.4	April–May			1	1
	11	Ebey Slough 3	2.5	May	7	1	12	3
All regions				April–July	124	30	53	18

size-exclusion high-performance liquid chromatography (HPLC) cleanup, and (c) quantitation of POPs using gas chromatography/mass spectrometry (GC/MS) with selected-ion monitoring (SIM). A subsample of each pre-cleaned extract was used to determine percent lipids gravimetrically (Sloan et al., 2014). As part of a performance-based quality assurance program, a solvent (dichloromethane) method blank and National Institute of Standards and Technology (NIST) Lake Michigan fish tissue Standard Reference Material (SRMs, 1947) were analyzed with each batch of field samples and the results of the quality control samples met established laboratory criteria (Sloan et al., 2019). The solvent method blank for each sample batch contained no more than five analytes that exceeded 2 × the lower limit of quantitation (LOQ), which met our laboratory QA criteria. Levels of ≥70% of individual analytes measured in NIST SRM 1947 for each sample batch were within 30% of either end of the 95% confidence interval of the NIST certified values. Surrogate recoveries for the POP analyses ranged from 99 to 116% and met established laboratory criteria (surrogate recoveries are to be between 60 and 130%). Additional details for our laboratory quality assurance measures and criteria for POPs analyses can be found in Sloan et al. (2019). The lower limits of quantitation (LOQ) for individual PBDEs, PCBs, and DDTs measured in the field samples and their associated quality assurance samples ranged from <0.063 to <0.31 ng/g, wet weight.

Analyte data are presented as summed values for PBDEs and DDTs. Summed PBDEs (i.e., $\sum_{11}$PBDEs), were calculated by summing detected concentrations of the congeners 28, 47, 49, 66, 85, 99, 100, 153, 154, 155, and 183. Summed DDTs (i.e., $\sum_6$DDTs) were calculated by summing the detected concentrations of *o,p′*-DDD, *o,p′*-DDE, *o,p′*-DDT, *p,p′*-DDD, *p,p′*-DDE, and *p,p′*-DDT. The total PCB concentration (i.e., TPCBs) was estimated using a simple algorithm based on the subset of 17 commonly detected congeners (and coeluting congeners) representing homologues containing three to ten chlorine atoms [congeners 18, 28, 44, 52, 95, 101(90), 105, 118, 128, 138(163,164), 153 (132), 170, 180, 187(159,182), 195, 206, and 209], wherein the sum of the detected values for these 17 (and coeluting) congeners was multiplied by two. The calculated TPCB concentration using this method was previously shown to agree well with the sum of 209 congeners measured by high resolution methods for two fish species (West et al., 2017) and is similar to method used by Lauenstein and Cantillo (1993) discussed in West et al. (2017). Summed or total POP results were expressed as nanogram (ng) per gram of tissue weight (wet weight). Additionally, we calculated POP concentrations on a lipid basis, as ng of contaminant per g of fish lipid (ng/g lipid), to facilitate comparisons with other published studies, including those on adverse critical body residues (CBRs). Published CBRs for POPs are sometimes reported as lipid normalized concentrations because POP toxicity can be inversely dependent on lipid content (Lassiter and Hallam, 1990).

2.5. Stable isotopes analyses

All samples with sufficient tissue mass (41 of 48 samples) were analyzed for stable isotope ratios of nitrogen, carbon, and sulfur. Frozen, non-lipid extracted tissue samples were freeze-dried, ground to a fine powder, and weighed into tin capsules for isotope analyses with a target mass of 0.5 mg of tissue for carbon and nitrogen and 7.5 mg for sulfur. Stable isotope analyses were performed at the University of Washington's IsoLab in Seattle, WA as in Fry et al. (1992) and Fry et al. (2002). A Costech Elemental Analyzer, Conflo III, and Thermo MAT253 isotope ratio mass spectrometer was used for a continuous-flow based measurement of bulk carbon δ^{13}C and bulk nitrogen δ^{15}N. A Eurovector Elemental Analyzer, Conflo III, and Thermo MAT253 isotope ratio mass spectrometer was used for a continuous flow based measurement of the bulk sulfur δ^{34}S. During analytical runs, these methods provided precisions (1 sigma) of ±0.05‰, ±0.1‰ and ±0.2‰ for carbon, nitrogen and sulfur, respectively.

Stable isotopes of carbon, nitrogen, and sulfur were expressed in standard delta notation (δ^{13}C, δ^{15}N, and δ^{34}S),

$$\delta\,(‰) = 10^3\left[\left(R_{sample}/R_{standard}\right)-1\right],$$

where R is the ratio of heavy and light isotopes in a sample (^{13}C:^{12}C, ^{15}N:^{14}N, and ^{34}S:^{32}S). We expressed stable isotope ratios in units of permil (‰ – parts per thousand) and are relative to international standards: Vienna PeeDee Belemnite (VPDB) for δ^{13}C, atmospheric nitrogen for δ^{15}N, and Vienna–Canyon Diablo Troilite (VCDT) for δ^{34}S. Most (78%) of the fish tissue samples had a C:N ratio greater than the 3.5 threshold for lipid correction (Post et al., 2007), indicating that the lipid content of the samples may have depleted the δ^{13}C values. Accordingly, we used the following equation from Post et al. (2007),

$$\delta^{13}C_{normalized} = \left(\delta^{13}C_{untreated}-3.32\right) + (0:99 \times C:N)$$

to mathematically lipid normalize δ^{13}C values.

2.6. Data analysis

We applied multiple linear regression (R Development Core Team, 2018) to identify the potential effects of four factors on contaminant concentration for three major POP classes (DDTs, PBDEs, and PCBs). The four predictor variables were: 1) capture region (one of three), 2) fish origin (natural or hatchery), 3) fish size (mean length of fish in composite sample) at capture, and (4) % lipid content. Fish origin was considered a factor because natural-origin fish may reside and feed in estuaries for longer periods than hatchery-origin fish (Levings et al., 1986; Rice et al., 2011), resulting in greater potential exposure. Fish length (an indirect measure of age and duration of exposure) and lipid content were included as factors as they can affect the concentrations of POPs accumulated (West et al., 2017). All POP data were log transformed to meet assumptions of normality and homogeneity of group variances. Additive and interactive effects were evaluated, however, due to limited degrees of freedom, only models with up to three factors were considered. Akaike Information Criterion corrected for small sample size (AICc) and Akaike weights were used to identify the best model to parsimoniously explain the variation in the concentrations of PBDE, PCBs and DDTs data (Akaike, 1974; Burnham and Anderson, 2002). The model with the lowest AICc and highest Akaike weight was considered the best fit. For the best fit model for each POP class, pairwise comparisons were conducted on estimated marginal means using the Holm-Sidak adjustment for multiple comparisons. Test results for pairwise comparisons were considered statistically significant at $p \le 0.05$. Additionally, independent linear regressions were performed for $\sum_6$DDT by fish length for each origin.

To illustrate POP fingerprints among the three regions by two origin groups, the proportion of $\sum_{11}$PBDEs and other POPs classes in Chinook salmon samples were compared among the six regions and origin groups using principal component analyses (PCA), as detailed in the software package Primer-E version 6 (Clarke and Warwick, 2006; Clarke and Gorley, 2006). Prior to analyzing with PCA, the POP class data were pretreated by standardizing (i.e., computing the proportional contribution of each POP class concentration to the total POP concentration in each sample) and then transforming the data by taking the square root to reduce the contribution of dominant classes. Similar POP fingerprints among groups would indicate consistent sources of contaminants, whereas dissimilar contaminant patterns would suggest inputs of specific POPs associated with different sources. Pairwise site comparisons of group patterns were conducted with ANOSIM, using the R statistic and p values to identify the main between-group differences. Values of the ANOSIM R statistic range from 0 (i.e., no separation, or complete similarity) to 1.0 (i.e., complete separation, or no similarity) of a population. A p value ≤ 0.05 was used as a guide for determining whether the measured segregation between groups (i.e., R statistic) was statistically significant.

A two-way ANOVA was used to test for difference in stable isotopes, fish length, and lipid content among regions and between natural and hatchery-origin fish. A Holm-Sidak test was used to conduct pairwise comparisons among group means for each POP class. Probability values were used to help evaluate the significance of differences; a p value ≤ 0.05 was used as a guide to assess whether results for pairwise comparisons were considered statistically significant.

Salmon POP fingerprints (i.e., PCA analyses of the proportion of $\sum_{11}$PBDEs and other POPs), a potential indicator of contaminant source, and δ^{15}N, an indicator of the nitrogen source, were compared to see if they co-varied. For each region and origin sampling group, we used linear regression to test for significant relationships between δ^{15}N and PC1 scores in salmon samples, two independent metrics that can both be affected by wastewater inputs. Additionally, linear regression was used to test for significant relationships between δ^{15}N and $\sum_{11}$PBDEs, and TPCBs.

3. Results

3.1. POPs concentrations

Mean POP wet weight (ww) concentrations in juvenile salmon varied 10-fold for $\sum_{11}$PBDEs as a function of sampling region and origin (naturally or hatchery produced), from 2.4 to 24 ng/g ww, and less so for TPCBs, from 12 to 31 ng/g ww (Table 3). In contrast, mean $\sum_6$DDT concentrations were much more similar among regions and origin groups, ranging from 1.7 to 2.9 ng/g ww. Although TPCBs varied less than $\sum_{11}$PBDEs among sampling groups, overall TPCB concentrations were greater than $\sum_{11}$PBDEs, followed by $\sum_6$DDTs (Table 3). For example, among fish of the same region, measured mean TPCBs concentrations were 1–3 times greater than $\sum_{11}$PBDE and 5–10 times greater than $\sum_6$DDTs for natural-origin fish and 2–6 times greater than $\sum_{11}$PBDEs and 6–16 times greater than $\sum_6$DDTs for hatchery-origin fish.

Concentrations of $\sum_{11}$PBDEs and TPCBs in juvenile salmon were best predicted by models that included factors for the collection region and the fish origin, rather than body size (i.e., length) or lipid content, but the importance of these factors varied by POP class (Table S1). Specifically, $\sum_{11}$PBDE concentrations were best predicted by models that included region, origin, and a strong region x origin interaction term (Adjusted $r^2 = 0.58$; Tables S1, S2). Post-hoc tests identified that natural-origin fish from the Lower Mainstem had the highest $\sum_{11}$PBDE concentrations (p ranged from 0.033 to <0.0001). Overall, concentrations of $\sum_{11}$PBDEs in natural-origin fish from the Lower Mainstem (mean = 24 ng/g ww) were 4–10 times higher than salmon from all other sampling groups, regardless of region or origin (Table 3, Fig. 2). The only other statistically significant difference in $\sum_{11}$PBDE concentrations was between natural- and hatchery-origin salmon from the Distributary Channels (means = 5.7 and 2.4 ng/g ww), representing the second highest and lowest concentrations (Table 3, Fig. 2, $p = 0.05$). The mean lipid content among samples ranged from 0.97% to 1.6% (Table 3) but did not differ significantly among regions or between fish origins (Two-Way ANOVA, region F = 0.722 and p = 0.492; origin F = 0.783 and $p = 0.781$). Moreover, models with lipid content as a single factor or in combination with region or origin were poor fits and explained less of the measured variation in $\sum_{11}$PBDEs (Table S1). Although natural-origin fish were smaller than hatchery-origin fish (mean = 65.7 vs. 77.4 mm, Table 3), fish length for combined origins did not differ among regions (Two-Way ANOVA, origin F = 9.910 and $p = 0.003$, region F = 0.217 and $p = 0.806$), and models with fish length alone or in combination with region or origin were poor fits and did not contribute substantively to the measured variation of $\sum_{11}$PBDEs (Table S1).

Concentrations of TPCBs were best predicted by sampling region, accounting for 46% of the measured TPCB variation (Table S1). Fish length and lipid content, as individual factors or in combination with region or origin, did not substantively improve the model fit. Overall, fish from the Lower Mainstem had measured TPCB concentrations (30 ng/g ww) approximately twice as high as those from the Upper Mainstem (mean = 13 ng/g ww) and the Distributary Channels (16 ng/g ww; Table 3, Fig. 2, $p < 0.0001$ for both comparisons), which did not differ from each other ($p > 0.05$).

Unlike the patterns measured for $\sum_{11}$PBDEs and TPCBs, fish size was significantly correlated with $\sum_6$DDT concentrations. The $\sum_6$DDT concentration was best predicted by the origin, fish length, and a fish origin-length interaction, accounting for 40% of the measured variation (Table S1). A model with only origin and fish length was not near as good a fit to the actual data (Table S1), indicating that the fish origin-length interaction term was significant. Predicted mean $\sum_6$DDT concentrations were higher in natural- than hatchery-origin fish (2.3 vs. 1.7 ng/g ww), based on a mean fish length of 70 mm in the best-fit model regression model (Table S2, Fig. 2c). However, predicted $\sum_6$DDT concentrations depicted in Fig. 2c do not fully represent the interaction between fish origin and fish length due to differences in sizes between natural- and hatchery-origin fish. The size of newly emerged natural-origin Chinook salmon prior to exogenous feeding (Beacham and Murray, 1990) are just a few mm smaller than those we sampled from the river, however, hatchery-origin fish are not released to the river until they reach approximately 65 mm, prohibiting full examination of $\sum_6$DDT size comparison for fish of both origins from the river. As a result, in addition to the full model, independent linear regressions were performed for $\sum_6$DDT by fish length for each origin (Fig. 3). There

Table 3
Arithmetic mean lipid content (Lipids), fork length (FL), and concentrations of $\sum_{11}$PBDE, $\sum$PBDE 47+99, TPCBs, and $\sum_6$DDTs of composite samples of Chinook salmon (*Oncorhynchus tshawytscha*). Measured POPs concentrations are reported as ng/g wet weight (ww) and ng/g lipid weight (lw), based on the measured gutted whole body wet weight and lipid content in the fish.

Region	Origin	N	Lipids (%)	FL (mm)	$\sum_{11}$PBDE ww	$\sum_{11}$PBDE lw	$\sum$PBDE$_{47+99}$[a] ww	$\sum$PBDE$_{47+99}$ lw	TPCBs ww	TPCBs[b] lw	$\sum_6$DDTs ww	$\sum_6$DDTs lw
Upper Mainstem	Natural	12	1.6	61.3	4.0	270	3.5	240	14	950	2.9	210
	Hatchery	3	0.97	85.7	5.2	640	4.4	540	12	1200	2.0	220
	Natural + hatchery	15	1.4	66.2	4.2	340	3.7	300	13	1000	2.7	210
Lower Mainstem	Natural	11	1.5	66.9	24	1500	20	1200	31	2100	2.9	210
	Hatchery	7	1.5	75.8	5.4	500	4.7	430	29	2600	1.9	140
	Natural + hatchery	18	1.5	70.3	17	1100	14	930	30	2300	2.5	180
Distributary Channels	Natural	7	1.1	71.3	5.7	540	4.9	460	18	1700	2.3	200
	Hatchery	8	1.6	75.8	2.4	190	2.0	160	15	940	1.7	110
	Natural + hatchery	15	1.4	73.7	3.9	350	3.4	300	16	1300	2.0	150
All regions	Natural	30	1.4	65.7	12	790	9.7	660	21	1500	2.8	210
	Hatchery	18	1.5	77.4	4.0	380	3.5	330	20	1600	1.8	140

[a] $\sum$PBDE$_{47+99}$ = sum of detected BDE-47 and BDE-99 congeners used to assess adverse critical body residues (CBR) for exposure to PBDEs.
[b] TPCB used to assess adverse CBR for exposure to PCBs.

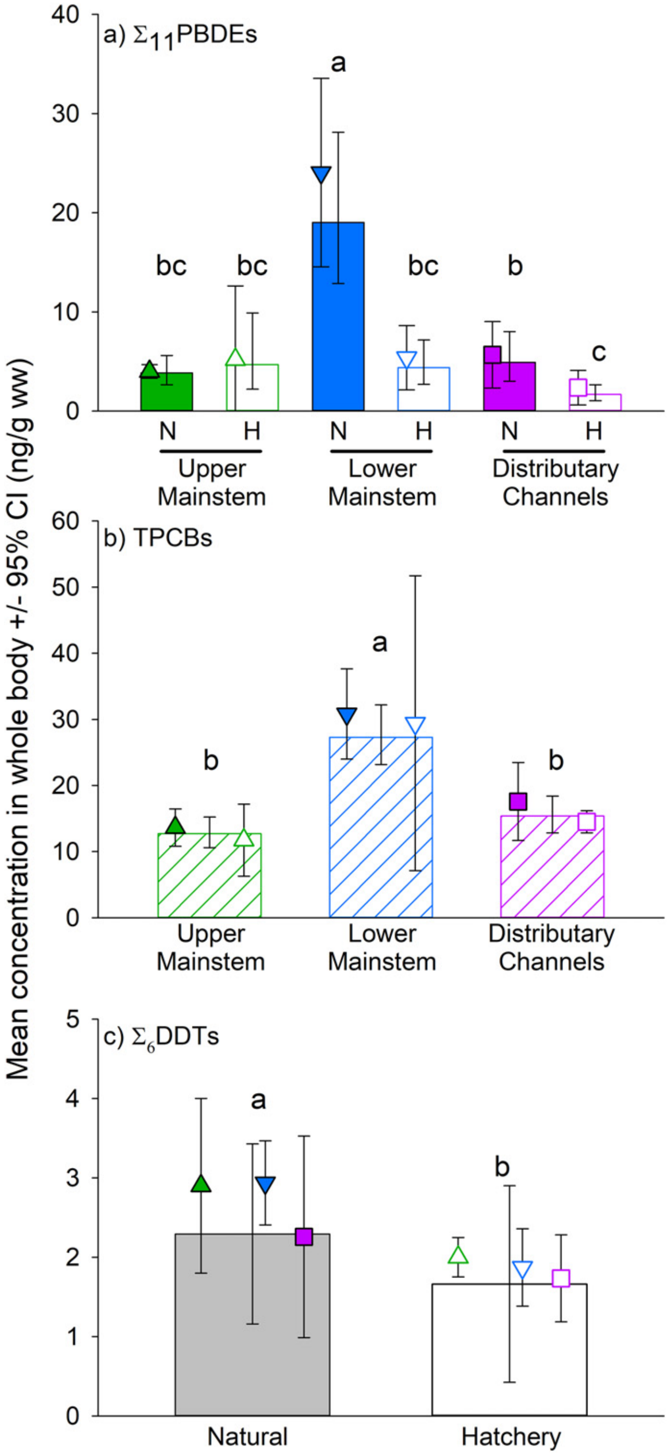

Fig. 2. Measured (symbols) and predicted (bars) concentrations of $\sum_{11}$PBDEs, TPCBs, and $\sum_6$DDTs in juvenile Chinook salmon collected from the Snohomish River estuary. Symbols represent the arithmetic mean concentrations for $\sum_{11}$PBDEs, TPCBs, and $\sum_6$DDTs where Upper Mainstem, Lower Mainstem, and the Distributary Channels sites are represented by upward triangles, downward triangles, and squares, respectively. Solid filled and open symbols are used to represent natural- and hatchery-origin fish, respectively. Bars are modeled estimated geometric mean concentrations with solid filled, open, and hatched bars used to represent natural-, hatchery- and mixed-origin fish, respectively. Predicted $\sum_6$DDTs concentrations were modeled using a grand mean fish length of 70 mm. For each POP class, groups with the same lower case letter are not significantly different from each other.

was an inverse relationship between fish length and $\sum_6$DDT for natural-origin fish, ranging from 40.2 to 90.0 mm (Fig. 3). In contrast, $\sum_6$DDT was not significantly correlated with fish length for hatchery-origin fish for the limited length range tested (65.1 to 95.1 mm, Fig. 3). Similarly, there is also no significant correlation between length and $\sum_6$DDT for natural-origin fish >65 mm ($p = 0.36$; data not shown).

3.2. POP fingerprints

A comparison of POP fingerprints among the samples indicated clear segregation between natural-origin fish from the Lower Mainstem and all but one of the other sampling groups (Fig. 4; Table 4). The natural-origin fish from the Lower Mainstem exhibited distinct POP fingerprints (Fig. 4, filled blue triangles), with the higher proportions of $\sum_{11}$PBDEs in the total POP concentration, compared to other sampling groups. These fingerprints were most different from hatchery-origin fish from the same region (Fig. 4, open blue triangles) and the Distributary Channels (Fig. 4, open pink squares), which exhibited the two lowest relative concentrations of $\sum_{11}$PBDEs (ANOSIM, $R = 0.484$ and 0.596), followed by natural origin fish from the other regions (ANOSIM, $R = 0.467$ and 0.315), with intermediate relative concentrations of $\sum_{11}$PBDEs (Table 4, $p \le 0.006$ for all pair-wise comparison). The only sampling group that was not clearly segregated from the natural-origin fish from the Lower Mainstem was the hatchery-origin fish from the Upper Mainstem (Fig. 4, open green triangles; ANOSIM, $R = 0.251$, $p = 0.052$); however, the sample size representing this group was small ($n = 3$), so the power to detect difference between these two groups, if it existed, was low.

The unique pattern of POPs in the Lower Mainstem natural-origin fish can be further illustrated by examination of POP fingerprints among the remaining five sampling groups, which were statistically indistinguishable from each other. For example, the POP fingerprints in natural-origin fish from the Upper Mainstem and the Distributary Channels were not different from each other ($R = 0.068$, $p = 0.195$) and nor were the hatchery-origin fish from the three regions different from each other (ANOSIM, R from 0.014 to 0.237, and $p = 0.103$–0.467 for all comparisons). Among these five sampling groups, natural-origin fish were only segregated from hatchery-origin fish in three of six comparisons (ANOSIM, R from 0.272 to 0.43, $p < 0.01$ for all comparisons; Table 4).

Among region and origin sample groups, the variation in congener patterns within the TPCB and $\sum_{11}$PBDEs POP classes was minor in comparison to the variation observed between the TPCBs and $\sum_{11}$PBDEs POP classes. The main PCB congeners contributing to the TPCB concentration in each region and origin sample groups (Table S3) were PCB 153 and 138, followed by 101, 118, and then 28 and 18, collectively accounting for 38–68% of the total concentration. The heavier congeners, 195, 206, and 209, were not detected in any samples and the remaining congeners, when detected, were at low concentration near the LOQ (Table S3). Although the TPCB concentrations were higher in fish collected from the Lower Mainstem compared to those from other regions, the pattern of detected concentrations of PCB congener homologues, was similar among region and origin sample groups (Fig. S1). The calculated values for $\sum_{11}$PBDEs were dominated primarily by contributions from BDE congeners 47 and 99, followed by 100 (Table S4), collectively accounting for 86–100% of the $\sum_{11}$PBDEs for individual fish samples. The BDE congeners 85, 155 and 183 were not detected in any salmon samples and the remaining congeners, when detected were at low concentrations near the LOQ (Table S4). Although natural-origin fish from the Lower Mainstem had higher $\sum_{11}$PBDE concentrations compared to other region and origin sample groups, the pattern of BDE congeners detected was similar among these groups (Fig. S2). Likewise, the DDT and DDT metabolites patterns did not vary among region and origin sample groups. The calculated $\sum_6$DDTs concentration was dominated by *p,p′*-DDE, which was detected in 100% of the samples (Table S5). The other DDT compounds were never detected (i.e., *o,p′*-DDE, *o,p′*-DDT) or infrequently (8–21%) detected at concentration near the LOQ (i.e., *o,p′*-DDD, *p,p′*-DDD, and *p,p′*-DDT) in all region and origin sample groups.

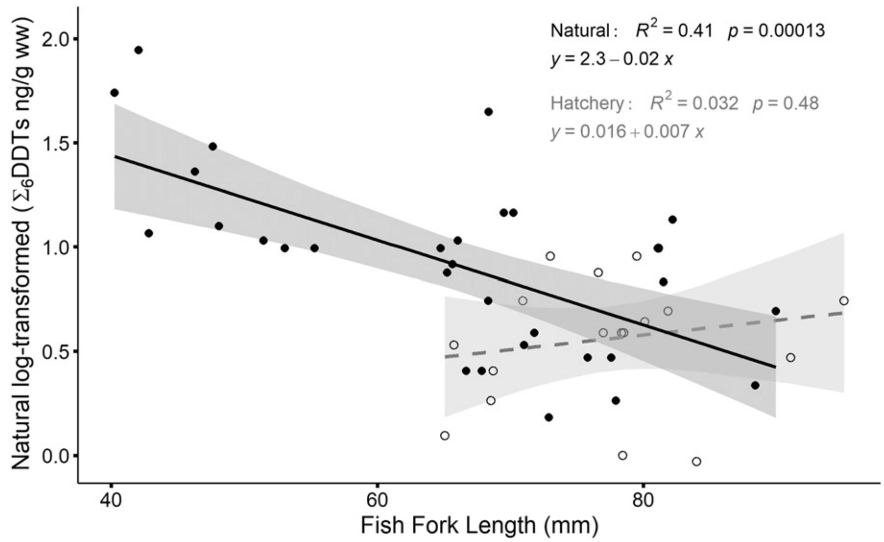

Fig. 3. Relationships between fish length and $\sum_6$DDTs for natural-origin (black solid line ± 95% CI shaded region) and hatchery-origin (dashed line ± 95% CI shaded region) fish. Actual data are plotted using solid filled symbols for natural-origin fish and open symbols for hatchery-origin.

3.3. Stable isotopes

The isotopic values $\delta^{34}S$ and $\delta^{13}C$ in Chinook salmon generally showed a similar pattern of enrichment from upper to downstream regions of the estuary, and more enrichment in hatchery- than natural-origin fish within each region (Two-Way ANOVA, Table 5; Fig. 5a). Overall, $\delta^{34}S$ values (Fig. 5a, vertical axis) in fish from the Distributary Channels (squares) were 2.1 times more enriched than those in the Upper Mainstem (upward triangles; $t = 10.278$, $p < 0.001$) and 1.2 times more enriched than those from the Lower Mainstem (downward triangles; $t = 4.314$, $p < 0.001$). Measured $\delta^{34}S$ in fish from the Lower Mainstem (downward triangles) were also 1.7 times more enriched than those from the Upper Mainstem (upper triangles; $t = 6.646$, $p < 0.001$). Overall, $\delta^{34}S$ was 1.1 times more enriched in hatchery- than natural-origin fish (open vs. closed symbols; $t = 2.561$, $p = 0.015$). A somewhat similar pattern of enrichment was measured for $\delta^{13}C$ in fish, although the differences were less pronounced from upstream to downstream (Fig. 5a, horizontal axis). Measured $\delta^{13}C$ in fish from the Distributary Channels (squares) were 1.1 times more enriched than those from the Upper Mainstem (upward triangles; $t = 4.509$, $p < 0.001$) and the Lower Mainstem (downward triangles; $t = 4.141$, $p < 0.001$), which did not differ from each other ($t = 1.043$, $p = 0.304$). Overall, $\delta^{13}C$ in hatchery-origin fish (open symbols) were 1.1 times greater than those of natural-origin (closed symbols; $t = 6.664$, $p < 0.001$).

The patterns of $\delta^{15}N$ in Chinook salmon (Fig. 5b, vertical axis) were more complex than those of $\delta^{34}S$ and $\delta^{13}C$, with depleted $\delta^{15}N$ values in natural-origin fish from the Lower Mainstem (solid downward triangles) compared to other sample groups (Two-Way ANOVA, Table 5). Apart from the natural-origin fish in the Lower Mainstem, as juvenile salmon moved from the Upper Mainstem to the more saltwater influenced region of the Lower Mainstem and the Distributary Channels, values of $\delta^{15}N$ and $\delta^{34}S$ were positively correlated and increasingly enriched (Fig. 5b). Natural-origin fish from the Distributary Channels (filled squares) were 1.2 times more enriched in $\delta^{15}N$ values compared to natural-origin fish from the Upper Mainstem (filled upward triangles; means = 10.8 and 9.3, $t = 3.624$, $p = 0.002$). Hatchery-origin fish (open symbols) had more similar $\delta^{15}N$ values among regions, but a slight enrichment (1.1 times) was also measured in the downstream

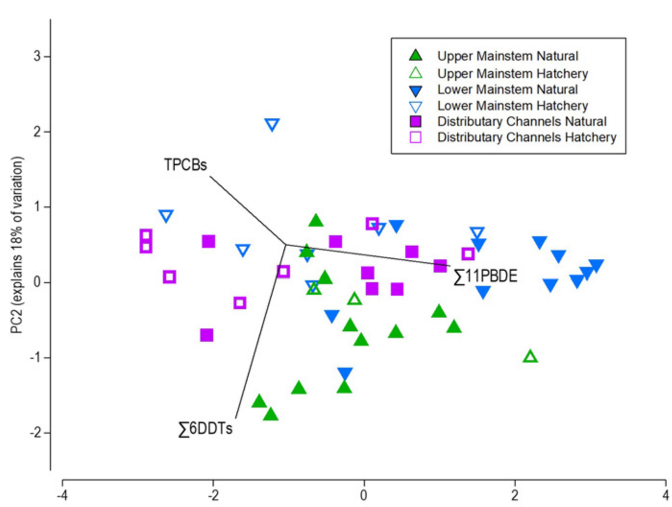

Fig. 4. Plot of the first two principal components (PC) based on the Principal Component Analysis (PCA) of proportions of $\sum_{11}$PBDEs, TPCBs and $\sum_6$DDTs measured in juvenile Chinook salmon collected from three regions of the Snohomish River estuary. Collectively, both PCAs explain 99.3% of the variation, with PC1 accounting for 81.3%, showing higher proportions of $\sum_{11}$PBDEs in natural-origin fish from the Lower Mainstem.

Table 4
ANOSIM statistical results for pairwise comparisons of the proportion of POP classes in juvenile Chinook salmon sampling groups. R varies between 0 and 1, although small negative values close to zero are possible. R values closer to 1 signify a higher degree of separation. Statistically significant differences are noted with an *. LM = Lower Mainstem region, UM = Upper Mainstem region, and DC = Distributary Channels region. Global R for test = 0.306 and p = 0.001.

Sampling group comparisons	R	p	
LM natural vs. DC hatchery	0.596	0.001	*
LM natural vs. LM hatchery	0.484	0.004	*
LM natural vs. UM natural	0.467	0.001	*
LM natural vs. DC natural	0.315	0.006	*
LM natural vs. UM hatchery	0.251	0.052	
UM natural vs. DC natural	0.068	0.195	
UM natural vs. DC hatchery	0.43	0.002	*
UM natural vs. LM hatchery	0.318	0.01	*
UM natural vs. UM hatchery	0.018	0.411	
DC natural vs. DC hatchery	0.272	0.033	*
DC natural vs. UM hatchery	0.127	0.258	
DC natural vs. LM hatchery	0.106	0.097	
UM hatchery vs. DC hatchery	0.237	0.103	
UM hatchery vs. LM hatchery	0.111	0.283	
DC hatchery vs. LM hatchery	−0.014	0.467	

Table 5
Results of a two-way ANOVA with sampling region (i.e. Region) and fish origin (i.e. Origin) as factors affecting stable isotopes of sulfur (δ34S), carbon ($\delta^{13}C$), and nitrogen (δ15N) measured in whole-body samples of juvenile Chinook salmon collected from the estuary of the Snohomish River.

Stable isotopes	Factor	d.f	Sum squared	Mean squared	F value	*p* value
$\delta^{34}S$	Region	2	187.39	93.695	52.863	<0.001
	Origin	1	11.623	11.623	6.558	0.015
	Region × Origin	2	0.403	0.202	0.114	0.893
	Residual	35	62.035	1.772		
	Total	40	315.047	7.876		
$\delta^{13}C$	Region	2	35.649	17.825	13.299	<0.001
	Origin	1	59.511	59.511	44.402	<0.001
	Region × Origin	2	1.89	0.945	0.705	0.501
	Residual	35	46.91	1.34		
	Total	40	172.28	4.307		
$\delta^{15}N$	Region	2	20.219	10.11	14.779	<0.001
	Origin	1	9.874	9.874	14.435	<0.001
	Region × Origin	2	7.132	3.566	5.213	0.01
	Residual	35	23.942	0.684		
	Total	40	71.463	1.787		

Distributary Channels region compared to those from the Upper Mainstem (means = 11.2 and 9.8, $t = 2.456$, $p = 0.056$). However, in stark contrast, $\delta^{15}N$ in natural-origin fish from the Lower Mainstem was significantly more depleted than would be predicted based on their $\delta^{34}S$ values (Fig. 5b). Mean $\delta^{15}N$ in natural-origin fish from the Lower Mainstem were only 90% of those in natural-origin fish from the Upper Mainstem (means =8.372 and 9.268, $t = 2.284$, $p = 0.029$). A comparison of natural- and hatchery–origin fish within regions also revealed $\delta^{15}N$ was only depleted in natural- compared to hatchery-origin fish in the Lower Mainstem (means = 8.372 and 10.595; $t = 5.205$, $p < 0.001$), however, significant differences were not observed from either the Upper Mainstem ($t = 0.973$, $p = 0.337$) or the Distributary Channels ($t = 0.885$, $p = 0.382$).

Nitrogen isotopic signatures of natural-origin fish from the Lower Mainstem were also negatively correlated with higher relative concentrations of $\sum_{11}$PBDEs ($R^2 = 0.68$, $p = 0.003$, slope = −0.74, intercept = 8.15). In natural-origin fish from the Lower Mainstem, the greater the depletion in nitrogen isotopic signature, the higher the proportion of $\sum_{11}$PBDEs (Fig. 6a; proportion of $\sum_{11}$PBDEs measured by PC1 in Fig. 4). The $\delta^{15}N$ values were also negatively correlated with absolute concentrations of $\sum_{11}$PBDEs ($R^2 = 0.68$, $p = 0.003$, slope = −8.93 and intercept =100.64) and TPCBs ($R^2 = 0.63$, $p = 0.006$, slope = −6.56 and intercept = 86.52), not shown for brevity. In contrast, for each of the other sampling groups, there was no relationship between $\delta^{15}N$ and PC1 (Fig. 6b) or $\sum_{11}$PBDEs, or TPCB (not shown for brevity). Furthermore, samples of natural-origin fish that were presumed to have spent the least amount of time in the Lower Mainstem, based on their lower $\delta^{34}S$, deviated most from the predicted relationship between PC1 score and $\delta^{14}N$ (Fig. S3, F = 27.0701, $p = 0.0008$, $R^2 = 0.77$).

4. Discussion

Our study demonstrated the value of three types of complementary chemical tracer data (POP concentrations, POP fingerprints, and stable isotopes), to assess location and source of contaminant exposure for juvenile Chinook salmon migrating seaward through a developed watershed with multiple contaminant sources. Using contaminant concentration data, we first assessed that along their migration pathway through Snohomish River estuary, salmon were exposed predominantly to PCBs and PBDEs in the Lower Mainstem region, with higher $\sum_{11}$PBDEs in natural- rather than hatchery-origin fish but similar TPCBs in both fish origins (Fig. 2). Second, we used POP fingerprints to determine that natural-origin fish captured from the Lower Mainstem had a distinct pattern from other region and origin samples, with a much higher proportion of $\sum_{11}$PBDEs in the total POP concentration, indicating a different contaminant source (Fig. 4). Third, we used stable isotopes, an independent tracer of food sources and habitat use, to document that natural-origin fish from the Lower Mainstem region had depleted $\delta^{15}N$ signatures compared to fish from the other region and origin groups (Fig. 5b). Moreover, the $\sum_{11}$PBDE-enhanced POP fingerprint in the natural-origin salmon from the Lower Mainstem was negatively correlated with the $\delta^{15}N$ in the salmon (Fig. 6), suggesting a common source for both the high PBDEs exposure and the depleted nitrogen isotopic signal.

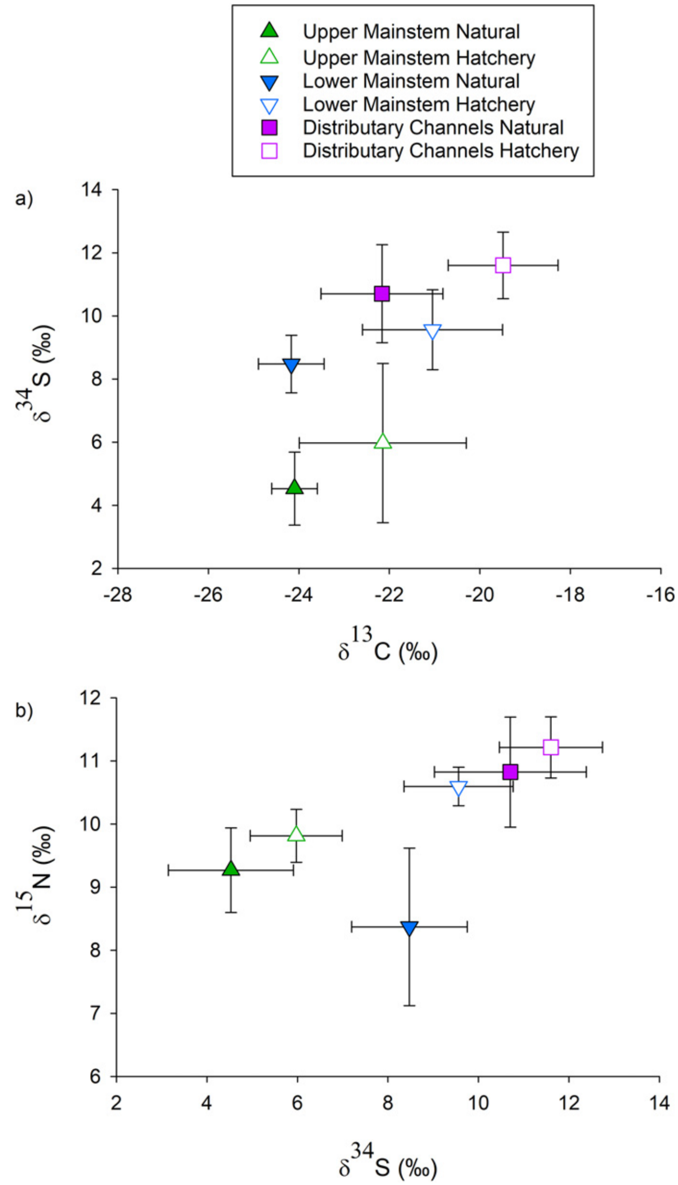

Fig. 5. Stable isotopes of a) sulfur ($\delta^{34}S$) and carbon ($\delta^{13}C$) and b) nitrogen ($\delta^{15}N$) and sulfur, measured in natural- and hatchery-origin juvenile Chinook salmon (mean ± 95% CI) collected from three regions of the Snohomish River estuary.

4.1. POP concentrations

As hypothesized, POPs concentrations, and $\sum_{11}$PBDEs in particular, were greatest in salmon sampled from the Lower Mainstem, nearest a high volume wastewater outfall, suggesting a wastewater source. Natural-origin fish from the Lower Mainstem had $\sum_{11}$PBDE concentrations 4–10 times higher than salmon from other regions, regardless of origin, indicating the natural-origin fish were most exposed in this

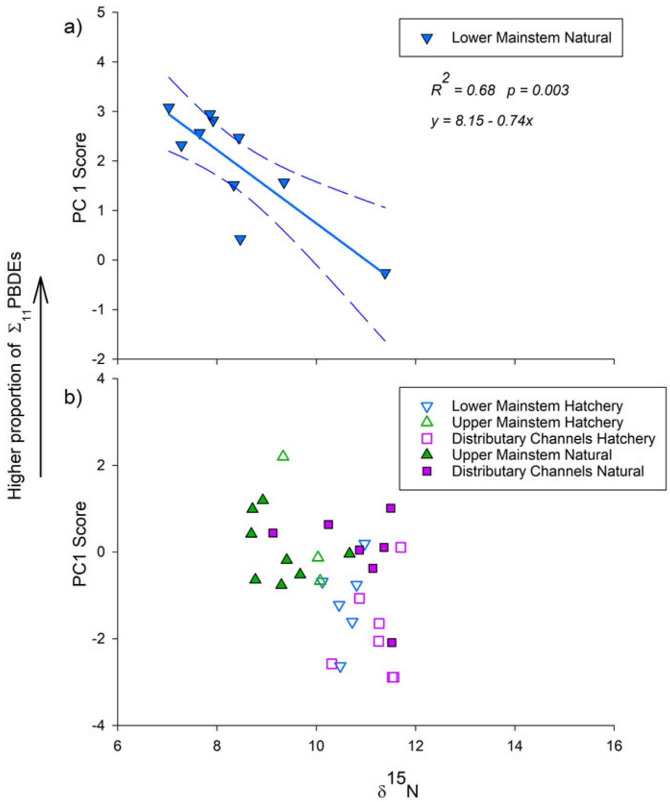

Fig. 6. Relationship between PC1 score and δ^{15}N showing a significant inverse relationship for a) natural-origin fish collected from the Lower Mainstem, but no relationship for b) each of the other region and origin sampling groups (i.e., $p > 0.05$) for each group.

region. Similar but less pronounced patterns were measured for TPCBs; concentrations in fish from the Lower Mainstem were approximately twice as high as those in fish from the less developed Distributary Channels and the Upper Mainstem, however, TPCBs did not differ by fish origins. Unlike $\sum_{11}$PBDEs and TPCBs, $\sum_{6}$DDT concentrations were uniformly low in all regions sampled.

The best-fit models for TPCB and $\sum_{11}$PBDE concentrations measured in juvenile salmon in this study support the conclusion that POP concentrations were determined primarily by the sampling region where the fish were captured (i.e., TPCBs) or the sampling region and the origin of the salmon (i.e., $\sum_{11}$PBDEs), rather than fish size or lipid content (Table S1). Although lipids can affect contaminant uptake (Elskus et al., 2005; West et al., 2017), the small range of lipid values measured in the juvenile Chinook salmon in this study likely dampened the importance of this factor. Likewise, fish length was only a factor for $\sum_{6}$DDT concentrations (Table S1), but this potential effect was obscured by the small range in fish sizes and differential size distributions between natural- and hatchery-origin fish. The inverse relationship between $\sum_{6}$DDT concentrations in the natural–origin salmon (Fig. 3), was consistent with previous studies documenting maternal transfer of DDTs to eggs and fry (Miller, 1994), and subsequent growth dilution. Given the limited size range of hatchery-origin fish collected, we cannot test for the presence of maternal transfer and growth dilution in these fish. POPs in maturing female Pacific salmon are transferred to the developing eggs (deBruyn et al., 2004; Ewald et al., 1998; Miller, 1993). Estimated $\sum_{6}$DDT concentrations in newly emerged Chinook salmon would range from 0.9 and 7 ng/g ww, based on a range of $\sum_{6}$DDT concentrations measured in muscle tissue of adult Chinook salmon (4.3–59 ng/g ww) returning to Puget Sound rivers (West et al., 2001) and correlations between POP concentrations in muscle and fry of Chinook salmon (Miller, 1994). Notably, the estimated maximum $\sum_{6}$DDT concentration encompassed the highest $\sum_{6}$DDT concentrations (i.e., 5.7–7.0 ng/g ww) we measured in small (≤42 mm) natural-origin fish, which are just a few mm larger than newly emerged Chinook salmon prior to exogenous feeding (Beacham and Murray, 1990), supporting the hypothesis that the elevated $\sum_{6}$DDTs in the smaller natural-origin fish we sampled were maternally derived. The lack of relationship between $\sum_{6}$DDT concentrations and fish length in hatchery-origin fish is likely due to the lack of availability of small fish (i.e. hatchery-origin fish are not released until they reach approximately 65 mm) and subsequent sampling of hatchery-origin fish after growth dilution occurred. Moreover, these observations suggest DDTs were not present in the Chinook salmon prey in this system in great enough quantities to overcome growth dilution.

The higher $\sum_{11}$PBDE concentrations in natural-origin fish from the Lower Mainstem compared to the natural-origin salmon from other regions, suggests a higher input of PBDEs into this region of the Snohomish River estuary. However, the higher $\sum_{11}$PBDE concentrations in natural-origin fish from the Lower Mainstem compared to the hatchery-origin fish from the same regions suggests fish of different origins were not equally exposed to the higher inputs of PBDEs. Natural-origin juvenile Chinook salmon were primarily exposed to and accumulated $\sum_{11}$PBDEs at two sites within the Lower Mainstem of the Snohomish River estuary, both located in the immediate vicinity of an Everett WPCF outfall and multiple CSOs. In contrast, hatchery-origin salmon from the same region accumulated lower $\sum_{11}$PBDE concentrations, likely because they moved through the estuary more rapidly than natural-origin fish (Levings et al., 1986; Rice et al., 2011) or they spent less time in the tidally influenced mesohaline area of the estuary (Davis et al., 2018) where wastewater was discharged. Davis et al. (2018) documented that seaward migrating juvenile Chinook from another river estuary in Puget Sound exhibited distinct habitat use patterns; natural-origin fish were more frequently captured in the tidally influenced freshwater and mesohaline habitats whereas hatchery-origin fish were more frequently captured in the nearshore intertidal habitat (Davis et al., 2018).

Concentrations of TPCBs were similarly elevated in natural- and hatchery-origin juvenile Chinook salmon, suggesting that although TPCBs inputs were greater in the more developed Lower Mainstem region of the estuary compared to other regions, the inputs were likely from more dispersed sources throughout the region, and not high enough to disproportionately elevate concentrations for natural-fish that likely resided in the area for a longer time.

Previous contaminant studies in juvenile Chinook salmon have also documented elevated levels of POPs in this species, especially those sampled from moderately to highly urbanized rivers and estuaries of Puget Sound (Johnson et al., 2007a; Meador et al., 2010; O'Neill et al., 2015; Olson et al., 2008; Sloan et al., 2010) and the lower Columbia River and Washington and Oregon coasts (Johnson et al., 2013; Johnson et al., 2007b; Sloan et al., 2010). The $\sum_{11}$PBDE concentrations we measured in natural-origin Chinook salmon in the Lower Mainstem were 2 to 24 times higher than concentrations in natural- and hatchery-origin fish from other Puget Sound estuaries and nearshore marine habitats (O'Neill et al., 2015; Sloan et al., 2010), but they were lower than the highest concentrations measured in samples collected from the Columbia River near areas with high inputs of wastewater (Sloan et al., 2010). Additionally, the Snohomish River estuary appears to be a consistent but possibly decreasing PBDE hotspot for seaward migrating juvenile Chinook salmon. Mean concentration of $\sum_{11}$PBDEs in the natural-origin Chinook salmon in the Lower Mainstem in this study (29 ng/g ww) were similar to those measured in natural-origin fish at the same location in 2013 (24 ng/g ww) but half (1100 vs. 2400 ng/g lipid weight) those measured in 2006 by Sloan et al. (2010), potentially indicating a decline in PBDEs as has been observed for other fish species in Puget Sound (West et al., 2017). Alternatively, the higher PBDE concentrations measured by Sloan et al. (2010) could be associated with differences in the mean fish length (100 vs. 66.9 mm) or sampling time (August vs April–July) compared to the present study. Concentrations of TPCBs in juvenile Chinook salmon from our study were similar to those measured in 2013 (30 vs. 27 ng/g ww) at the same sampling location in the Lower Mainstem (O'Neill et al., 2015). The TPCB concentrations we measured in salmon were higher than those measured at rural river and estuary sites in the Pacific Northwest (Johnson et al., 2013; Johnson et al., 2007a; Johnson et al., 2007b), but below those generally observed at heavily urbanized estuaries in Puget Sound (Johnson et al., 2007a; Meador et al., 2010; Olson et al., 2008) and the Columbia River (Johnson et al., 2013; Johnson et al., 2007b). In contrast to TPCBs and $\sum_{11}$PBDEs, the $\sum_{6}$DDT concentrations measured in juvenile Chinook salmon from the Snohomish River estuary were not elevated compared to other sites in Puget Sound in 2013 (O'Neill et al., 2015). Higher DDT concentrations were measured in juvenile Chinook salmon from the Columbia River basin from 2005 to 2009, approximately 8 to 12 times higher than those we measured in the Snohomish River, possibly associated with the high degree of agricultural activity in the interior Columbia River as well as Willamette basins and point sources within Portland Harbor (Johnson et al., 2013).

Concentrations of $\sum_{11}$PBDEs, and to a lesser extent TPCBs, we measured in juvenile Chinook salmon in the Snohomish River estuary were high enough to pose a conservation threat. Based on published laboratory exposure studies (Arkoosh et al., 2010, 2018; Meador et al., 2002), the concentrations of these POPs in some Chinook salmon were within ranges of adverse CBRs known to impair their health. Approximately 73% and 14% of the natural-origin Chinook sampled from the Lower Mainstem and the Distributary Channels, the two regions receiving wastewater effluent discharges, had concentrations of BDE congeners 47 and 99 (Table 3), the two congeners detected most frequently and at the highest concentrations, within the range of concentrations found to alter their immune response and increase disease susceptibility (Arkoosh et al., 2010, 2018). In contrast, none of the natural-origin Chinook salmon from the Upper Mainstem or hatchery-origin Chinook salmon from this study had $\sum$PBDE$_{47+99}$ levels high enough to predict altered immune response.

Impairment of immune response is of particular concern for salmonids because a properly functioning immune system is vital for both individual survival and population productivity (Segner et al., 2003). Seaward migrating salmonids are exposed to a number of naturally occurring pathogens and parasites, including the trematode *Nanophyetus salmincola* (Arkoosh et al., 2004). Exposure to PBDEs and other POPs may reduce the marine survival of juvenile salmonids due to immune suppression, thus increasing their susceptibility to naturally occurring infectious and parasitic diseases, causing direct mortality or indirect mortality via predation by larger fish, birds and mammals. For example, Hostetter et al. (2011) reported steelhead (*O. mykiss*) smolts that tested positive for pathogens were more likely to have poor external condition (i.e., external signs of disease or more scale loss). Moreover, tagged fish with poor external condition were subsequently observed to have lower overall marine survival (Hostetter et al., 2011), associated with increased avian predation (Hostetter et al., 2012). In addition to directly impairing the immune function of salmonids, exposure to POPs has been documented to work in conjunction with naturally occurring parasites (i.e., trematode exposure) further increasing their susceptibility to a naturally occurring marine bacterial pathogen (Jacobson et al., 2003), potentially leading to population level effects (Arkoosh et al., 1998; Loge et al., 2005; Meador, 2014; Spromberg and Meador, 2005). Chen et al. (2018) suggested the exposure to POPs and *N. salmincola* serve as mortality cofactors for juvenile steelhead from Puget Sound, with the proximate cause of death involving bacterial pathogens or selective predation of infected cohorts.

Based on lipid normalized TPCB concentrations (ng/g lw) measured in salmon from the Upper Mainstem, Lower Mainstem and Distributary Channels, 0%, 27%, and 29%, respectively of the natural–origin fish and 0%, 14% and 0%, respectively of the hatchery-origin fish, had concentrations above an adverse CBR threshold for total PCBs (Meador et al., 2002). Published CBR thresholds based on individual congeners were not available for salmon. These lipid normalized values likely underestimate the number of impaired fish because juvenile salmon rapidly metabolize lipids as they migrate downstream, typically achieving lipid concentrations of 1% or less by the time they move from the estuary to marine waters (Arkoosh et al., 2011; O'Neill et al., 2015). For example, modeling a 1% lipid content for the natural–origin fish from the Lower Mainstem to predict their increased risk after lipids have been metabolized, would increase the number of fish above the PCB CBR from 27% to 64% for natural-origin fish and 14% to 29% for hatchery-origin fish, potentially increasing the likelihood of reducing their marine survival. Indeed, Meador (2014) documented that hatchery Chinook salmon originating from Puget Sound rivers with contaminated estuaries, including the Snohomish River, have lower marine survival than those originating from uncontaminated rivers.

4.2. POP fingerprints

Analyses of POP fingerprints in salmon from the three regions support the hypothesis that salmon in the Lower Mainstem are exposed to a contaminant source influenced primarily by wastewater rather than stormwater. Except for the hatchery fish from the Upper Mainstem, natural-origin Chinook salmon from the Lower Mainstem had distinct POP fingerprints from all other sampling groups (Fig. 4, Table 4), with high relative concentrations of $\sum_{11}$PBDEs. The POP fingerprints in natural-origin fish from the Lower Mainstem overlapped with those of hatchery-origin fish from the Upper Mainstem ($R = 0.251$) and the p value was 0.052, suggesting that the difference between these groups may not be statistically significant. However, the small sample size ($n = 3$) representing the hatchery-origin fish from the Upper Mainstem, limited our ability to adequately evaluate a significant difference between these groups should one exist. Although POPs can enter the Snohomish River estuary via various sources such as WWTPs, stormwater, or atmospheric deposition, wastewater is considered to be the primary source for PBDEs in Puget Sound, whereas stormwater is the greater source for PCBs (Osterberg and Pelletier, 2015). Modeled loading of contaminants to Puget Sound indicated that most PBDEs enter Puget Sound via publically owned WWTPs, followed by stormwater related surface runoff, and then atmospheric deposition (9.91, 4.56, and 3.49 kg/year, respectively) (Osterberg and Pelletier, 2015). In contrast, Osterberg and Pelletier (2015) concluded that most PCBs enter Puget Sound via stormwater surface runoff (4.17 kg/yr), with considerably less entering via publically owned WWTPs and atmospheric deposition (0.32 and 0.43 kg/yr). In the year we conducted our study, the Lower Mainstem received wastewater DIN loads 1.5 times higher than those in the Distributary Channels (Table 1), and the Upper Mainstem region did not receive direct input of wastewater effluent. Although we do not have estimates of stormwater loads to the three regions of the Snohomish River estuary sampled by our study, loadings from surface runoff are likely highest in the Lower Mainstem region, based on the high percentage (41–94%) of impervious surface area in the lands adjacent to this region of the river (Fig. 1), potentially contributing to the higher concentrations of TPCBs in both natural-and hatchery-origin fish from this location. However, stormwater loadings to the Snohomish River are likely lower than those of more urbanized rivers because measured PCBs in juvenile Chinook from the Snohomish are much less than those measured in other more urbanized estuaries in the Puget Sound (Johnson et al., 2007a; Meador et al., 2010; O'Neill et al., 2015; Olson et al., 2008) and the Columbia River (Johnson et al., 2013; Johnson et al., 2007a; Johnson et al., 2007b).

Contaminant fingerprints are well established chemical tracers for providing information about the sources of POPs and movement patterns of migratory animals (Ramos and González-Solís, 2012), but typically over a broader geographic areas than evaluated in this study. For example, Krahn et al. (2007) used ratios of PCBs and DDTs acquired by migratory killer whales, to discriminate differences in feeding areas and contaminant sources for three pods of whales that forage along the west coast of North America. In contrast, we used variation in POP fingerprints in juvenile salmon sampled over <30 rkm to identify a PBDE contaminant-source, indicating the robustness of POPs fingerprint at discriminating contaminant sources along a contaminant gradient.

4.3. Stable isotopes

Isotopic signatures of salmon, especially $\delta^{15}N$, from three regions of the Snohomish estuary (Fig. 5) also support the hypothesis that natural-origin salmon from the Lower Mainstem region were exposed primarily to a wastewater source rather than a stormwater contaminant source. Stable isotopic signatures of nitrogen in biota are tools to assess assimilation of wastewater-derived sources of nitrogen into aquatic food webs (deBruyn and Rasmussen, 2002; Savage, 2005). In addition to the ambient nitrogen load in the river, nitrogen in wastewater is incorporated into aquatic food webs though the uptake of sewage-derived nutrients by primary producers or consumption of particulate-organic matter by primary consumers (Tucker et al., 1999), and then subsequently transferred through the food web (McClelland et al., 1997; Vander Zanden et al., 2005). Incorporation of wastewater-derived nitrogen sources into the food web, beyond the background river nitrogen, causes shifts in nitrogen stable isotopes in aquatic organisms when compared to background or reference values in both freshwater (deBruyn and Rasmussen, 2002; Hicks et al., 2017; Loomer et al., 2015; Steffy and Kilham, 2004) and marine systems (Savage, 2005; Schlacher et al., 2005; Tucker et al., 1999). However, the extent to which biota exposed to wastewater have altered $\delta^{15}N$ values depends on the treatment processes used at the plant, effluent quality (e.g., concentration and load of ammonia/ammonium), and the characteristics of the receiving waters (Hicks et al., 2017).

Depleted $\delta^{15}N$ in natural-origin fish from the Lower Mainstem suggests they were exposed to sewage characterized by relatively high nutrient concentrations. In contrast, the $\delta^{15}N$ in the hatchery-origin fish from this region was not depleted, suggesting they were less exposed to nutrient rich wastewater effluent. Complex treatment processes determine the amount of nutrient removal, and whether dissolved inorganic nitrogen in effluent is discharged as ammonia/ammonium, nitrite or nitrate (Metcalfe et al., 2003). WWTPs designed to optimize removal of nutrients from wastewater typically use nitrification (conversion of ammonia to nitrate) followed by de-nitrification (conversion of nitrate to nitrogen gas) processes to remove nitrogen. In contrast, WWTPs designed without specific nutrient removal, discharge effluent with more ammonium than nitrates (Hicks et al., 2017; Loomer et al., 2015). Furthermore, nitrification, denitrification, as well as volatilization of wastewater, can alter the concentration and the nitrogen isotopic signature of the pools of ammonia/ammonium and nitrate/nitrite they act upon (Heaton, 1986; Valiela et al., 2000), as well as the resulting effluent released to the aquatic systems (Toyoda et al., 2011). Overall, biota exposed to untreated and primary treated sewage, or secondary sewage with insufficient nutrient removal, typically exhibit a depleted $\delta^{15}N$ signal (deBruyn and Rasmussen, 2002; Hicks et al., 2017; Loomer et al., 2015), as we observed in natural-origin Chinook salmon from the Lower Mainstem. Indeed, the form of DIN discharged by the Everett's WPCF is atypical compared to other Puget Sound wastewater facilities that discharge into rivers and nearshore marine receiving waters, with a higher proportion of ammonium compared to nitrates and nitrites (Table 1). Conversely, biota exposed to secondary and tertiary sewage treatment that removes excess nitrogen with nitrifying and denitrifying bacteria typically have an enriched $\delta^{15}N$ signal compared to background values (Heaton, 1986; Savage, 2005; Valiela et al., 2000).

In contrast to nitrogen isotopes, carbon and sulfur stable isotopes were enriched in salmon as they moved downstream (see Fig. 5a), consistent with the frequency and amount of saltwater intrusion into the downstream regions of the Snohomish River (Hall et al., 2018) and a gradual shift to downstream food sources, as noted in salmon from other rivers (Moore et al., 2016). Sulfur and carbon isotopes provide information regarding food sources for consumers, with marine food webs typically more enriched in $\delta^{34}S$ and $\delta^{13}C$ than freshwater systems (Peterson and Fry, 1987), and thus reveal the prey base and movements of animals (Hobson, 1999). Based on Hall et al. (2018), there is a continuum from freshwater in the Upper Mainstem region to more saline waters in both the Lower Mainstem and Distributary Channels regions. The higher $\delta^{34}S$ and $\delta^{13}C$ we measured in salmon in these downstream regions, reflects this salinity gradient and the salmons' changing food supply that is incorporated into their tissues as they migrate downstream. Similarly, Moore et al. (2016) documented that natural-origin juvenile Chinook salmon from the relatively undeveloped watershed of the Skeena River in British Columbia, Canada, became enriched in both $\delta^{13}C$ and $\delta^{34}S$ as they migrated from the headwaters of the river to nearshore marine waters. The slight enrichment of $\delta^{34}S$ and $\delta^{13}C$ in hatchery-origin fish, compared to natural-origin fish from the same region, may be due to the residual influence of the diet of hatchery fish, prior to release from the hatchery (Weber et al., 2002). In the hatchery, fish are fed commercial diets dominated by protein from marine sources enriched in $\delta^{34}S$, whereas, natural-origin fish consume freshwater prey with more depleted $\delta^{34}S$, and the muscle tissue of fish reflect these sources (Weber et al., 2002). However, tissue differences in $\delta^{34}S$ between hatchery- and natural-origin fish will rapidly be masked by the freshwater diet consumed by hatchery-origin fish after they leave the hatchery, given the rapid turnover rates of liver and muscle tissue of juvenile salmonids (Heady and Moore, 2013).

4.4. Complementary chemical tracers

We used multiple, complementary chemical tracers to infer nutrient and contaminant sources to seaward migrating juvenile salmon, more discernable information than either tracer provided individually. Collectively, the isotope tracers and POP fingerprints indicated that natural-origin salmon were exposed to and assimilated both nitrogen and POPs from wastewater in the Lower Mainstem. The $\sum_{11}$PBDE enhanced POP fingerprints in natural-origin fish from the Lower Mainstem were inversely correlated with their $\delta^{15}N$ (Fig. 6), suggesting similar sources for both; the more fish were exposed to the ammonia/ammonium rich effluent, the more depleted they were in $\delta^{15}N$ and the greater their relative $\sum_{11}$PBDE concentrations. Concentrations of $\sum_{11}$PBDEs and TPCBs were also each negatively correlated with $\delta^{15}N$ in salmon. However, the slope of these relationships were steeper for $\sum_{11}$PBDEs (8.93 vs. 6.55), supporting our previous conclusion that the wastewater the fish were exposed to had a greater load of PBDEs than PCBs. Additionally, based on their $\delta^{34}S$, the natural-origin fish that had spent the least amount of time in the Lower Mainstem where the wastewater discharged, deviated most from the predicted relationship between PC1 score and $\delta^{15}N$ (Fig. S3), further supporting our conclusion that fish were exposed to and accumulated PBDEs from a wastewater source in the Lower Mainstem.

These results highlight the role of wastewater as a vector of toxic contaminants to aquatic consumers, as demonstrated previously (Meador et al., 2016; Spies et al., 1989), and raises additional concerns about juvenile salmon exposure to other contaminants in wastewater not evaluated in this study. Effluent from WWTPs are major sources of industrial chemicals (Servos, 1999), pharmaceutical and personal care products, (PPCPs) (Metcalfe et al., 2010), and natural and synthetic hormones (Ternes et al., 1999). Adverse effects observed in aquatic biota exposed to wastewater include endocrine disruption in individuals (Tyler and Jobling, 2008; Vajda et al., 2011), and alterations in species communities (Tetreault et al., 2013). Most pertinent to our study, Chinook salmon collected from wastewater impacted sites had modeled fish plasma concentrations for a variety of PPCPs in the range expected to produce adverse effects in fish (Meador et al. 2017); mitochondrial dysfunction, which is adverse for growing juvenile fish (Yeh et al., 2017); and altered blood chemistry parameters, a potential early indicator of metabolic disruption (Meador et al., 2018).

5. Conclusions

Our study demonstrated the utility of multiple chemical tracers to document the spatial extent, magnitude, and source of contaminant exposure in juvenile Chinook salmon, information necessary to formulate appropriate conservation measures to reduce or remediate contaminant exposure. Three types of complementary chemical tracer data, POP concentrations, POP fingerprints, and stable isotopes, allowed us to 1) identify where in their migration pathway threatened Chinook salmon were exposed to and accumulated PBDEs (and to a lesser extent PCBs), at concentrations high enough to impair their health, and 2) reveal that wastewater discharging into the river was the likely source of these POPs. These results highlight the importance of understanding the role that wastewater may play as a vector of toxic contaminants to aquatic consumers.

Data from this study can be used to guide and prioritize management actions to reduce threats from wastewater and other habitat stressors to juvenile salmon migrating through the Snohomish River estuary to Puget Sound. Specifically, identifying the region within the Snohomish watershed where salmon are most exposed to PBDEs, as well as the source (i.e., wastewater or stormwater), allows environmental managers to establish corrective actions to control PBDE inputs. Ultimately, reductions in PBDE exposure should improve Chinook salmon health and enhance their marine survival. The Snohomish River is the second largest contributor of Chinook salmon to the Puget Sound evolutionarily significant unit (Jonathan Carey, National Marine Fisheries Service, Personal communication); consequently, reductions in salmon survival due to wastewater-contaminant exposure could affect the recovery of the ESA-listed Chinook salmon from Puget Sound. Furthermore, exposure to contaminants in wastewater may thwart substantial habitat remediation efforts underway throughout the US Pacific Northwest to improve survival of natural-origin salmon. For example, between 2005 and 2017 approximately $ 90,000,000 US has been spent to improve the freshwater, estuarine and nearshore marine rearing habitat for natural-origin Chinook salmon originating from the Snohomish River (Snohomish Basin Salmon Recovery Forum, 2019), with the ultimate goal of improving their overall survival. The efficacy of this effort could be reduced if juvenile salmon have increased susceptibility to disease because of exposure to wastewater-derived contaminants. More broadly, Chinook and other salmon species are at risk in much of the southern part of their North American range (Gustafson et al., 2007), where interactions with many anthropogenic factors affect them, including contaminants (Lundin et al., 2019; Meador, 2014).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary Material

Supplementary material to this article can be found online at https://doi.org/10.1016/j.scitotenv.2019.135516.

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Chemical tracers guide identification of the location and source of persistent organic pollutants in juvenile Chinook salmon (*Oncorhynchus tshawytscha*), migrating seaward through an estuary with multiple contaminant inputs

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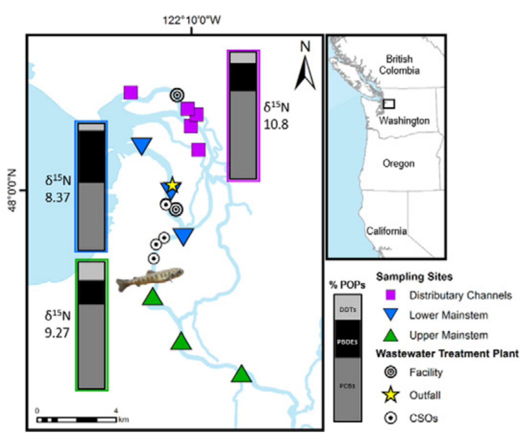
HIGHLIGHTS

- Three chemical tracers identified a contaminant source for seaward migrating salmon.
- Salmon collected near a wastewater outfall had higher contaminant concentrations.
- Salmon near the outfall had distinct combinations of contaminants (fingerprint).
- Altered $\delta^{15}N$ signatures were correlated with distinct contaminant fingerprints.
- Wastewater was the source for both distinct fingerprint and altered $\delta^{15}N$ signature.

GRAPHICAL ABSTRACT



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ABSTRACT

Understanding the spatial extent, magnitude, and source of contaminant exposure in biota is necessary to formulate appropriate conservation measures to reduce or remediate contaminant exposure. However, obtaining such information for migratory animals is challenging. Juvenile Chinook salmon (*Oncorhynchus tshawytscha*), a threatened species throughout the US Pacific Northwest, are exposed to persistent organic pollutants (POPs), including polybrominated diphenyl ether (PBDE) flame retardants and polychlorinated biphenyls (PCBs), in many developed rivers and estuaries. This study used three types of complementary chemical tracer data (contaminant concentrations, POP fingerprints, and stable isotopes), to determine the location and source of contaminant exposure for natural- and hatchery-origin Chinook salmon migrating seaward through a developed watershed with multiple contaminant sources. Concentration data revealed that salmon were exposed to and accumulated predominantly PBDEs and PCBs in the lower mainstem region of the river, with higher PBDEs in natural- than hatchery-origin fish but similar PCBs in both groups, associated with differences in contaminant inputs and/or habitat use. The POP fingerprints of the natural-origin-fish captured from this region were also distinct from other region and

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origin sample groups, with much higher proportions of PBDEs in the total POP concentration, indicating a different contaminant source or habitat use than the hatchery-origin fish. Stable isotopes, independent tracers of food sources and habitat use, revealed that natural-origin fish from this region also had depleted $\delta^{15}N$ signatures compared to other sample groups, associated with exposure to nutrient-rich wastewater. The PBDE-enhanced POP fingerprints in these salmon were correlated with the degree of depletion in nitrogen stable isotopes of the fish, suggesting a common wastewater source for both the PBDEs and the nitrogen. Identification of the location and source of contaminant exposure allows environmental managers to establish conservation measures to control contaminant inputs, necessary steps to improve the health of Chinook salmon and enhance their marine survival.

1. Introduction

An understanding of the spatial extent, magnitude, and source of contaminant exposure in biota is necessary to formulate appropriate conservation measures to reduce or remediate contaminant exposure. In some cases, there is an obvious point source of the contaminants, but in other instances the sources may be cryptic or dispersed, making them more difficult to identify and remediate. Obtaining such information for migratory animals is especially challenging because their routes may traverse habitats exposing them to different contaminants from multiple sources. Persistent organic pollutants (POPs) are contaminants of global concern because of their persistence, bioavailability, and toxicity (Jones and de Voogt, 1999). POPs include a wide variety of toxic chemicals, including polychlorinated biphenyls (PCBs), polybrominated diphenyl ether flame-retardants (PBDEs), and chlorinated pesticides such as dichlorodiphenyltrichloroethane and its metabolites (DDTs). All POPs are slowly metabolized, bioaccumulate in lipid-rich tissues, and biomagnify in the food web (Aguilar et al., 2002; Borrell et al., 2006; Jones and de Voogt, 1999; Tierney et al., 2014).

Proximity to contaminated habitats and the associated POPs in prey are the primary factors for determining the extent to which POPs are accumulated by fishes (Good et al., 2014; O'Neill and West, 2009; West et al., 2008) and marine mammals (Aguilar et al., 2002; Borrell et al., 2006). However, duration of exposure and body condition, including lipid content, reproductive status, and trophic position, can also affect accumulation (Aguilar et al., 1999; Burreau et al., 2006; Fisk et al., 2001; West et al., 2017). For migratory animals, the link between contaminated habitats and POP concentrations can be further obscured by multiple POP inputs (Borrell et al., 2006) as the animals move between habitats.

Although POPs can adversely affect animal health, the proportion of different types of POPs also serve as chemical tracers elucidating information about the trophic ecology, migration patterns, and population structure, for many migratory species (Ramos and González-Solís, 2012) including Atlantic salmon, *Salmo salar* (Svendsen et al., 2009), bluefin tuna, *Thunnus thynnus* (Deshpande et al., 2016a), harbor porpoise, *Phocoena phocoena* (Calambokidis and Barlow, 1991), beluga whales, *Delphinapterus leucas* (Krahn et al., 1999) and killer whales, *Orcinus orca* (Krahn et al., 2007). Additionally, the proportions of different types of POPs have been used to identify sources of POPs in Pacific herring, *Clupea pallasii* (West et al., 2008), bluefish *Pomatomus saltatrix* (Deshpande et al., 2016b), and bottlenose dolphins, *Tursiops truncatus* (Fair et al., 2010).

Current and historical inputs of POPs create environments with distinct chemical proportions or "fingerprints." Given sufficient foraging time, migratory animals accumulate POPs in proportion to their availability in the environments through which they migrate. Furthermore, unlike an individual POP concentration, POP fingerprints are less influenced by individual biological traits (Borrell et al., 2006; Dickhut et al., 2009; Svendsen et al., 2008), such that changes in POP fingerprints in animals along their migration route can indicate different inputs or sources of contaminants in prey along their migration route.

Naturally occurring stable isotopes of carbon, nitrogen, and sulfur also serve as chemical tracers, providing insights into ecological processes and patterns (Boecklen et al., 2011; Newsome et al., 2010; Peterson and Fry, 1987; Thompson et al., 2005). Stable isotopes of nitrogen are frequently used to indicate diet and trophic status (Caut et al., 2009; Olson et al., 2010; Ramos et al., 2011) because consumers accumulate higher levels of $\delta^{15}N$ than their prey. Nitrogen isotopes have also been used to assess exposure to sewage and wastewater inputs (Cabana and Rasmussen, 1996; Loomer et al., 2015; Schlacher et al., 2005), and they can reveal possible exposure to contaminants associated with the wastewater (Spies et al., 1989). Stable isotopes of sulfur and carbon are typically only slightly enriched between trophic levels. Instead, these stable isotopes are typically used as tracers of the types of food sources and have been used to assess habitat use (Connolly et al., 2004; Moore et al., 2016), and migratory patterns (Graham et al., 2010; Hobson, 1999). Sulfur stable isotopes are an especially good source indicator of terrestrial vs. marine producers, with more enrichment of heavier isotopes in marine systems (Thode, 1991; Willacker et al., 2017), and have been used to track residency in estuarine fishes (Fry and Chumchal, 2011) and movements of fish between freshwater and marine systems (Godbout et al., 2010; Moore et al., 2016). Moreover, when stable isotopes of sulfur, nitrogen and carbon are used together they can provide additional information on habitat use and trophic structure than stable isotopes of carbon and nitrogen alone (Connolly et al., 2004). Because stable isotopes fractionate with the organism's metabolism and change with its diet (Hobson, 1999), whereas POPs are not readily metabolized nor eliminated, they provide complementary information about the organism (Fisk et al., 2002; Herman et al., 2005; Ramos and González-Solís, 2012).

Pacific salmon of the genus *Oncorhynchus* exemplify organisms whose migrations take them through multiple habitats, including some where contaminants pose a concern (Johnson et al., 2007a; O'Neill and West, 2009; Ross et al., 2013). Spawned in cool, clear streams and other freshwater habitats, the juveniles feed for a period prior to seaward migration that varies among species, populations, and individuals (Quinn, 2018). Spawning typically takes place high in watersheds where contaminant concentrations are low, but their seaward migration may lead the juveniles through agricultural, industrial, and urbanized areas, each with different classes of contaminants.

In large parts of the southern portion of their native range, Pacific salmon species have experienced declines in abundance sufficient to limit fisheries, resulting in listings under the U.S. Endangered Species Act (ESA), and even lead to extinction. This loss of intra-specific diversity (Gustafson et al., 2007) has many causes, and the relative importance of each varies among watersheds (NRC, 1996) but chemical contaminants can contribute to poor survival of juveniles in populations migrating through contaminated habitats (Johnson et al., 2013; Meador, 2014).

Chinook salmon, *O. tshawytscha*, is listed as Threatened under the US ESA in Puget Sound, Washington, where individuals spawn in a number of large and medium-sized rivers (Myers et al., 1998; Ruckelshaus et al., 2006). The Snohomish River is typical of these, and is characterized by headwaters in forested land with few major sources of contaminants, with a transition to areas dominated by agriculture and increasingly suburban, urban and industrial areas where they flow into Puget Sound, Washington (Pess et al., 2002). Survival rates of juvenile salmon entering Puget Sound have been low for several decades (Quinn et al., 2005) but vary among rivers (Ruff et al., 2017), indicating that local as well as regional factors affect survival. Some of this variation has been linked to the extent to which the natal estuary has been modified from its natural condition (Magnusson and Hilborn, 2003), including chemical contamination (Meador, 2014). Moreover, natural-origin fish migrate more slowly and reside and feed in estuaries for longer periods than hatchery-origin fish (Levings et al., 1986; Rice et al., 2011), potentially resulting in greater contaminant exposure for natural-origin salmon.

Our goal was to use complementary data types to assess the location and source of contaminant exposure for juvenile Chinook salmon migrating through habitats with multiple contaminant sources, notably wastewater and stormwater. This study was conducted in the Snohomish River Washington, where two previous studies (O'Neill et al., 2015; Sloan et al., 2010) documented elevated levels of PBDEs (a POP class associated with wastewater; Osterberg and Pelletier, 2015) in juvenile Chinook salmon, at concentrations high enough to alter their immune response and increase their susceptibility to naturally occurring diseases, based on laboratory exposure studies (Arkoosh et al., 2010, 2018). The specific objectives were to determine where in their migratory pathway salmon become exposed to potentially harmful concentrations of PBDEs, and to identify potential sources so that corrective actions could be identified. We measured levels of PBDEs, other POPs, and stable isotopes of nitrogen, sulfur, and carbon in salmon collected along their migration routes in the estuarine portions of the Snohomish River. We hypothesized that Chinook salmon caught in the more developed reaches of the river, near wastewater inputs, would exhibit higher concentrations of PBDEs and that their POP fingerprints would have a higher proportion of PBDEs compared to other POPs, more indicative of a wastewater source. We further hypothesized that altered stable isotope ratios of nitrogen would be observed in fish captured in the vicinity of the wastewater inputs, and associated with the amount and type of nitrogen discharged. Additionally, this population includes Chinook salmon spawned naturally in the river and ones produced in a hatchery and we predicted that the natural-origin fish would exhibit higher POP concentrations associated with their higher residence time in the estuaries (Levings et al., 1986; Rice et al., 2011).

2. Material and methods

2.1. Study area

The Snohomish River watershed, in western Washington State, drains approximately 4600 km^2 into Puget Sound (USGS, 2011), and is formed by the confluence of the Skykomish and Snoqualmie rivers. It flows approximately 37 km to Puget Sound via a mainstem and a complex system of deltaic braided distributary channels through Union, Steamboat, and Ebey sloughs (Hall et al., 2018). The Snohomish River estuary's tidal influence extends throughout the distributary channels and up the mainstem to river kilometer (rkm) 27 (Collins and Sheikh, 2005). The maximum extent of saltwater (0.5 ppt) intrusion also extends throughout the distributary channels and to 15.9 rkm on the mainstem channel (Hall et al., 2018). Overall, 75% of the upland areas of Snohomish River basin is forested (Pess et al., 2002). In contrast, land cover in the floodplains and neighboring foothills along the major river channels are much more impacted by human activities, predominantly rural-residential, agricultural, and urban (Pess et al., 2002).

Modern human activities in the Snohomish River estuary have resulted in degradation and loss of juvenile salmonid habitat, considered the primary factor limiting Chinook salmon survival in the basin (Snohomish Basin Salmon Recovery Forum, 2005). Currently available wetland habitat area in the Snohomish estuary is estimated at 1389 ha; roughly 20% of the historical habitat extent in the delta (Beechie et al., 2017; Collins and Sheikh, 2005). The majority of the remaining available rearing habitat for juvenile Chinook salmon is located in the lower estuary (1238 ha) and distributed unevenly between the mainstem (88 ha) and the distributary (1150 ha) portions of the delta (Beechie et al., 2017).

Contaminant inputs likely coincide with the physical habitat loss in the Snohomish estuary. In particular, developed habitats with impervious surfaces adjacent to the river likely increase loadings of contaminants in stormwater to the river, as has been demonstrated for other aquatic systems (Brown and Peake, 2006; Lee et al., 2004; McCarthy et al., 2008). Indeed, stormwater was documented to be a major source of PCB loading to Puget Sound, with developed lands with more impervious surface contributing higher loads of PCBs to the watershed (Osterberg and Pelletier, 2015). Although specific inputs on PCBs to the Snohomish River were lacking, we used impervious surface and road area as proxies for urbanization in this study area and potential inputs of PCBs. The metric utilized for impervious surface was calculated by determining the "percent developed imperviousness", %IS (Fry et al., 2011; Wickham et al., 2013) within predefined watershed catchment areas called Assessment Units (AUs). The %IS values in our study ranged from 0 to 94%, with the most impervious surfaces (41–94%) in the City of Everett, located on the lower section of the mainstem, and the city of Marysville, located in the lower section of Ebey Slough (Fig. 1).

In addition to contaminant inputs from stormwater, the cities of Marysville and Everett primarily discharge treated wastewater, a potential source of PBDEs and other contaminants, into the estuarine portion of the Snohomish River. Specific levels of PBDEs discharged into the Snohomish River are unknown, as wastewater dischargers in WA State are not required to monitor PBDEs in their effluent. Everett's Water Pollution Control Facility (WPCF) is adjacent to the mainstem of the Snohomish River. The facility operates two outfalls and 13 combined sewer overflows (CSOs). One outfall and six CSOs discharge into the lower section of the river's mainstem and the others discharge into the marine waters of Port Gardner in Possession Sound (Fig. 1). The WPCF uses an aeration/oxidation pond (lagoon) system for treating the wastewater that discharges to the Snohomish River outfall (WA Dept. Ecology, 2015). Marysville's WWTP is located in the Distributary Channels, adjacent to Ebey Slough and uses an aerated lagoon with a filtration system to treat sewage prior to discharge into an outfall in Steamboat Slough or the marine waters of Port Gardner during the summer (WA Dept. Ecology, 2017). While most of the effluent discharged from these two facilities is treated, CSOs release untreated wastewater. CSOs occur on average, 1–2 times a year.

Discharges of dissolved inorganic nitrogen (DIN) in effluent from municipal WWTPs were used to assess the loads of nitrogen discharged from WWTPs. In total, Puget Sound has 78 municipal WWTPs discharging to Puget Sound – 70 discharge to marine waters and eight discharge to river estuaries. In the year of our study (2016), the Everett WPCF outfall in the Snohomish River had the highest DIN average daily discharge (average of February to July) of the eight facilities that discharge to the estuarine portion of Puget Sound rivers (Table 1). Additionally, the Everett WPCF outfall had the eight highest average daily discharge of DIN of all 78 municipal WWTPs discharging into Puget Sound (Table 1). WWTP loads were originally estimated for the years 1999–2008 using methods described in Mohamedali et al. (2011), and these inputs were updated through mid-2017 as described in Ahmed et al. (2019). During the 6-month migration window for juvenile Chinook salmon (February through July) in 2016, discharged DIN from the Everett WPCF averaged 1006 kg/day (Table 1). The Everett WPCF effluent, however, was atypical compared to other Puget Sound wastewater facilities, and contained a higher proportion of ammonium relative to nitrates and nitrites compared to the effluent from other facilities that discharge into similar waters frequented by juvenile salmon. The

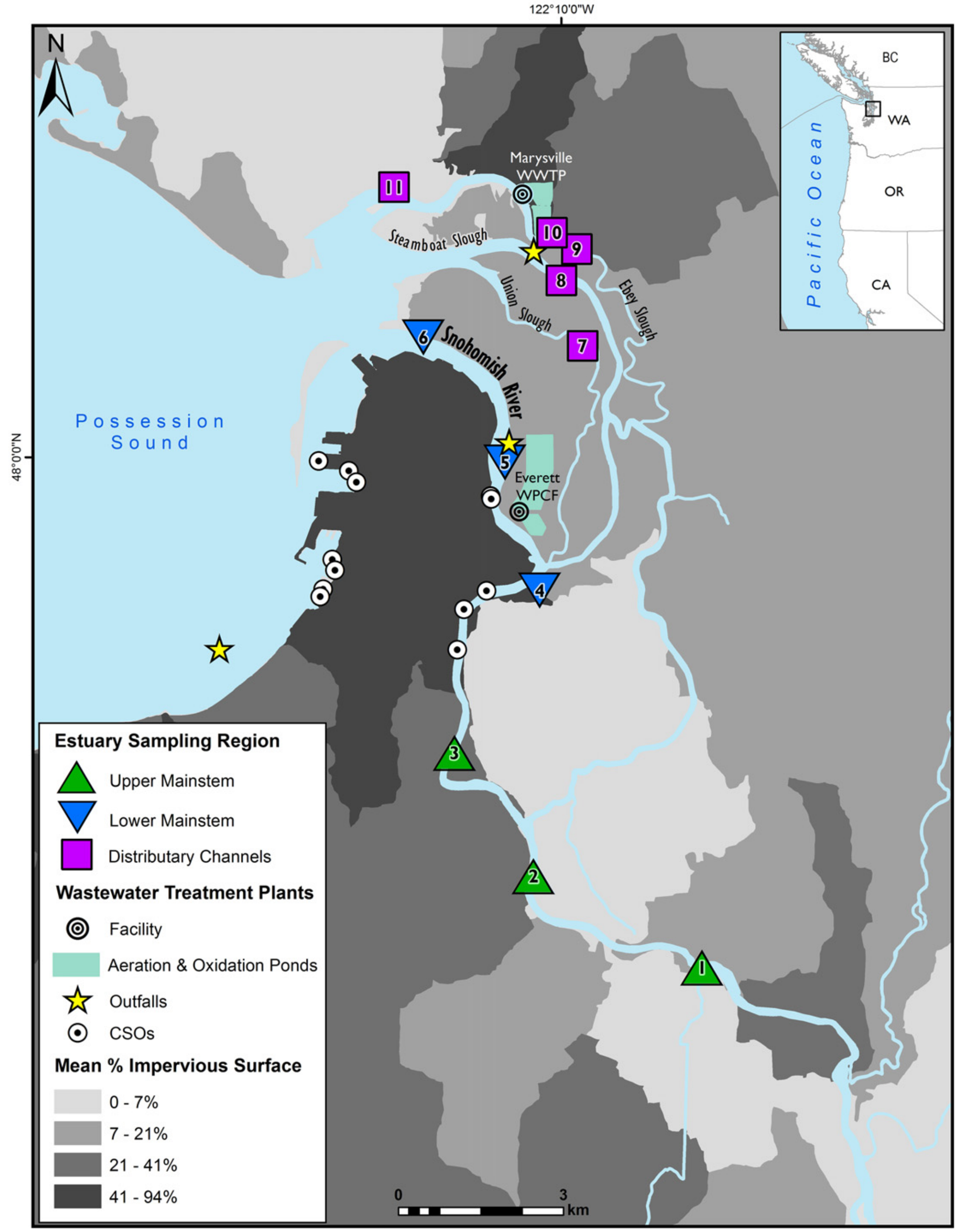

Fig. 1. Location of estuary sampling sites and sampling regions where juvenile Chinook salmon were collected for contaminant and stable isotope analyses (see Table 2 for additional site and sample data). Impervious land-surface is shown as grey scale gradations from <7% (lightest grey) to >40% (darkest grey). WPCF = Water Pollution Control Facility. WWTP = Wastewater Treatment Plant.

only other WWTP facilities discharging into Puget Sound with comparable or higher ammonium loads (>1000 kg/day) were high load facilities (≥250 DIN kg/day) that discharged in deep offshore marine waters, beyond habitats typically used by juvenile salmonids (Table 1).

2.2. Sampling design and fish collections

We sampled juvenile Chinook salmon for chemical tracers from 11 sites along their migration pathway in the estuarine portion of the Snohomish River in 2016. The sites were distributed in three regions: the Upper Mainstem, through which all the fish migrate, and two downstream regions, the Lower Mainstem and the Distributary Channels, that constitute alternative routes by which the fish can enter Puget Sound (Fig. 1). A minimum of three sites per region, distributed along the migration pathway within each region, were sampled to assess the range of stormwater and wastewater inputs that fish were potentially exposed to. Due to limitations on the number of ESA-listed Chinook salmon we were allowed to capture, our sampling design was intended to compare salmon among the three regions, rather than at specific sites. Our three sampling regions roughly represent the major bifurcation in the system based on hydrological properties of the rivers (Collins and Sheikh, 2005; Hall et al., 2018). The Upper Mainstem was the least developed of the three regions, with the most downstream site located 2 to 7 km upstream of the outfalls for the wastewater

Table 1
Mean and range (in parentheses) of daily loads of nitrogen types (DIN, ammonium, and nitrate + nitrite) and ratio of ammonium to nitrate + nitrite in municipal wastewater treatment plant effluent for facilities discharging into Puget Sound rivers and marine waters (Mohamedali et al., 2011; Ahmed et al., 2019), reported for each month from February through July of 2016. Effluent data for the Lower Mainstem and Distributary Channel regions of the Snohomish River sampled in this study are summarized separately from data for other facilities. Facilities discharging mean dissolved inorganic nitrogen (DIN) daily loads >250 kg/day for that six-month window were further categorized as either a freshwater, nearshore or offshore facility depending on the location of their effluent outfall in the receiving waters. All other facilities discharging into nearshore or offshore marine waters with a mean DIN <250 kg/day was placed in the "Other nearshore and offshore marine facilities" category. If load data was missing for a month, it was excluded from the average load calculation.

WWTP	n	DIN (kg/day)	Ammonium (kg/day)	Nitrate + Nitrite (kg/day)	Ratio of Ammonium (kg/day) to Nitrate + Nitrite (kg/day)
Lower Mainstem facility[a]	1	1006 (829–1162)	1002 (822–1161)	4.09 (1.71–6.97)	335 (118–678)
Distributary Channels facility[b]	1	649 (462–816)	628 (452–806)	20.4 (6.56–47.4)	48.3 (14.2–80.2)
Other river facilities (DIN ≥ 250 kg/day)	1	410 (203–583)	325 (126–462)	85.4 (33.2–158)	5.58 (1.64–13.9)
Other river facilities (DIN < 250 kg/day)	5	71.6 (1.61–257)	5.99 (0.005–58.0)	65.7 (1.60–256)	0.019 (0.002–2.14)
Nearshore marine facilities (DIN ≥ 250 kg/day)	3	658 (383–1177)	631 (365–1173)	27.0 (3.63–83.4)	84.7 (5.83–323)
Offshore marine facilities (DIN ≥ 250 kg/day)	13	2004 (229–9543)	1560 (7.87–8684)	445 (0.73–2794)	61.7 (0.0029–1385)
Other nearshore and offshore marine facilities (DIN < 250 kg/day)	54	32.9 (0.0077–352)	17.0 (0.0012–300)	15.9 (0.0012–236)	10.1 (0.00035–416)

[a] Everett Water Pollution Control Facility (see Fig. 1, Everett WPCF).
[b] Marysville Wastewater Treatment Plant (see Fig. 1, Marysville WWTP).

treatment facility and associated CSOs. We assumed that contaminants measured in seaward migrating salmon collected in the Upper Mainstem region represented cumulative exposure from all upstream sources. At each subsequent downstream site in the Lower Mainstem and the Distributary Channels, we assumed contaminant concentrations in salmon indicated additional inputs from stormwater and wastewater to which the salmon were exposed.

Juvenile Chinook salmon were collected in 2016 from April through July, primarily during the peak of downstream migration (April and May) to represent the average contaminant concentrations of the river system's fish populations. All fish were collected with beach seines or fyke nets, following procedures described in Roegner et al. (2009), euthanized, transferred to the laboratory on ice, assigned a unique number, and stored at −80 °C until tissue samples for chemistry and stable isotopes were prepared.

2.3. Sample processing

To process fish for analyses of contaminants and stable isotopes, fish were thawed slightly, fork length (mm) was recorded for each fish, and scales were removed for age determination (sub-yearling vs. yearling). To ensure the gut contents did not influence the contaminant and stable isotope data, they were removed from the stomach and intestine of fish and discarded to create gutted whole body fish samples. Additionally, the brain was removed from each fish for use in a separate study. Each fish was examined for presence of a clipped adipose fin, a coded wired tag (CWT), or thermally marked otoliths, any of which would indicate hatchery-origin fish. Based on thermally marked otoliths, we excluded from our study a few hatchery-origin fish that did not originate from within the Snohomish River, leaving 177 salmon for analyses (Table 2).

Forty-eight composite samples of gutted whole body fish, less the brain, were created by combining 1–8 similarly sized salmon in each sample (Table 2). The samples were homogenized, placed in pre-cleaned glass jars, and stored at −20 °C for subsequent chemical analyses. The proportion of natural-origin fish in each composite sample was used to classify the samples as either predominantly natural-origin (>65%) or hatchery-origin (<35%). In most cases, samples classified as predominantly natural- or hatchery-origin contained only fish of that designation (25 of 30 natural- and 15 of 18 hatchery-origin samples).

2.4. Contaminant analysis

Samples (approximately 2 g from each composite tissue sample) were analyzed for POPs, including 11 PBDEs, 46 PCBs, and six DDTs, using an established gas chromatography/mass spectrometry (GC/MS) method (Sloan et al., 2014). This method comprises three steps: (a) a dichloromethane extraction using an accelerated solvent extractor, (b) cleanup by gravity flow silica/aluminum columns and followed by

Table 2
Number (No.) of individual juvenile Chinook salmon and composite samples (Comps.) sampled in 2016 for contaminant analyses at multiple sites in the estuary habitat of the Snohomish River. Each composite sample is composed of 1–8 individual salmon of similar size and was classified as either natural- or hatchery–origin, based on the proportion of natural fish present. Site numbers refer to the sampling locations depicted in Fig. 1.

Sampling regions	Site No.	Site name	River km	Collection period	Natural origin		Hatchery origin	
					No. fish	No. Comps.	No. fish	No. Comps.
Upper Mainstem	1	Fields Riffle	18.7	April–July	16	5	3	1
	2	Big Tree	14.9	April–July	11	3		
	3	Old Bridge	11.5	April–July	15	4	4	2
Lower Mainstem	4	Old Barge	7.4	April–May	20	4	3	1
	5	Langus Pier	5.2	April–July	31	7	9	3
	6	Lower Mainstem	2.0	May–June			11	3
Distributary Channels	7	Union Slough	5.9	May June	8	2	3	1
	8	Steamboat Slough	4.8	April–May	6	2	3	1
	9	Ebey Slough 1	6.9	April–May	10	2	3	2
	10	Ebey Slough 2	6.4	April–May			1	1
	11	Ebey Slough 3	2.5	May	7	1	12	3
All regions				April–July	124	30	53	18

size-exclusion high-performance liquid chromatography (HPLC) cleanup, and (c) quantitation of POPs using gas chromatography/mass spectrometry (GC/MS) with selected-ion monitoring (SIM). A subsample of each pre-cleaned extract was used to determine percent lipids gravimetrically (Sloan et al., 2014). As part of a performance-based quality assurance program, a solvent (dichloromethane) method blank and National Institute of Standards and Technology (NIST) Lake Michigan fish tissue Standard Reference Material (SRMs, 1947) were analyzed with each batch of field samples and the results of the quality control samples met established laboratory criteria (Sloan et al., 2019). The solvent method blank for each sample batch contained no more than five analytes that exceeded 2 × the lower limit of quantitation (LOQ), which met our laboratory QA criteria. Levels of ≥70% of individual analytes measured in NIST SRM 1947 for each sample batch were within 30% of either end of the 95% confidence interval of the NIST certified values. Surrogate recoveries for the POP analyses ranged from 99 to 116% and met established laboratory criteria (surrogate recoveries are to be between 60 and 130%). Additional details for our laboratory quality assurance measures and criteria for POPs analyses can be found in Sloan et al. (2019). The lower limits of quantitation (LOQ) for individual PBDEs, PCBs, and DDTs measured in the field samples and their associated quality assurance samples ranged from <0.063 to <0.31 ng/g, wet weight.

Analyte data are presented as summed values for PBDEs and DDTs. Summed PBDEs (i.e., $\sum_{11}$PBDEs), were calculated by summing detected concentrations of the congeners 28, 47, 49, 66, 85, 99, 100, 153, 154, 155, and 183. Summed DDTs (i.e., $\sum_6$DDTs) were calculated by summing the detected concentrations of *o,p′*-DDD, *o,p′*-DDE, *o,p′*-DDT, *p,p′*-DDD, *p,p′*-DDE, and *p,p′*-DDT. The total PCB concentration (i.e., TPCBs) was estimated using a simple algorithm based on the subset of 17 commonly detected congeners (and coeluting congeners) representing homologues containing three to ten chlorine atoms [congeners 18, 28, 44, 52, 95, 101(90), 105, 118, 128, 138(163,164), 153 (132), 170, 180, 187(159,182), 195, 206, and 209], wherein the sum of the detected values for these 17 (and coeluting) congeners was multiplied by two. The calculated TPCB concentration using this method was previously shown to agree well with the sum of 209 congeners measured by high resolution methods for two fish species (West et al., 2017) and is similar to method used by Lauenstein and Cantillo (1993) discussed in West et al. (2017). Summed or total POP results were expressed as nanogram (ng) per gram of tissue weight (wet weight). Additionally, we calculated POP concentrations on a lipid basis, as ng of contaminant per g of fish lipid (ng/g lipid), to facilitate comparisons with other published studies, including those on adverse critical body residues (CBRs). Published CBRs for POPs are sometimes reported as lipid normalized concentrations because POP toxicity can be inversely dependent on lipid content (Lassiter and Hallam, 1990).

2.5. Stable isotopes analyses

All samples with sufficient tissue mass (41 of 48 samples) were analyzed for stable isotope ratios of nitrogen, carbon, and sulfur. Frozen, non-lipid extracted tissue samples were freeze-dried, ground to a fine powder, and weighed into tin capsules for isotope analyses with a target mass of 0.5 mg of tissue for carbon and nitrogen and 7.5 mg for sulfur. Stable isotope analyses were performed at the University of Washington's IsoLab in Seattle, WA as in Fry et al. (1992) and Fry et al. (2002). A Costech Elemental Analyzer, Conflo III, and Thermo MAT253 isotope ratio mass spectrometer was used for a continuous-flow based measurement of bulk carbon δ^{13}C and bulk nitrogen δ^{15}N. A Eurovector Elemental Analyzer, Conflo III, and Thermo MAT253 isotope ratio mass spectrometer was used for a continuous flow based measurement of the bulk sulfur δ^{34}S. During analytical runs, these methods provided precisions (1 sigma) of ±0.05‰, ±0.1‰ and ±0.2‰ for carbon, nitrogen and sulfur, respectively.

Stable isotopes of carbon, nitrogen, and sulfur were expressed in standard delta notation (δ^{13}C, δ^{15}N, and δ^{34}S),

$$\delta\,(‰) = 10^3\,\left[\left(R_{sample}/R_{standard}\right) - 1\right],$$

where *R* is the ratio of heavy and light isotopes in a sample (^{13}C:^{12}C, ^{15}N:^{14}N, and ^{34}S:^{32}S). We expressed stable isotope ratios in units of permil (‰ – parts per thousand) and are relative to international standards: Vienna PeeDee Belemnite (VPDB) for δ^{13}C, atmospheric nitrogen for δ^{15}N, and Vienna–Canyon Diablo Troilite (VCDT) for δ^{34}S. Most (78%) of the fish tissue samples had a C:N ratio greater than the 3.5 threshold for lipid correction (Post et al., 2007), indicating that the lipid content of the samples may have depleted the δ^{13}C values. Accordingly, we used the following equation from Post et al. (2007),

$$\delta^{13}C_{normalized} = \left(\delta^{13}C_{untreated} - 3.32\right) + (0:99 \times C:N)$$

to mathematically lipid normalize δ^{13}C values.

2.6. Data analysis

We applied multiple linear regression (R Development Core Team, 2018) to identify the potential effects of four factors on contaminant concentration for three major POP classes (DDTs, PBDEs, and PCBs). The four predictor variables were: 1) capture region (one of three), 2) fish origin (natural or hatchery), 3) fish size (mean length of fish in composite sample) at capture, and (4) % lipid content. Fish origin was considered a factor because natural-origin fish may reside and feed in estuaries for longer periods than hatchery-origin fish (Levings et al., 1986; Rice et al., 2011), resulting in greater potential exposure. Fish length (an indirect measure of age and duration of exposure) and lipid content were included as factors as they can affect the concentrations of POPs accumulated (West et al., 2017). All POP data were log transformed to meet assumptions of normality and homogeneity of group variances. Additive and interactive effects were evaluated, however, due to limited degrees of freedom, only models with up to three factors were considered. Akaike Information Criterion corrected for small sample size (AICc) and Akaike weights were used to identify the best model to parsimoniously explain the variation in the concentrations of PBDE, PCBs and DDTs data (Akaike, 1974; Burnham and Anderson, 2002). The model with the lowest AICc and highest Akaike weight was considered the best fit. For the best fit model for each POP class, pairwise comparisons were conducted on estimated marginal means using the Holm-Sidak adjustment for multiple comparisons. Test results for pairwise comparisons were considered statistically significant at $p \leq 0.05$. Additionally, independent linear regressions were performed for $\sum_6$DDT by fish length for each origin.

To illustrate POP fingerprints among the three regions by two origin groups, the proportion of $\sum_{11}$PBDEs and other POPs classes in Chinook salmon samples were compared among the six regions and origin groups using principal component analyses (PCA), as detailed in the software package Primer-E version 6 (Clarke and Warwick, 2006; Clarke and Gorley, 2006). Prior to analyzing with PCA, the POP class data were pretreated by standardizing (i.e., computing the proportional contribution of each POP class concentration to the total POP concentration in each sample) and then transforming the data by taking the square root to reduce the contribution of dominant classes. Similar POP fingerprints among groups would indicate consistent sources of contaminants, whereas dissimilar contaminant patterns would suggest inputs of specific POPs associated with different sources. Pairwise site comparisons of group patterns were conducted with ANOSIM, using the R statistic and *p* values to identify the main between-group differences. Values of the ANOSIM R statistic range from 0 (i.e., no separation, or complete similarity) to 1.0 (i.e., complete separation, or no similarity) of a population. A *p* value ≤ 0.05 was used as a guide for determining whether the measured segregation between groups (i.e., R statistic) was statistically significant.

A two-way ANOVA was used to test for difference in stable isotopes, fish length, and lipid content among regions and between natural and hatchery-origin fish. A Holm-Sidak test was used to conduct pairwise comparisons among group means for each POP class. Probability values were used to help evaluate the significance of differences; a p value ≤ 0.05 was used as a guide to assess whether results for pairwise comparisons were considered statistically significant.

Salmon POP fingerprints (i.e., PCA analyses of the proportion of $\sum_{11}$PBDEs and other POPs), a potential indicator of contaminant source, and δ^{15}N, an indicator of the nitrogen source, were compared to see if they co-varied. For each region and origin sampling group, we used linear regression to test for significant relationships between δ^{15}N and PC1 scores in salmon samples, two independent metrics that can both be affected by wastewater inputs. Additionally, linear regression was used to test for significant relationships between δ^{15}N and $\sum_{11}$PBDEs, and TPCBs.

3. Results

3.1. POPs concentrations

Mean POP wet weight (ww) concentrations in juvenile salmon varied 10-fold for $\sum_{11}$PBDEs as a function of sampling region and origin (naturally or hatchery produced), from 2.4 to 24 ng/g ww, and less so for TPCBs, from 12 to 31 ng/g ww (Table 3). In contrast, mean $\sum_6$DDT concentrations were much more similar among regions and origin groups, ranging from 1.7 to 2.9 ng/g ww. Although TPCBs varied less than $\sum_{11}$PBDEs among sampling groups, overall TPCB concentrations were greater than $\sum_{11}$PBDEs, followed by $\sum_6$DDTs (Table 3). For example, among fish of the same region, measured mean TPCBs concentrations were 1–3 times greater than $\sum_{11}$PBDE and 5–10 times greater than $\sum_6$DDTs for natural-origin fish and 2–6 times greater than $\sum_{11}$PBDEs and 6–16 times greater than $\sum_6$DDTs for hatchery-origin fish.

Concentrations of $\sum_{11}$PBDEs and TPCBs in juvenile salmon were best predicted by models that included factors for the collection region and the fish origin, rather than body size (i.e., length) or lipid content, but the importance of these factors varied by POP class (Table S1). Specifically, $\sum_{11}$PBDE concentrations were best predicted by models that included region, origin, and a strong region x origin interaction term (Adjusted $r^2 = 0.58$; Tables S1, S2). Post-hoc tests identified that natural-origin fish from the Lower Mainstem had the highest $\sum_{11}$PBDE concentrations (p ranged from 0.033 to <0.0001). Overall, concentrations of $\sum_{11}$PBDEs in natural-origin fish from the Lower Mainstem (mean = 24 ng/g ww) were 4–10 times higher than salmon from all other sampling groups, regardless of region or origin (Table 3, Fig. 2). The only other statistically significant difference in $\sum_{11}$PBDE concentrations was between natural- and hatchery-origin salmon from the Distributary Channels (means = 5.7 and 2.4 ng/g ww), representing the second highest and lowest concentrations (Table 3, Fig. 2, $p = 0.05$). The mean lipid content among samples ranged from 0.97% to 1.6% (Table 3) but did not differ significantly among regions or between fish origins (Two-Way ANOVA, region F = 0.722 and $p = 0.492$; origin F = 0.783 and $p = 0.781$). Moreover, models with lipid content as a single factor or in combination with region or origin were poor fits and explained less of the measured variation in $\sum_{11}$PBDEs (Table S1). Although natural-origin fish were smaller than hatchery-origin fish (mean = 65.7 vs. 77.4 mm, Table 3), fish length for combined origins did not differ among regions (Two-Way ANOVA, origin F = 9.910 and $p = 0.003$, region F = 0.217 and $p = 0.806$), and models with fish length alone or in combination with region or origin were poor fits and did not contribute substantively to the measured variation of $\sum_{11}$PBDEs (Table S1).

Concentrations of TPCBs were best predicted by sampling region, accounting for 46% of the measured TPCB variation (Table S1). Fish length and lipid content, as individual factors or in combination with region or origin, did not substantively improve the model fit. Overall, fish from the Lower Mainstem had measured TPCB concentrations (30 ng/g ww) approximately twice as high as those from the Upper Mainstem (mean = 13 ng/g ww) and the Distributary Channels (16 ng/g ww; Table 3, Fig. 2, $p < 0.0001$ for both comparisons), which did not differ from each other ($p > 0.05$).

Unlike the patterns measured for $\sum_{11}$PBDEs and TPCBs, fish size was significantly correlated with $\sum_6$DDT concentrations. The $\sum_6$DDT concentration was best predicted by the origin, fish length, and a fish origin-length interaction, accounting for 40% of the measured variation (Table S1). A model with only origin and fish length was not near as good a fit to the actual data (Table S1), indicating that the fish origin-length interaction term was significant. Predicted mean $\sum_6$DDT concentrations were higher in natural- than hatchery-origin fish (2.3 vs. 1.7 ng/g ww), based on a mean fish length of 70 mm in the best-fit model regression model (Table S2, Fig. 2c). However, predicted $\sum_6$DDT concentrations depicted in Fig. 2c do not fully represent the interaction between fish origin and fish length due to differences in sizes between natural- and hatchery-origin fish. The size of newly emerged natural-origin Chinook salmon prior to exogenous feeding (Beacham and Murray, 1990) are just a few mm smaller than those we sampled from the river, however, hatchery-origin fish are not released to the river until they reach approximately 65 mm, prohibiting full examination of $\sum_6$DDT size comparison for fish of both origins from the river. As a result, in addition to the full model, independent linear regressions were performed for $\sum_6$DDT by fish length for each origin (Fig. 3). There

Table 3
Arithmetic mean lipid content (Lipids), fork length (FL), and concentrations of $\sum_{11}$PBDE, $\sum$PBDE 47+99, TPCBs, and $\sum_6$DDTs of composite samples of Chinook salmon (*Oncorhynchus tshawytscha*). Measured POPs concentrations are reported as ng/g wet weight (ww) and ng/g lipid weight (lw), based on the measured gutted whole body wet weight and lipid content in the fish.

Region	Origin	N	Lipids (%)	FL (mm)	$\sum_{11}$PBDE ww	$\sum_{11}$PBDE lw	$\sum$PBDE$_{47+99}$[a] ww	$\sum$PBDE$_{47+99}$ lw	TPCBs ww	TPCBs[b] lw	$\sum_6$DDTs ww	$\sum_6$DDTs lw
Upper Mainstem	Natural	12	1.6	61.3	4.0	270	3.5	240	14	950	2.9	210
	Hatchery	3	0.97	85.7	5.2	640	4.4	540	12	1200	2.0	220
	Natural + hatchery	15	1.4	66.2	4.2	340	3.7	300	13	1000	2.7	210
Lower Mainstem	Natural	11	1.5	66.9	24	1500	20	1200	31	2100	2.9	210
	Hatchery	7	1.5	75.8	5.4	500	4.7	430	29	2600	1.9	140
	Natural + hatchery	18	1.5	70.3	17	1100	14	930	30	2300	2.5	180
Distributary Channels	Natural	7	1.1	71.3	5.7	540	4.9	460	18	1700	2.3	200
	Hatchery	8	1.6	75.8	2.4	190	2.0	160	15	940	1.7	110
	Natural + hatchery	15	1.4	73.7	3.9	350	3.4	300	16	1300	2.0	150
All regions	Natural	30	1.4	65.7	12	790	9.7	660	21	1500	2.8	210
	Hatchery	18	1.5	77.4	4.0	380	3.5	330	20	1600	1.8	140

[a] $\sum$PBDE$_{47+99}$ = sum of detected BDE-47 and BDE-99 congeners used to assess adverse critical body residues (CBR) for exposure to PBDEs.
[b] TPCB used to assess adverse CBR for exposure to PCBs.

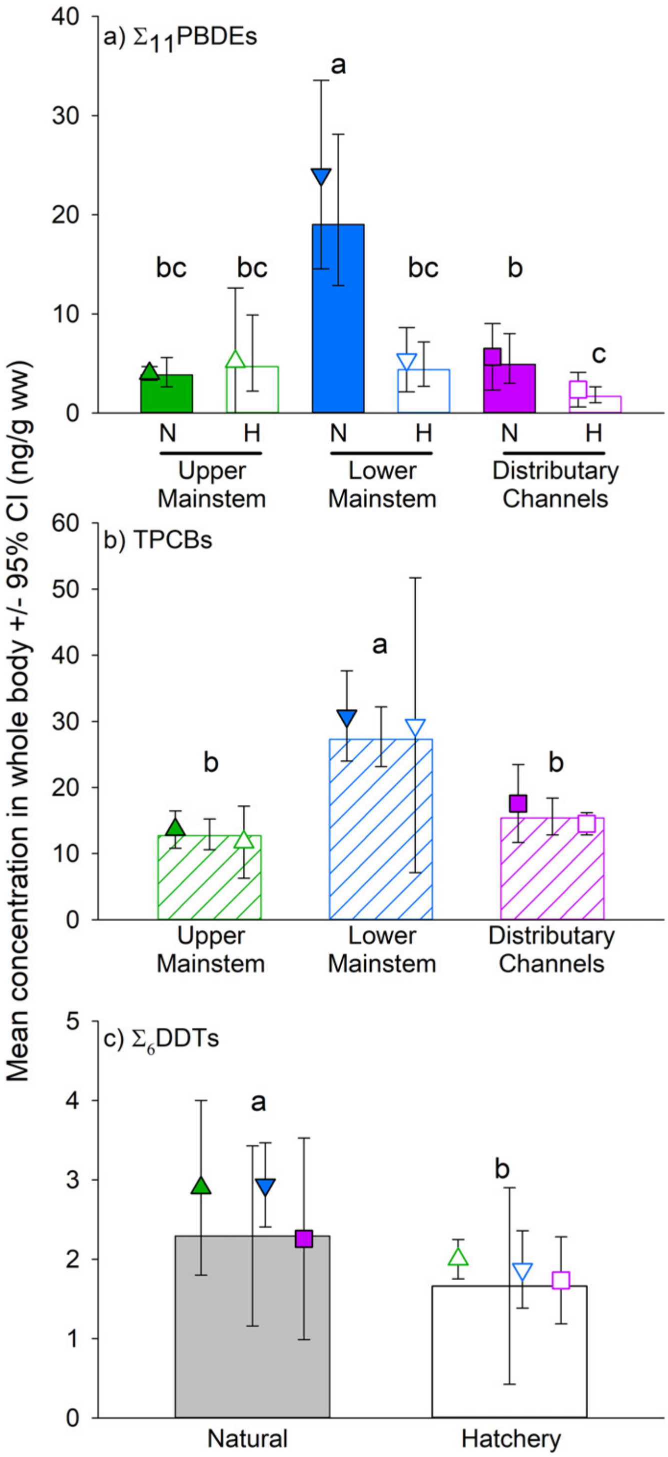

Fig. 2. Measured (symbols) and predicted (bars) concentrations of $\sum_{11}$PBDEs, TPCBs, and $\sum_6$DDTs in juvenile Chinook salmon collected from the Snohomish River estuary. Symbols represent the arithmetic mean concentrations for $\sum_{11}$PBDEs, TPCBs, and $\sum_6$DDTs where Upper Mainstem, Lower Mainstem, and the Distributary Channels sites are represented by upward triangles, downward triangles, and squares, respectively. Solid filled and open symbols are used to represent natural- and hatchery-origin fish, respectively. Bars are modeled estimated geometric mean concentrations with solid filled, open, and hatched bars used to represent natural-, hatchery- and mixed-origin fish, respectively. Predicted $\sum_6$DDTs concentrations were modeled using a grand mean fish length of 70 mm. For each POP class, groups with the same lower case letter are not significantly different from each other.

was an inverse relationship between fish length and $\sum_6$DDT for natural-origin fish, ranging from 40.2 to 90.0 mm (Fig. 3). In contrast, $\sum_6$DDT was not significantly correlated with fish length for hatchery-origin fish for the limited length range tested (65.1 to 95.1 mm, Fig. 3). Similarly, there is also no significant correlation between length and $\sum_6$DDT for natural-origin fish >65 mm ($p = 0.36$; data not shown).

3.2. POP fingerprints

A comparison of POP fingerprints among the samples indicated clear segregation between natural-origin fish from the Lower Mainstem and all but one of the other sampling groups (Fig. 4; Table 4). The natural-origin fish from the Lower Mainstem exhibited distinct POP fingerprints (Fig. 4, filled blue triangles), with the higher proportions of $\sum_{11}$PBDEs in the total POP concentration, compared to other sampling groups. These fingerprints were most different from hatchery-origin fish from the same region (Fig. 4, open blue triangles) and the Distributary Channels (Fig. 4, open pink squares), which exhibited the two lowest relative concentrations of $\sum_{11}$PBDEs (ANOSIM, $R = 0.484$ and 0.596), followed by natural origin fish from the other regions (ANOSIM, $R = 0.467$ and 0.315), with intermediate relative concentrations of $\sum_{11}$PBDEs (Table 4, $p \le 0.006$ for all pair-wise comparison). The only sampling group that was not clearly segregated from the natural-origin fish from the Lower Mainstem was the hatchery-origin fish from the Upper Mainstem (Fig. 4, open green triangles; ANOSIM, $R = 0.251$, $p = 0.052$); however, the sample size representing this group was small ($n = 3$), so the power to detect difference between these two groups, if it existed, was low.

The unique pattern of POPs in the Lower Mainstem natural-origin fish can be further illustrated by examination of POP fingerprints among the remaining five sampling groups, which were statistically indistinguishable from each other. For example, the POP fingerprints in natural-origin fish from the Upper Mainstem and the Distributary Channels were not different from each other ($R = 0.068$, $p = 0.195$) and nor were the hatchery-origin fish from the three regions different from each other (ANOSIM, R from 0.014 to 0.237, and $p = 0.103$–0.467 for all comparisons). Among these five sampling groups, natural-origin fish were only segregated from hatchery-origin fish in three of six comparisons (ANOSIM, R from 0.272 to 0.43, $p < 0.01$ for all comparisons; Table 4).

Among region and origin sample groups, the variation in congener patterns within the TPCB and $\sum_{11}$PBDEs POP classes was minor in comparison to the variation observed between the TPCBs and $\sum_{11}$PBDEs POP classes. The main PCB congeners contributing to the TPCB concentration in each region and origin sample groups (Table S3) were PCB 153 and 138, followed by 101, 118, and then 28 and 18, collectively accounting for 38–68% of the total concentration. The heavier congeners, 195, 206, and 209, were not detected in any samples and the remaining congeners, when detected, were at low concentration near the LOQ (Table S3). Although the TPCB concentrations were higher in fish collected from the Lower Mainstem compared to those from other regions, the pattern of detected concentrations of PCB congener homologues, was similar among region and origin sample groups (Fig. S1). The calculated values for $\sum_{11}$PBDEs were dominated primarily by contributions from BDE congeners 47 and 99, followed by 100 (Table S4), collectively accounting for 86–100% of the $\sum_{11}$PBDEs for individual fish samples. The BDE congeners 85, 155 and 183 were not detected in any salmon samples and the remaining congeners, when detected were at low concentrations near the LOQ (Table S4). Although natural-origin fish from the Lower Mainstem had higher $\sum_{11}$PBDE concentrations compared to other region and origin sample groups, the pattern of BDE congeners detected was similar among these groups (Fig. S2). Likewise, the DDT and DDT metabolites patterns did not vary among region and origin sample groups. The calculated $\sum_6$DDTs concentration was dominated by *p,p′*-DDE, which was detected in 100% of the samples (Table S5). The other DDT compounds were never detected (i.e., *o,p′*-DDE, *o,p′*-DDT) or infrequently (8–21%) detected at concentration near the LOQ (i.e., *o,p′*-DDD, *p,p′*-DDD, and *p,p′*-DDT) in all region and origin sample groups.

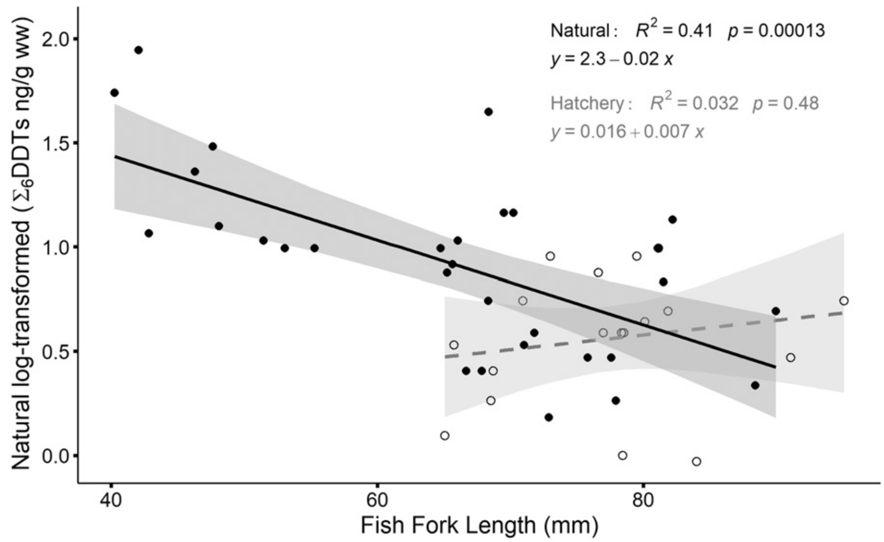

Fig. 3. Relationships between fish length and $\sum_6$DDTs for natural-origin (black solid line ± 95% CI shaded region) and hatchery-origin (dashed line ± 95% CI shaded region) fish. Actual data are plotted using solid filled symbols for natural-origin fish and open symbols for hatchery-origin.

3.3. Stable isotopes

The isotopic values $\delta^{34}S$ and $\delta^{13}C$ in Chinook salmon generally showed a similar pattern of enrichment from upper to downstream regions of the estuary, and more enrichment in hatchery- than natural-origin fish within each region (Two-Way ANOVA, Table 5; Fig. 5a). Overall, $\delta^{34}S$ values (Fig. 5a, vertical axis) in fish from the Distributary Channels (squares) were 2.1 times more enriched than those in the Upper Mainstem (upward triangles; $t = 10.278$, $p < 0.001$) and 1.2 times more enriched than those from the Lower Mainstem (downward triangles; $t = 4.314$, $p < 0.001$). Measured $\delta^{34}S$ in fish from the Lower Mainstem (downward triangles) were also 1.7 times more enriched than those from the Upper Mainstem (upper triangles; $t = 6.646$, $p < 0.001$). Overall, $\delta^{34}S$ was 1.1 times more enriched in hatchery- than natural-origin fish (open vs. closed symbols; $t = 2.561$, $p = 0.015$). A somewhat similar pattern of enrichment was measured for $\delta^{13}C$ in fish, although the differences were less pronounced from upstream to downstream (Fig. 5a, horizontal axis). Measured $\delta^{13}C$ in fish from the Distributary Channels (squares) were 1.1 times more enriched than those from the Upper Mainstem (upward triangles; $t = 4.509$, $p < 0.001$) and the Lower Mainstem (downward triangles; $t = 4.141$, $p < 0.001$), which did not differ from each other ($t = 1.043$, $p = 0.304$). Overall, $\delta^{13}C$ in hatchery-origin fish (open symbols) were 1.1 times greater than those of natural-origin (closed symbols; $t = 6.664$, $p < 0.001$).

The patterns of $\delta^{15}N$ in Chinook salmon (Fig. 5b, vertical axis) were more complex than those of $\delta^{34}S$ and $\delta^{13}C$, with depleted $\delta^{15}N$ values in natural-origin fish from the Lower Mainstem (solid downward triangles) compared to other sample groups (Two-Way ANOVA, Table 5). Apart from the natural-origin fish in the Lower Mainstem, as juvenile salmon moved from the Upper Mainstem to the more saltwater influenced region of the Lower Mainstem and the Distributary Channels, values of $\delta^{15}N$ and $\delta^{34}S$ were positively correlated and increasingly enriched (Fig. 5b). Natural-origin fish from the Distributary Channels (filled squares) were 1.2 times more enriched in $\delta^{15}N$ values compared to natural-origin fish from the Upper Mainstem (filled upward triangles; means = 10.8 and 9.3, $t = 3.624$, $p = 0.002$). Hatchery-origin fish (open symbols) had more similar $\delta^{15}N$ values among regions, but a slight enrichment (1.1 times) was also measured in the downstream

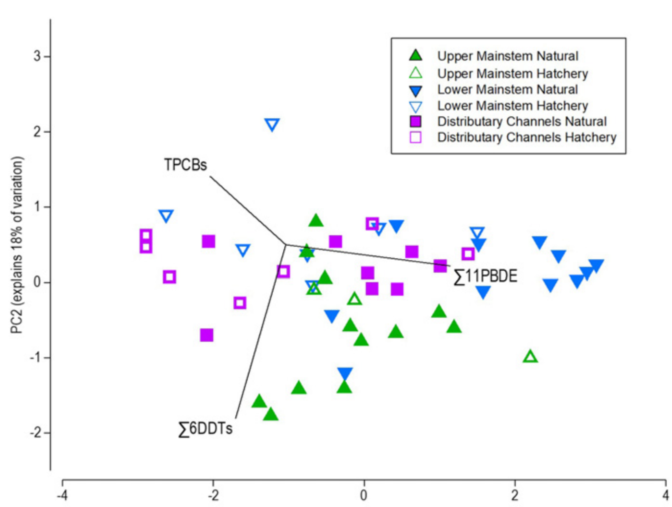

Fig. 4. Plot of the first two principal components (PC) based on the Principal Component Analysis (PCA) of proportions of $\sum_{11}$PBDEs, TPCBs and $\sum_6$DDTs measured in juvenile Chinook salmon collected from three regions of the Snohomish River estuary. Collectively, both PCAs explain 99.3% of the variation, with PC1 accounting for 81.3%, showing higher proportions of $\sum_{11}$PBDEs in natural-origin fish from the Lower Mainstem.

Table 4
ANOSIM statistical results for pairwise comparisons of the proportion of POP classes in juvenile Chinook salmon sampling groups. R varies between 0 and 1, although small negative values close to zero are possible. R values closer to 1 signify a higher degree of separation. Statistically significant differences are noted with an *. LM = Lower Mainstem region, UM = Upper Mainstem region, and DC = Distributary Channels region. Global R for test = 0.306 and p = 0.001.

Sampling group comparisons	R	p	
LM natural vs. DC hatchery	0.596	0.001	*
LM natural vs. LM hatchery	0.484	0.004	*
LM natural vs. UM natural	0.467	0.001	*
LM natural vs. DC natural	0.315	0.006	*
LM natural vs. UM hatchery	0.251	0.052	
UM natural vs. DC natural	0.068	0.195	
UM natural vs. DC hatchery	0.43	0.002	*
UM natural vs. LM hatchery	0.318	0.01	*
UM natural vs. UM hatchery	0.018	0.411	
DC natural vs. DC hatchery	0.272	0.033	*
DC natural vs. UM hatchery	0.127	0.258	
DC natural vs. LM hatchery	0.106	0.097	
UM hatchery vs. DC hatchery	0.237	0.103	
UM hatchery vs. LM hatchery	0.111	0.283	
DC hatchery vs. LM hatchery	−0.014	0.467	

Table 5
Results of a two-way ANOVA with sampling region (i.e. Region) and fish origin (i.e. Origin) as factors affecting stable isotopes of sulfur (δ34S), carbon ($\delta^{13}C$), and nitrogen (δ15N) measured in whole-body samples of juvenile Chinook salmon collected from the estuary of the Snohomish River.

Stable isotopes	Factor	d.f	Sum squared	Mean squared	F value	*p* value
$\delta^{34}S$	Region	2	187.39	93.695	52.863	<0.001
	Origin	1	11.623	11.623	6.558	0.015
	Region × Origin	2	0.403	0.202	0.114	0.893
	Residual	35	62.035	1.772		
	Total	40	315.047	7.876		
$\delta^{13}C$	Region	2	35.649	17.825	13.299	<0.001
	Origin	1	59.511	59.511	44.402	<0.001
	Region × Origin	2	1.89	0.945	0.705	0.501
	Residual	35	46.91	1.34		
	Total	40	172.28	4.307		
$\delta^{15}N$	Region	2	20.219	10.11	14.779	<0.001
	Origin	1	9.874	9.874	14.435	<0.001
	Region × Origin	2	7.132	3.566	5.213	0.01
	Residual	35	23.942	0.684		
	Total	40	71.463	1.787		

Distributary Channels region compared to those from the Upper Mainstem (means = 11.2 and 9.8, t = 2.456, p = 0.056). However, in stark contrast, $\delta^{15}N$ in natural-origin fish from the Lower Mainstem was significantly more depleted than would be predicted based on their $\delta^{34}S$ values (Fig. 5b). Mean $\delta^{15}N$ in natural-origin fish from the Lower Mainstem were only 90% of those in natural-origin fish from the Upper Mainstem (means =8.372 and 9.268, t = 2.284, p = 0.029). A comparison of natural- and hatchery–origin fish within regions also revealed $\delta^{15}N$ was only depleted in natural- compared to hatchery-origin fish in the Lower Mainstem (means = 8.372 and 10.595; t = 5.205, p < 0.001), however, significant differences were not observed from either the Upper Mainstem (t = 0.973, p = 0.337) or the Distributary Channels (t = 0.885, p = 0.382).

Nitrogen isotopic signatures of natural-origin fish from the Lower Mainstem were also negatively correlated with higher relative concentrations of $\sum_{11}$PBDEs (R^2 = 0.68, p = 0.003, slope = −0.74, intercept = 8.15). In natural-origin fish from the Lower Mainstem, the greater the depletion in nitrogen isotopic signature, the higher the proportion of $\sum_{11}$PBDEs (Fig. 6a; proportion of $\sum_{11}$PBDEs measured by PC1 in Fig. 4). The $\delta^{15}N$ values were also negatively correlated with absolute concentrations of $\sum_{11}$PBDEs (R^2 = 0.68, p = 0.003, slope = −8.93 and intercept =100.64) and TPCBs (R^2 = 0.63, p = 0.006, slope = −6.56 and intercept = 86.52), not shown for brevity. In contrast, for each of the other sampling groups, there was no relationship between $\delta^{15}N$ and PC1 (Fig. 6b) or $\sum_{11}$PBDEs, or TPCB (not shown for brevity). Furthermore, samples of natural-origin fish that were presumed to have spent the least amount of time in the Lower Mainstem, based on their lower $\delta^{34}S$, deviated most from the predicted relationship between PC1 score and $\delta^{14}N$ (Fig. S3, F = 27.0701, p = 0.0008, R^2 = 0.77).

4. Discussion

Our study demonstrated the value of three types of complementary chemical tracer data (POP concentrations, POP fingerprints, and stable isotopes), to assess location and source of contaminant exposure for juvenile Chinook salmon migrating seaward through a developed watershed with multiple contaminant sources. Using contaminant concentration data, we first assessed that along their migration pathway through Snohomish River estuary, salmon were exposed predominantly to PCBs and PBDEs in the Lower Mainstem region, with higher $\sum_{11}$PBDEs in natural- rather than hatchery-origin fish but similar TPCBs in both fish origins (Fig. 2). Second, we used POP fingerprints to determine that natural-origin fish captured from the Lower Mainstem had a distinct pattern from other region and origin samples, with a

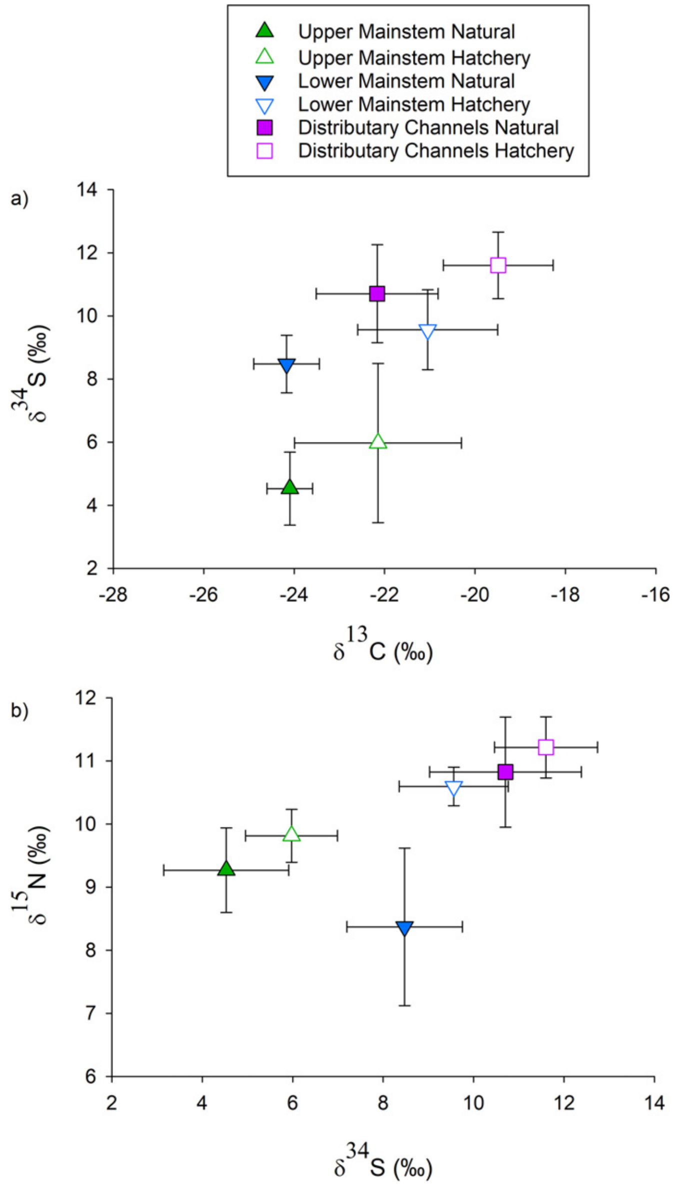

Fig. 5. Stable isotopes of a) sulfur ($\delta^{34}S$) and carbon ($\delta^{13}C$) and b) nitrogen ($\delta^{15}N$) and sulfur, measured in natural- and hatchery-origin juvenile Chinook salmon (mean ± 95% CI) collected from three regions of the Snohomish River estuary.

much higher proportion of $\sum_{11}$PBDEs in the total POP concentration, indicating a different contaminant source (Fig. 4). Third, we used stable isotopes, an independent tracer of food sources and habitat use, to document that natural-origin fish from the Lower Mainstem region had depleted $\delta^{15}N$ signatures compared to fish from the other region and origin groups (Fig. 5b). Moreover, the $\sum_{11}$PBDE-enhanced POP fingerprint in the natural-origin salmon from the Lower Mainstem was negatively correlated with the $\delta^{15}N$ in the salmon (Fig. 6), suggesting a common source for both the high PBDEs exposure and the depleted nitrogen isotopic signal.

4.1. POP concentrations

As hypothesized, POPs concentrations, and $\sum_{11}$PBDEs in particular, were greatest in salmon sampled from the Lower Mainstem, nearest a high volume wastewater outfall, suggesting a wastewater source. Natural-origin fish from the Lower Mainstem had $\sum_{11}$PBDE concentrations 4–10 times higher than salmon from other regions, regardless of origin, indicating the natural-origin fish were most exposed in this

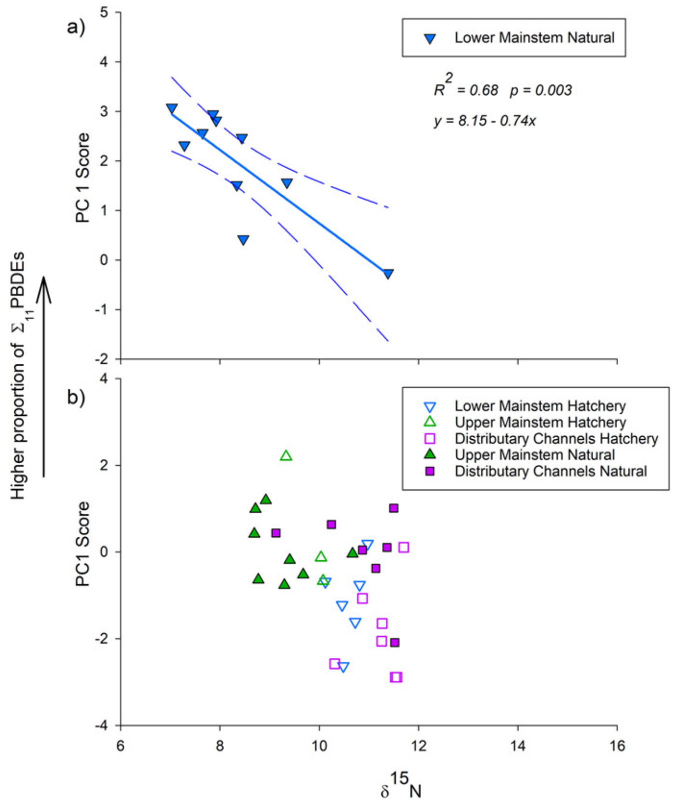

Fig. 6. Relationship between PC1 score and δ^{15}N showing a significant inverse relationship for a) natural-origin fish collected from the Lower Mainstem, but no relationship for b) each of the other region and origin sampling groups (i.e., $p > 0.05$) for each group.

region. Similar but less pronounced patterns were measured for TPCBs; concentrations in fish from the Lower Mainstem were approximately twice as high as those in fish from the less developed Distributary Channels and the Upper Mainstem, however, TPCBs did not differ by fish origins. Unlike $\sum_{11}$PBDEs and TPCBs, $\sum_6$DDT concentrations were uniformly low in all regions sampled.

The best-fit models for TPCB and $\sum_{11}$PBDE concentrations measured in juvenile salmon in this study support the conclusion that POP concentrations were determined primarily by the sampling region where the fish were captured (i.e., TPCBs) or the sampling region and the origin of the salmon (i.e., $\sum_{11}$PBDEs), rather than fish size or lipid content (Table S1). Although lipids can affect contaminant uptake (Elskus et al., 2005; West et al., 2017), the small range of lipid values measured in the juvenile Chinook salmon in this study likely dampened the importance of this factor. Likewise, fish length was only a factor for $\sum_6$DDT concentrations (Table S1), but this potential effect was obscured by the small range in fish sizes and differential size distributions between natural- and hatchery-origin fish. The inverse relationship between $\sum_6$DDT concentrations in the natural–origin salmon (Fig. 3), was consistent with previous studies documenting maternal transfer of DDTs to eggs and fry (Miller, 1994), and subsequent growth dilution. Given the limited size range of hatchery-origin fish collected, we cannot test for the presence of maternal transfer and growth dilution in these fish. POPs in maturing female Pacific salmon are transferred to the developing eggs (deBruyn et al., 2004; Ewald et al., 1998; Miller, 1993). Estimated $\sum_6$DDT concentrations in newly emerged Chinook salmon would range from 0.9 and 7 ng/g ww, based on a range of $\sum_6$DDT concentrations measured in muscle tissue of adult Chinook salmon (4.3–59 ng/g ww) returning to Puget Sound rivers (West et al., 2001) and correlations between POP concentrations in muscle and fry of Chinook salmon (Miller, 1994). Notably, the estimated maximum $\sum_6$DDT concentration encompassed the highest $\sum_6$DDT concentrations (i.e., 5.7–7.0 ng/g ww) we measured in small (≤42 mm) natural-origin fish, which are just a few mm larger than newly emerged Chinook salmon prior to exogenous feeding (Beacham and Murray, 1990), supporting the hypothesis that the elevated $\sum_6$DDTs in the smaller natural-origin fish we sampled were maternally derived. The lack of relationship between $\sum_6$DDT concentrations and fish length in hatchery-origin fish is likely due to the lack of availability of small fish (i.e. hatchery-origin fish are not released until they reach approximately 65 mm) and subsequent sampling of hatchery-origin fish after growth dilution occurred. Moreover, these observations suggest DDTs were not present in the Chinook salmon prey in this system in great enough quantities to overcome growth dilution.

The higher $\sum_{11}$PBDE concentrations in natural-origin fish from the Lower Mainstem compared to the natural-origin salmon from other regions, suggests a higher input of PBDEs into this region of the Snohomish River estuary. However, the higher $\sum_{11}$PBDE concentrations in natural-origin fish from the Lower Mainstem compared to the hatchery-origin fish from the same regions suggests fish of different origins were not equally exposed to the higher inputs of PBDEs. Natural-origin juvenile Chinook salmon were primarily exposed to and accumulated $\sum_{11}$PBDEs at two sites within the Lower Mainstem of the Snohomish River estuary, both located in the immediate vicinity of an Everett WPCF outfall and multiple CSOs. In contrast, hatchery-origin salmon from the same region accumulated lower $\sum_{11}$PBDE concentrations, likely because they moved through the estuary more rapidly than natural-origin fish (Levings et al., 1986; Rice et al., 2011) or they spent less time in the tidally influenced mesohaline area of the estuary (Davis et al., 2018) where wastewater was discharged. Davis et al. (2018) documented that seaward migrating juvenile Chinook from another river estuary in Puget Sound exhibited distinct habitat use patterns; natural-origin fish were more frequently captured in the tidally influenced freshwater and mesohaline habitats whereas hatchery-origin fish were more frequently captured in the nearshore intertidal habitat (Davis et al., 2018).

Concentrations of TPCBs were similarly elevated in natural- and hatchery-origin juvenile Chinook salmon, suggesting that although TPCBs inputs were greater in the more developed Lower Mainstem region of the estuary compared to other regions, the inputs were likely from more dispersed sources throughout the region, and not high enough to disproportionately elevate concentrations for natural-fish that likely resided in the area for a longer time.

Previous contaminant studies in juvenile Chinook salmon have also documented elevated levels of POPs in this species, especially those sampled from moderately to highly urbanized rivers and estuaries of Puget Sound (Johnson et al., 2007a; Meador et al., 2010; O'Neill et al., 2015; Olson et al., 2008; Sloan et al., 2010) and the lower Columbia River and Washington and Oregon coasts (Johnson et al., 2013; Johnson et al., 2007b; Sloan et al., 2010). The $\sum_{11}$PBDE concentrations we measured in natural-origin Chinook salmon in the Lower Mainstem were 2 to 24 times higher than concentrations in natural- and hatchery-origin fish from other Puget Sound estuaries and nearshore marine habitats (O'Neill et al., 2015; Sloan et al., 2010), but they were lower than the highest concentrations measured in samples collected from the Columbia River near areas with high inputs of wastewater (Sloan et al., 2010). Additionally, the Snohomish River estuary appears to be a consistent but possibly decreasing PBDE hotspot for seaward migrating juvenile Chinook salmon. Mean concentration of $\sum_{11}$PBDEs in the natural-origin Chinook salmon in the Lower Mainstem in this study (29 ng/g ww) were similar to those measured in natural-origin fish at the same location in 2013 (24 ng/g ww) but half (1100 vs. 2400 ng/g lipid weight) those measured in 2006 by Sloan et al. (2010), potentially indicating a decline in PBDEs as has been observed for other fish species in Puget Sound (West et al., 2017). Alternatively, the higher PBDE concentrations measured by Sloan et al. (2010) could be associated with differences in the mean fish length (100 vs. 66.9 mm) or sampling time (August vs April–July) compared to the present study. Concentrations of TPCBs in juvenile Chinook salmon from our study were similar to those measured in 2013 (30 vs. 27 ng/g ww) at the same sampling location in the Lower Mainstem (O'Neill et al., 2015). The TPCB concentrations we measured in salmon were higher than those measured at rural river and estuary sites in the Pacific Northwest (Johnson et al., 2013; Johnson et al., 2007a; Johnson et al., 2007b), but below those generally observed at heavily urbanized estuaries in Puget Sound (Johnson et al., 2007a; Meador et al., 2010; Olson et al., 2008) and the Columbia River (Johnson et al., 2013; Johnson et al., 2007b). In contrast to TPCBs and $\sum_{11}$PBDEs, the $\sum_{6}$DDT concentrations measured in juvenile Chinook salmon from the Snohomish River estuary were not elevated compared to other sites in Puget Sound in 2013 (O'Neill et al., 2015). Higher DDT concentrations were measured in juvenile Chinook salmon from the Columbia River basin from 2005 to 2009, approximately 8 to 12 times higher than those we measured in the Snohomish River, possibly associated with the high degree of agricultural activity in the interior Columbia River as well as Willamette basins and point sources within Portland Harbor (Johnson et al., 2013).

Concentrations of $\sum_{11}$PBDEs, and to a lesser extent TPCBs, we measured in juvenile Chinook salmon in the Snohomish River estuary were high enough to pose a conservation threat. Based on published laboratory exposure studies (Arkoosh et al., 2010, 2018; Meador et al., 2002), the concentrations of these POPs in some Chinook salmon were within ranges of adverse CBRs known to impair their health. Approximately 73% and 14% of the natural-origin Chinook sampled from the Lower Mainstem and the Distributary Channels, the two regions receiving wastewater effluent discharges, had concentrations of BDE congeners 47 and 99 (Table 3), the two congeners detected most frequently and at the highest concentrations, within the range of concentrations found to alter their immune response and increase disease susceptibility (Arkoosh et al., 2010, 2018). In contrast, none of the natural-origin Chinook salmon from the Upper Mainstem or hatchery-origin Chinook salmon from this study had $\sum$PBDE$_{47+99}$ levels high enough to predict altered immune response.

Impairment of immune response is of particular concern for salmonids because a properly functioning immune system is vital for both individual survival and population productivity (Segner et al., 2003). Seaward migrating salmonids are exposed to a number of naturally occurring pathogens and parasites, including the trematode *Nanophyetus salmincola* (Arkoosh et al., 2004). Exposure to PBDEs and other POPs may reduce the marine survival of juvenile salmonids due to immune suppression, thus increasing their susceptibility to naturally occurring infectious and parasitic diseases, causing direct mortality or indirect mortality via predation by larger fish, birds and mammals. For example, Hostetter et al. (2011) reported steelhead (*O. mykiss*) smolts that tested positive for pathogens were more likely to have poor external condition (i.e., external signs of disease or more scale loss). Moreover, tagged fish with poor external condition were subsequently observed to have lower overall marine survival (Hostetter et al., 2011), associated with increased avian predation (Hostetter et al., 2012). In addition to directly impairing the immune function of salmonids, exposure to POPs has been documented to work in conjunction with naturally occurring parasites (i.e., trematode exposure) further increasing their susceptibility to a naturally occurring marine bacterial pathogen (Jacobson et al., 2003), potentially leading to population level effects (Arkoosh et al., 1998; Loge et al., 2005; Meador, 2014; Spromberg and Meador, 2005). Chen et al. (2018) suggested the exposure to POPs and *N. salmincola* serve as mortality cofactors for juvenile steelhead from Puget Sound, with the proximate cause of death involving bacterial pathogens or selective predation of infected cohorts.

Based on lipid normalized TPCB concentrations (ng/g lw) measured in salmon from the Upper Mainstem, Lower Mainstem and Distributary Channels, 0%, 27%, and 29%, respectively of the natural–origin fish and 0%, 14% and 0%, respectively of the hatchery-origin fish, had concentrations above an adverse CBR threshold for total PCBs (Meador et al., 2002). Published CBR thresholds based on individual congeners were not available for salmon. These lipid normalized values likely underestimate the number of impaired fish because juvenile salmon rapidly metabolize lipids as they migrate downstream, typically achieving lipid concentrations of 1% or less by the time they move from the estuary to marine waters (Arkoosh et al., 2011; O'Neill et al., 2015). For example, modeling a 1% lipid content for the natural–origin fish from the Lower Mainstem to predict their increased risk after lipids have been metabolized, would increase the number of fish above the PCB CBR from 27% to 64% for natural-origin fish and 14% to 29% for hatchery-origin fish, potentially increasing the likelihood of reducing their marine survival. Indeed, Meador (2014) documented that hatchery Chinook salmon originating from Puget Sound rivers with contaminated estuaries, including the Snohomish River, have lower marine survival than those originating from uncontaminated rivers.

4.2. POP fingerprints

Analyses of POP fingerprints in salmon from the three regions support the hypothesis that salmon in the Lower Mainstem are exposed to a contaminant source influenced primarily by wastewater rather than stormwater. Except for the hatchery fish from the Upper Mainstem, natural-origin Chinook salmon from the Lower Mainstem had distinct POP fingerprints from all other sampling groups (Fig. 4, Table 4), with high relative concentrations of $\sum_{11}$PBDEs. The POP fingerprints in natural-origin fish from the Lower Mainstem overlapped with those of hatchery-origin fish from the Upper Mainstem ($R = 0.251$) and the p value was 0.052, suggesting that the difference between these groups may not be statistically significant. However, the small sample size ($n = 3$) representing the hatchery-origin fish from the Upper Mainstem, limited our ability to adequately evaluate a significant difference between these groups should one exist. Although POPs can enter the Snohomish River estuary via various sources such as WWTPs, stormwater, or atmospheric deposition, wastewater is considered to be the primary source for PBDEs in Puget Sound, whereas stormwater is the greater source for PCBs (Osterberg and Pelletier, 2015). Modeled loading of contaminants to Puget Sound indicated that most PBDEs enter Puget Sound via publically owned WWTPs, followed by stormwater related surface runoff, and then atmospheric deposition (9.91, 4.56, and 3.49 kg/year, respectively) (Osterberg and Pelletier, 2015). In contrast, Osterberg and Pelletier (2015) concluded that most PCBs enter Puget Sound via stormwater surface runoff (4.17 kg/yr), with considerably less entering via publically owned WWTPs and atmospheric deposition (0.32 and 0.43 kg/yr). In the year we conducted our study, the Lower Mainstem received wastewater DIN loads 1.5 times higher than those in the Distributary Channels (Table 1), and the Upper Mainstem region did not receive direct input of wastewater effluent. Although we do not have estimates of stormwater loads to the three regions of the Snohomish River estuary sampled by our study, loadings from surface runoff are likely highest in the Lower Mainstem region, based on the high percentage (41–94%) of impervious surface area in the lands adjacent to this region of the river (Fig. 1), potentially contributing to the higher concentrations of TPCBs in both natural-and hatchery-origin fish from this location. However, stormwater loadings to the Snohomish River are likely lower than those of more urbanized rivers because measured PCBs in juvenile Chinook from the Snohomish are much less than those measured in other more urbanized estuaries in the Puget Sound (Johnson et al., 2007a; Meador et al., 2010; O'Neill et al., 2015; Olson et al., 2008) and the Columbia River (Johnson et al., 2013; Johnson et al., 2007a; Johnson et al., 2007b).

Contaminant fingerprints are well established chemical tracers for providing information about the sources of POPs and movement patterns of migratory animals (Ramos and González-Solís, 2012), but typically over a broader geographic areas than evaluated in this study. For example, Krahn et al. (2007) used ratios of PCBs and DDTs acquired by migratory killer whales, to discriminate differences in feeding areas and contaminant sources for three pods of whales that forage along the west coast of North America. In contrast, we used variation in POP fingerprints in juvenile salmon sampled over <30 rkm to identify a PBDE contaminant-source, indicating the robustness of POPs fingerprint at discriminating contaminant sources along a contaminant gradient.

4.3. Stable isotopes

Isotopic signatures of salmon, especially $\delta^{15}N$, from three regions of the Snohomish estuary (Fig. 5) also support the hypothesis that natural-origin salmon from the Lower Mainstem region were exposed primarily to a wastewater source rather than a stormwater contaminant source. Stable isotopic signatures of nitrogen in biota are tools to assess assimilation of wastewater-derived sources of nitrogen into aquatic food webs (deBruyn and Rasmussen, 2002; Savage, 2005). In addition to the ambient nitrogen load in the river, nitrogen in wastewater is incorporated into aquatic food webs though the uptake of sewage-derived nutrients by primary producers or consumption of particulate-organic matter by primary consumers (Tucker et al., 1999), and then subsequently transferred through the food web (McClelland et al., 1997; Vander Zanden et al., 2005). Incorporation of wastewater-derived nitrogen sources into the food web, beyond the background river nitrogen, causes shifts in nitrogen stable isotopes in aquatic organisms when compared to background or reference values in both freshwater (deBruyn and Rasmussen, 2002; Hicks et al., 2017; Loomer et al., 2015; Steffy and Kilham, 2004) and marine systems (Savage, 2005; Schlacher et al., 2005; Tucker et al., 1999). However, the extent to which biota exposed to wastewater have altered $\delta^{15}N$ values depends on the treatment processes used at the plant, effluent quality (e.g., concentration and load of ammonia/ammonium), and the characteristics of the receiving waters (Hicks et al., 2017).

Depleted $\delta^{15}N$ in natural-origin fish from the Lower Mainstem suggests they were exposed to sewage characterized by relatively high nutrient concentrations. In contrast, the $\delta^{15}N$ in the hatchery-origin fish from this region was not depleted, suggesting they were less exposed to nutrient rich wastewater effluent. Complex treatment processes determine the amount of nutrient removal, and whether dissolved inorganic nitrogen in effluent is discharged as ammonia/ammonium, nitrite or nitrate (Metcalfe et al., 2003). WWTPs designed to optimize removal of nutrients from wastewater typically use nitrification (conversion of ammonia to nitrate) followed by de-nitrification (conversion of nitrate to nitrogen gas) processes to remove nitrogen. In contrast, WWTPs designed without specific nutrient removal, discharge effluent with more ammonium than nitrates (Hicks et al., 2017; Loomer et al., 2015). Furthermore, nitrification, denitrification, as well as volatilization of wastewater, can alter the concentration and the nitrogen isotopic signature of the pools of ammonia/ammonium and nitrate/nitrite they act upon (Heaton, 1986; Valiela et al., 2000), as well as the resulting effluent released to the aquatic systems (Toyoda et al., 2011). Overall, biota exposed to untreated and primary treated sewage, or secondary sewage with insufficient nutrient removal, typically exhibit a depleted $\delta^{15}N$ signal (deBruyn and Rasmussen, 2002; Hicks et al., 2017; Loomer et al., 2015), as we observed in natural-origin Chinook salmon from the Lower Mainstem. Indeed, the form of DIN discharged by the Everett's WPCF is atypical compared to other Puget Sound wastewater facilities that discharge into rivers and nearshore marine receiving waters, with a higher proportion of ammonium compared to nitrates and nitrites (Table 1). Conversely, biota exposed to secondary and tertiary sewage treatment that removes excess nitrogen with nitrifying and denitrifying bacteria typically have an enriched $\delta^{15}N$ signal compared to background values (Heaton, 1986; Savage, 2005; Valiela et al., 2000).

In contrast to nitrogen isotopes, carbon and sulfur stable isotopes were enriched in salmon as they moved downstream (see Fig. 5a), consistent with the frequency and amount of saltwater intrusion into the downstream regions of the Snohomish River (Hall et al., 2018) and a gradual shift to downstream food sources, as noted in salmon from other rivers (Moore et al., 2016). Sulfur and carbon isotopes provide information regarding food sources for consumers, with marine food webs typically more enriched in $\delta^{34}S$ and $\delta^{13}C$ than freshwater systems (Peterson and Fry, 1987), and thus reveal the prey base and movements of animals (Hobson, 1999). Based on Hall et al. (2018), there is a continuum from freshwater in the Upper Mainstem region to more saline waters in both the Lower Mainstem and Distributary Channels regions. The higher $\delta^{34}S$ and $\delta^{13}C$ we measured in salmon in these downstream regions, reflects this salinity gradient and the salmons' changing food supply that is incorporated into their tissues as they migrate downstream. Similarly, Moore et al. (2016) documented that natural-origin juvenile Chinook salmon from the relatively undeveloped watershed of the Skeena River in British Columbia, Canada, became enriched in both $\delta^{13}C$ and $\delta^{34}S$ as they migrated from the headwaters of the river to nearshore marine waters. The slight enrichment of $\delta^{34}S$ and $\delta^{13}C$ in hatchery-origin fish, compared to natural-origin fish from the same region, may be due to the residual influence of the diet of hatchery fish, prior to release from the hatchery (Weber et al., 2002). In the hatchery, fish are fed commercial diets dominated by protein from marine sources enriched in $\delta^{34}S$, whereas, natural-origin fish consume freshwater prey with more depleted $\delta^{34}S$, and the muscle tissue of fish reflect these sources (Weber et al., 2002). However, tissue differences in $\delta^{34}S$ between hatchery- and natural-origin fish will rapidly be masked by the freshwater diet consumed by hatchery-origin fish after they leave the hatchery, given the rapid turnover rates of liver and muscle tissue of juvenile salmonids (Heady and Moore, 2013).

4.4. Complementary chemical tracers

We used multiple, complementary chemical tracers to infer nutrient and contaminant sources to seaward migrating juvenile salmon, more discernable information than either tracer provided individually. Collectively, the isotope tracers and POP fingerprints indicated that natural-origin salmon were exposed to and assimilated both nitrogen and POPs from wastewater in the Lower Mainstem. The $\sum_{11}$PBDE enhanced POP fingerprints in natural-origin fish from the Lower Mainstem were inversely correlated with their $\delta^{15}N$ (Fig. 6), suggesting similar sources for both; the more fish were exposed to the ammonia/ammonium rich effluent, the more depleted they were in $\delta^{15}N$ and the greater their relative $\sum_{11}$PBDE concentrations. Concentrations of $\sum_{11}$PBDEs and TPCBs were also each negatively correlated with $\delta^{15}N$ in salmon. However, the slope of these relationships were steeper for $\sum_{11}$PBDEs (8.93 vs. 6.55), supporting our previous conclusion that the wastewater the fish were exposed to had a greater load of PBDEs than PCBs. Additionally, based on their $\delta^{34}S$, the natural-origin fish that had spent the least amount of time in the Lower Mainstem where the wastewater discharged, deviated most from the predicted relationship between PC1 score and $\delta^{15}N$ (Fig. S3), further supporting our conclusion that fish were exposed to and accumulated PBDEs from a wastewater source in the Lower Mainstem.

These results highlight the role of wastewater as a vector of toxic contaminants to aquatic consumers, as demonstrated previously (Meador et al., 2016; Spies et al., 1989), and raises additional concerns about juvenile salmon exposure to other contaminants in wastewater not evaluated in this study. Effluent from WWTPs are major sources of industrial chemicals (Servos, 1999), pharmaceutical and personal care products, (PPCPs) (Metcalfe et al., 2010), and natural and synthetic hormones (Ternes et al., 1999). Adverse effects observed in aquatic biota exposed to wastewater include endocrine disruption in individuals (Tyler and Jobling, 2008; Vajda et al., 2011), and alterations in species communities (Tetreault et al., 2013). Most pertinent to our study, Chinook salmon collected from wastewater impacted sites had modeled fish plasma concentrations for a variety of PPCPs in the range expected to produce adverse effects in fish (Meador et al. 2017); mitochondrial dysfunction, which is adverse for growing juvenile fish (Yeh et al., 2017); and altered blood chemistry parameters, a potential early indicator of metabolic disruption (Meador et al., 2018).

5. Conclusions

Our study demonstrated the utility of multiple chemical tracers to document the spatial extent, magnitude, and source of contaminant exposure in juvenile Chinook salmon, information necessary to formulate appropriate conservation measures to reduce or remediate contaminant exposure. Three types of complementary chemical tracer data, POP concentrations, POP fingerprints, and stable isotopes, allowed us to 1) identify where in their migration pathway threatened Chinook salmon were exposed to and accumulated PBDEs (and to a lesser extent PCBs), at concentrations high enough to impair their health, and 2) reveal that wastewater discharging into the river was the likely source of these POPs. These results highlight the importance of understanding the role that wastewater may play as a vector of toxic contaminants to aquatic consumers.

Data from this study can be used to guide and prioritize management actions to reduce threats from wastewater and other habitat stressors to juvenile salmon migrating through the Snohomish River estuary to Puget Sound. Specifically, identifying the region within the Snohomish watershed where salmon are most exposed to PBDEs, as well as the source (i.e., wastewater or stormwater), allows environmental managers to establish corrective actions to control PBDE inputs. Ultimately, reductions in PBDE exposure should improve Chinook salmon health and enhance their marine survival. The Snohomish River is the second largest contributor of Chinook salmon to the Puget Sound evolutionarily significant unit (Jonathan Carey, National Marine Fisheries Service, Personal communication); consequently, reductions in salmon survival due to wastewater-contaminant exposure could affect the recovery of the ESA-listed Chinook salmon from Puget Sound. Furthermore, exposure to contaminants in wastewater may thwart substantial habitat remediation efforts underway throughout the US Pacific Northwest to improve survival of natural-origin salmon. For example, between 2005 and 2017 approximately $ 90,000,000 US has been spent to improve the freshwater, estuarine and nearshore marine rearing habitat for natural-origin Chinook salmon originating from the Snohomish River (Snohomish Basin Salmon Recovery Forum, 2019), with the ultimate goal of improving their overall survival. The efficacy of this effort could be reduced if juvenile salmon have increased susceptibility to disease because of exposure to wastewater-derived contaminants. More broadly, Chinook and other salmon species are at risk in much of the southern part of their North American range (Gustafson et al., 2007), where interactions with many anthropogenic factors affect them, including contaminants (Lundin et al., 2019; Meador, 2014).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary Material

Supplementary material to this article can be found online at https://doi.org/10.1016/j.scitotenv.2019.135516.

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EVERETT
WASHINGTON

January 30, 2024

Tonya Lane
Municipal Facility Manager
Washington State Department of Ecology
P.O. Box 330316
Shoreline, WA 98133-9716

RE: City of Everett draft permit public comments

Dear Ms. Lane

Comment No. 1 – Condition S9.C.3.b Post Construction Monitoring Plan

The City of Everett requests that the CSO outfalls PSO1, 2, 3, 4, 5, 6, and 7 be excluded from the requirement for water quality and sediment data under a Post Construction Monitoring Plan (PCMP). In accordance with section S9.C.3 Everett will update the PCMP to specify that Port Gardner is designated as a Primary Contact Recreation as required. After the Port Gardner Storage Facility (PGSF) is constructed the PCMP will be updated to address all Everett CSO outfalls. Computer modeling of wastewater flows in Everett's sewer system after the (PGSF) is constructed indicates that PSO1, 2, 3, 5, 6, and 7 would not have had any CSO events in the last 34 years based on the recorded rainfall record over that time period. PSO1, 2, 3, 5, 6, and 7 are all near shore CSO outfalls, whereas PSO4 will be a deep-water outfall after the PGSF project also known as Outfall 100. One primary goal of the PGSF project was to significantly reduce near shore CSO discharges. Over this 34-year period the model predicts only one CSO event, and this would have discharged out of PS04 at Outfall 100. Outfall 100 discharges at a depth of over 350 feet and 1,300 feet from the shoreline. The outfall has a modern diffuser that achieves a dilution factor of 156 at the edge of the acute mixing zone (a distance of 55 feet from the diffuser ports) and achieves a dilution factor of 696 at the edge of the chronic mixing zone (a distance of 550 feet) as detailed in the NPDES Permit Fact Sheet. Since modeling indicates CSO events at each of the near shore CSO outfalls are expected to have less than a 3% chance of occurring in any one year based on the last 34 years of rainfall data, we believe real-time level monitoring of frequency and duration of PSO1, 2, 3, 5, 6, and 7 is sufficient to satisfy the requirements of the presumption approach and therefore water quality monitoring is not needed to demonstrate compliance with numeric water quality standards. Further, due to the physical location of PS04 (Outfall 100), and the mixing and dilution factor at this outfall, we believe real-time level monitoring of frequency and duration of CSOs at this outfall is sufficient to satisfy the requirements of the presumption approach and therefore water quality monitoring is not needed to demonstrate compliance with numeric water quality standards as well.

PUBLIC WORKS
Category 2: Sensitive information
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Comment No. 2 – Condition S9.3

The reference to section “IV.F” in the fact sheet appears to be incorrect. The correct reference appears to be section V.F in the fact sheet.

Comment No. 3 – Condition S9.E

Condition S9.E sets forth a compliance schedule to complete elements of the *2020 CSO Control Plan Update.* The City of Everett requests that the language in this condition be consistent with Section IV in the 2015 Agreed Order, Docket No. 11638, between Ecology and the city by allowing for amendments to the projects submitted by the city and approved by Ecology. There should be some flexibility as contemplated under the Agreed Order to modify the specific projects in the plan with Ecology approval as long as the deadline for compliance remains the same. The City of Everett proposes that Ecology incorporate the language from the Agreed Order in lieu of the text and table in condition S9.E:

> In order to meet the requirements of WAC 173-245-020(22), Everett shall complete construction of CSO reduction projects identified in the *2020 CSO Control Plan Update* or future amendments submitted by Everett and approved by Ecology to reduce CSOs from the remaining 10 uncontrolled CSO basins down to an average of no more than one overflow per outfall per year by December 31, 2027. Future CSO Reduction Plan Amendments may not result in a compliance date later than December 31, 2027.

Comment No. 4 – Condition S1.A

The City of Everett is requesting Ecology reevaluate the pH limits proposed for outfall 015. Ecology’s calculation spreadsheet used for outfall 015 pH limits that assumes little dilution under static conditions is unnecessarily restrictive for compliance with a pH of 7.0 at the mixing zone boundary. A probabilistic analysis of available dilution combining effluent discharged in Outfall 015 and Snohomish River flows supports a lower pH effluent limitation of 6.4, and perhaps as low as 6.0, while maintaining the water quality standard in the river of pH 7.0

Comment No. 5 – Condition S6.E

Per section S6.E the City will be required to update or revise the IU inventory to include industry categories known or suspected to discharge PBDEs. The City requests that industrial sampling not be included in the required survey efforts. PBDEs are primarily a legacy contaminant and therefore should not be actively used in industrial processes. The principal manufacture and use of the final remaining PBDE, DecaBDE, was phased out by December 31, 2013. While it still remains in some uses as a flame retardant, the SNUR and TSCA rules regulating its usage are a better mechanism for tracing its presence than sampling industrial discharges. In addition, the current analytical methods for PBDEs are very expensive; therefore, the IUs will bear the cost which would have a negative fiscal impact on the community. If through survey efforts an IU is identified that is actively using PBDEs in their process, then the City may sample the IU in order to determine their PBDE contribution.

Sincerely,

Derek Kerlee
Wastewater Quality Process Analyst
Everett Water Pollution Control Facility

cc: Jeff Marrs, Operations Superintendent
John Smit, WPCF Plant Manager
Chris Merwede, Everett Environmental Lab Manager
Eddie Jones, WPCF Senior Operator
Joe Ferguson, Wastewater Quality Process Analyst
Chron file

Snohomish Basin Salmon Recovery Technical Committee

Please see attached official comment letter from the Snohomish Basin Salmon Recovery Technical Committee.

Thanks you,
Have a nice day.

Snohomish Basin Salmon Recovery Technical Committee

To: Washington State Department of Ecology

Re: City of Everett Water Pollution Control Facility NPDES Permit Renewal, and PBDE's in the Snohomish River Estuary as related to Chinook Salmon in the Snohomish River and greater Puget Sound.

To Whom It May Concern,

Thank you for the opportunity to comment on the City of Everett Water Pollution Control Facility NPDES permit renewal application for Permit # WA0024494.

We are writing on behalf of the Snohomish Basin Salmon Recovery Technical Committee (SBSRTC). For over 20 years, we have worked to provide scientific support for protection and enhancement of the abundance, productivity, diversity, and spatial structure of all salmonid populations in the Snohomish River Basin. The Committee is an independent, self-guiding, and self-directing body that works in parallel with, and in support of, the Snohomish Basin Salmon Recovery Forum and the Snohomish Basin Lead Entity. We are made up of member organizations including Tribes, Federal and State agencies, cities, counties, and NGOs.

Recent scientific research studies led by State agencies and Snohomish Basin partners have illuminated contaminants of emerging concern (CECs) including Polybrominated Diphenyl Ethers (PBDEs) and their potential for toxicity to Chinook salmon and other native species in the environment. Chinook salmon are a keystone species in Puget Sound and a healthy population is critical to maintaining tribal treaty rights and as a food source for many species, including critically endangered Southern Resident Killer Whales. Findings from research conducted under the Salish Sea Marine Survival Project published in 2021 by Long Live the Kings[1] and supported by an array of member organizations suggest that, "evidence indicates that local factors contribute significantly to salmon health and survival in specific populations including toxic contaminants near urban areas," and that "contaminants are limiting the recovery of many Chinook populations, especially those that come from urbanized watersheds in Central and South Puget Sound." The findings go on to describe that "juvenile Chinook in the Snohomish River estuary…were found with very high levels of PBDEs, well above thresholds that cause adverse effects" and that reducing toxic contamination in locations that have the greatest impact, like the Snohomish estuary PBDE hotspot, is amongst the highest priority management actions that can be taken to support salmon survival.

First and foremost, we would like to recognize and commend the actions taken to date by the City of Everett (COE) and the Water Pollution Control Facility. COE has demonstrated a strong commitment to better understanding and evaluating the risks of PBDEs in wastewater and has acted in making expeditious efforts to minimize these risks utilizing currently available programs and infrastructure. We applaud these recent efforts and support a continued proactive approach by COE and the Pollution Control Facility as we learn more about the emergence of PBDEs as a CEC.

Despite these most recent efforts, there is more that can be done to better understand and ameliorate the prevalence of these CECs in Snohomish River water, inhabiting species, sediments, and biosolids. We support calls from member organizations including basin Tribes, Long Live the Kings, and others, for specific monitoring and mitigation actions that would protect salmon in the Snohomish Estuary. We believe that through an increased monitoring effort we may be able to better understand the nature and extent of this issue. This should include increases in the geographic extent of monitoring locations; the frequency in which this monitoring is occurring; and the matrices sampled for these CECs to include influent, effluent, both deepwater and Snohomish River outfalls, retention pond sediments and associated biosolids. This monitoring then may inform the most effective best management practices (BMPs) and corrective measures. Based on the results of this expanded monitoring and future research, we ask for efforts towards increased mitigation and remediation of these chemical compounds, as well as source control identification and correction, as provisions of this permit.

In summary, PBDEs present many threats to salmon and the environment as a CEC. Amongst these challenges, we recognize the unique circumstances in which these expanded permit revisions may impact COE, its ratepayers, and the WWTP facility infrastructure. Further, we understand and appreciate the responsibility of COE to consider the needs of its ratepayers a paramount consideration. We commend and fully support efforts by COE to date to assist in evaluating and controlling the prevalence of this CEC in the environment. The committee supports assertions by basin Tribes and member agencies calling for expanded monitoring, source control, and remediation as provisions of this permit to support furtherance of baseline understandings of the nature and extent of this CEC and its impacts on the natural environment. Expanded monitoring may lead to enhanced source identification and control, and ultimately, remediation of these chemical substances from our wastewaters and ultimately our natural environment. Continued research and remediation efforts identified in this permit may aid in establishing BMPs to be replicated elsewhere, setting the standard in this field. We support permit considerations and provision of resources to avoid inequitably concentrating negative impacts of source control and remediation efforts on small businesses and underserved communities, as well as exploring ways to equitably distribute any impacts on ratepayers, such as progressive rate structures. We recognize and appreciate the efforts that have been made on these fronts to date, and we look forward to seeing continued support and engagement from the COE and the WWTP into the future.

Sincerely,

Stuart Baker Senior Habitat Specialist, Snohomish County	Norah Kates WRIA 7 Technical Coordinator, King County	Matt Pouley Restoration Biologist, Tulalip Tribes

[1] Findings of the Salish Sea Marine Survival Project. 2021. Long Live the Kings. Available at: https://marinesurvivalproject.com/research-findings/

Tricia Miller, Permit Coordinator.
Washington State Department of Ecology, Northwest Regional Office
PO Box 330316
Shoreline, WA 98133-9716

January 29, 2024

RE: City of Everett Water Pollution Control Facility (NPDES Permit No. WA0024490) Public Comment

Dear Tricia Miller,

We are writing to request that the Department of Ecology (Ecology) take strong action to protect juvenile Chinook salmon from polybrominated diphenyl ethers (PBDEs) in wastewater effluent discharged near the Snohomish Estuary. PBDEs are a class of flame retardant that have been largely banned but are still discharged into our waterways by public water treatment facilities, along with other sources. Chinook salmon are listed as Threatened under the federal Endangered Species Act (ESA), are critical to satisfy Tribal Treaty rights, and are an essential food source for southern resident orca. Millions of dollars and years of effort have been invested to restore habitat in the Snohomish Estuary and ongoing pollution jeopardizes these investments.

In 2014, Long Live the Kings and Canada's Pacific Salmon Foundation launched the Salish Sea Marine Survival Project, an international research effort leading 60 organizations to understand why salmon are dying during their migration through Puget Sound, Strait of Georgia, and Strait of Juan de Fuca. The research, among other things, highlighted the lack of estuary habitat and high levels of contaminants in fish as factors compromising some Chinook populations. The initial and subsequent research from Washington Department of Fish and Wildlife (WDFW) indicated that PBDEs were appearing in harmful levels in juvenile Chinook in these estuarian environments and that wastewater was a likely pathway. PBDEs' harmful impact to juvenile Chinook likely contributes to their mortality. Unintentionally harming an ESA-listed species is an Incidental Take and may not be permissible.

The City of Everett (COE) has been highly responsive and cooperative, and they have demonstrated their dedication to protecting salmon through transparency and voluntary action. The Department of Ecology has also responded quickly and investigated the issue in more depth. Research from these parties has confirmed a PBDE "hotspot" near the City of Everett's "015 outfall" in the Snohomish estuary and that PBDEs are originating from COE's wastewater users and are subsequently being discharged into public waters by COE's Water Pollution Control Facility treated effluent.

The National Pollutant Discharge Elimination System (NPDES) Permit for COE's Water Pollution Control Facility is a critical tool to empower COE to protect the environment while still maintaining their fiduciary responsibility to ratepayers. We are happy to see that PBDEs are included as a consideration in the draft permit, but we urge the permit to be strengthened in the following ways.

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Ensure a robust pretreatment program through specific requirements. Currently the draft permit looks to the highly capable COE Water Pollution Control Facility team to define a pretreatment program for PBDEs, but the COE team has conflicting objectives which may be at odds with a robust pretreatment program – COE's fiduciary responsibly to the ratepayers. Permit mandates for a rigorous pretreatment program will focus COE on finding the most equitable and effective ways to protect the environment and will avoid putting the city in the position to choose between the protection of listed species or ratepayers. A rigorous pretreatment program would include the following elements:

- PBDE tests of each industrial users at least quarterly in the first year of permit issuance to assess baseline PBDE conditions. Complete subsequent quarterly PBDE testing of each industrial user with baseline testing results above background PBDE levels to assess the effectiveness of PBDE removal efforts.
- Ecology to evaluate all known, available, and reasonable methods of prevention, control, and treatment to address PBDE pollution.
- Require pollution reduction plans for industrial users with baseline testing results above background PBDE levels. Set timelines for reduction plans and measurable goals for PBDE reduction. Revisit plans at least annually to adaptively manage a strong response to PBDE reduction and approved by Ecology.
- Publish test results and specific sample sources to the public in a timely manner.

Use COE's Water Pollution Control Facility to minimize PDBE discharge during the Chinook outmigration period (February-July with the peak in April and May). The draft permit follows conventional theory for pollution control – eliminate the source. However, PBDE pathways are characterized as distributed and numerous and the draft permit's focus on an industrial pretreatment as the action to protect Threatened Chinook is not consistent with how PBDEs are understood to enter the wastewater system. These additional actions could make the permit measures to reduce the pollutant more consistent with known pathways:

- Formalize COE voluntary actions to minimize discharge from the Snohomish Estuary outfall during February-July and redirect to the Port Gardner outfall. To monitor this strategy, assess PBDEs near the Port Gardner outfall by sampling water, juvenile Chinook, biofilm, and Chinook prey. Discontinue redirecting effluent to Port Gardner if monitoring indicates that discharging at Port Gardner is similarly harmful to Chinook as compared to discharging in the estuary.
- Test sediment in the lagoons for PBDE contamination that may be contributing to PBDEs in wastewater effluent. Remove contaminated sediment if it appears to be substantially above background levels in comparable sediment.
- Test influent and effluent for PBDEs on a quarterly basis throughout the whole permit cycle. Test treatment systems (lagoon and trickling filter) and both outfalls separately.
- Set PBDE reduction goals through a pollution reduction plan that is updated annually and approved by Ecology.
- Test biosolids for PBDEs and inform biosolid users of the results.
- Publish test results and specific sample sources to the public in a timely manner.
- Use sampling methods that can establish PBDE removal efficiency so facility performance can be compared to other facilities.

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Assess progress using ongoing Chinook sampling and analysis from WDFW and other descriptive measurements. The permit factsheet implies that PBDE contamination in juvenile salmon is the impetus for the PBDE influent monitoring and pretreatment program. WDFW's T-Bios team plans to continue monitoring juvenile Chinook for PBDEs during the permit period. Data from this research should be used as a gauge to assess the effectiveness of changes intended to reduce PBDE pollution. Additional measures of progress could include percent reduction of total PBDEs and reduction in total suspended solids.

Evaluate long-term capital improvements to reduce the impact multiple waste streams. PBDEs are not the only pollutant highlighted in the draft permit (PFAS and nutrients) and it is likely that the facility will face problems will other contaminates of emerging concern in the future. More advanced treatment options exist to better address multiple waste streams, including PBDEs. Ecology should support COE in completing an assessment over the 5-year permit period concerning the cost and benefits of other, more advanced treatment technologies and creating a plan to implement more advance treatment.

Minimize costs associated with PBDE pollution being shouldered by the least able to pay. Actions to protect the environment have associated expenses that will most likely be passed onto the ratepayers. These rate increases can disproportionally impact lower-income users. This reality is compounded when in many cases this user segment contributes relatively less pollution. We would encourage COE, with Ecology's support, to pursue rate structures that are adjusted to address this circumstance and grant programs that may offset these expenses to users or directly to the facility. A pretreatment program that holds individual industrial users accountable for PBDE pollution will also help minimize these costs from being externalized to other users.

Lastly, we understand that the NPDES permit is not the only tool to prevent PBDE pollution. There is much more that can be done throughout levels of government, businesses, and the community. Long Live the Kings looks forward to working with all parties to pursue positive outcomes for salmon.

Sincerely,

Jacques White
Chief Executive Officer

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Orca Network

Thank you for the opportunity to comment on the City of Everett Water Pollution Control Facility draft permit. Please see attached comments.

Connecting Whales and People
in the Pacific Northwest

January 31, 2024

Tricia Miller, Permit Administrator
WA State Dept of Ecology - NWRO
PO Box 330316
Shoreline, WA 98133-9716
Submitted via web portal

Re: Comments on the Draft permit for the City of Everett Water Pollution Control Facility

Dear Tricia Miller,

Thank you for the opportunity to comment on the Draft permit for the City of Everett Water Pollution Control Facility. Orca Network is a 501(c)3 organization dedicated to raising awareness of the whales of the Salish Sea and the importance of providing them healthy and safe habitats. Our education, outreach and advocacy efforts reach almost 700,000 people through our Whale Sighting Network, social media, education programs, and visitors to our Langley Whale Center on Whidbey Island. We respectfully submit these comments on behalf of our staff and Board of Directors and urge you to implement strong measures to reduce toxic pollution at the Everett plant and set an example that can be followed by other wastewater treatment plants across the country.

Wastewater treatment plants are a primary source of pollutants, including polybrominated diphenyl ethers (PBDEs), per- and poly-fluoroalkyl substances (PFAS, also known as "forever chemicals), and nutrient pollution, all of which present significant health concerns for humans, salmon, and whales. The lower Snohomish River is a known hotspot for these chemicals.

- PBDEs are chemicals used in flame retardants and consumer products. While they are in the process of being phased out in Washington, they are still found in wastewater plant discharges. They are highly bioaccumulative and they biomagnify through the marine food web. PBDEs are known to cause a host of health effects including neurodevelopmental toxicity, thyroid hormone imbalance and cancers.[1]
- PFAS, which come from industrial releases, firefighting foam, and a range of consumer products, are called forever chemicals because they do not break down in the environment and can move through soil to contaminate water. They are associated with several health concerns, including weakened immune system, reproductive impacts, and cancers.[2] PFAS have been detected in a variety of marine life with indications that they persist and bioaccumulate in the marine environment. [3]

[1] Siddiqi et al. 2003. Polybrominated Diphenyl Ethers (PBDEs): New Pollutants-Old Diseases
[2] https://www.epa.gov/pfas/our-current-understanding-human-health-and-environmental-risks-pfas.
[3] Khan et al. 2023. Occurrence and Bioaccumulation Patterns of Per- and Polyfluoroalkyl Substances (PFAS) in the Marine Environment.

- Wastewater from the Everett plant contains nitrogen and phosphorus which contribute to nutrient pollution. When nutrients reach high levels, they can increase algal growth, causing toxic algae blooms and reducing dissolved oxygen levels, and these impacts can be compounded by climate change.[4]

Salmon

Salmon are an icon of the Pacific Northwest. They are important culturally for local tribes, many of whom hold treaty fishing rights, and they are the most important source of food for the endangered Southern Resident orcas, comprising over 90% of their diet. Salmon are experiencing declines in many parts of their range, and they are susceptible to chemical pollution. Persistent chemicals such as PBDEs contribute to salmon declines by accumulating in the bodies of juvenile salmon, impacting their immune systems, and increasing susceptibility to disease.[5] Scientists have found that salmon in Puget Sound estuaries tested positive for chemicals at levels known to cause adverse health effects. PBDE levels were high enough in 75% of salmon collected from the Snohomish River to alter thyroid hormone production, which play important roles in olfaction and migration. [6] Reduced levels of dissolved oxygen can have significant negative effects on the survival of salmon, including impacts on growth and development in eggs, alevins and fry, and on the swimming, feeding and reproductive ability of juveniles and adults. [7]

Southern Resident Orcas

Southern Resident orcas are a genetically, acoustically, socially, and culturally distinct population of fish-eating orcas. They were listed as endangered under the U.S. Endangered Species Act in 2005 but are continuing to decline despite the protection and recovery actions initiated by this listing. The population is currently at 74 individuals, the lowest number in four decades. [8] Their main threats include a lack of available prey, namely due to a decline in their primary prey, Chinook salmon; environmental contaminants, particularly bio-accumulative organochlorines such as DDT, PBDEs, and PCBs; and vessel effects and sound, as well as increased potential for oil spills and disease. [9] Salmon depletion has led to changes in their social structure, decrease in presence in their core summer feeding areas, an increase in stress hormones and a miscarriage rate of almost 70%.[10] Toxicants, such as PCBs and PBDEs, accumulate in the blubber of orcas through ingestion of their prey. These contaminants are known to cause numerous adverse health effects in multiple species, including endocrine disruption, reproductive failure, immunotoxicity, and cancers. Nutritional stress exacerbates the role of toxicants as metabolized lipid reserves from the blubber move into circulation in the body.[11]

In 2018, Governor Inslee assembled the Southern Resident Orca Task Force with the directive to make recommendations on a suite of actions necessary to prevent the extinction of the Southern Residents. The Task Force

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[4] https://www.frontiersin.org/news/2020/08/17/effects-of-nutrient-pollution-in-marine-ecosystems-are-compounded-by-human-activity/

[5] Arkoosh et al. 2015. Dietary Exposure to Individual Polybrominated Diphenyl Ether Congeners BDE-47 and BDE-99 Alters Innate Immunity and Disease Susceptibility in Juvenile Chinook Salmon.

[6] O'Neill et al. Assessing the threat of toxic contaminants to early marine survival of Chinook salmon in the Salish Sea.

[7] The Effects of Dissolved Oxygen on Steelhead Trout, Coho Salmon, and Chinook Salmon Biology and Function by Life Stage; Carter 2005.

[8] Center for Whale Research Orca Survey data

[9] National Marine Fisheries Service. 2008. Recovery Plan for Southern Resident Killer Whales (Orcinus orca). National Marine Fisheries Service, Northwest Region, Seattle, Washington

[10] Data from the Center for Whale Research; Shields MW. 2023. 2018–2022 Southern Resident killer whale presence in the Salish Sea: continued shifts in habitat usage; Wasser S.K. et al. 2017. Population growth is limited by nutritional impacts on pregnancy success in endangered Southern Resident killer whales (Orcinus orca).

[11] Mongillo et al. 2016. NOAA Technical Memorandum. Exposure to a mixture of toxic chemicals: Implications for the health of endangered Southern Resident killer whales.

final report includes 49 recommendations intended to increase salmon, decrease contaminants, and reduce noise pollution. Several of these recommendations address prey abundance and toxic pollution as priorities, including a recommendation that focuses on nutrient pollution from wastewater discharge.[12]

Gray Whales

Eastern Pacific gray whales undertake one of the longest migrations of any mammal in the world, traveling up to 12,000 miles round trip each year between breeding grounds in Baja, Mexico and feeding grounds in the Bering and Chukchi Seas. Within this population, there is a unique group of around 20 individuals known as the North Puget Sound gray whales, or Sounders. Some of these whales have been returning to Puget Sound each year since 1990 to feed on ghost shrimp around the southern ends of Whidbey and Camano Islands, Saratoga Passage, Port Susan, Gedney/Hat Island, and the Snohomish Delta. They are baleen whales, primarily feeding in shallower water, taking in sediment and filtering out the bottom dwelling organisms such as ghost shrimp.

Gray whales are currently undergoing an “Unusual Mortality Event” (UME) due to an unexpected significant die-off that was declared in 2019. [13] A total of 692 dead gray whales haves stranded along the migration route from Mexico to Alaska, possibly representing only 10% of the actual mortality, and as of June 2023 the population has declined a staggering 46%.[14] Many of the deceased whales were thin or emaciated and appeared to have died of starvation, and this appears to be due primarily to changes in sea ice conditions in their Arctic feeding grounds.[15] The Sounders gray whales however, have remained relatively stable, and feeding on ghost shrimp in Puget Sound has allowed them to survive and better deal with nutritional stress.[16] As the population of Sounders gray whales continues to grow with the introduction of new individuals finding the Puget Sound ghost shrimp, reduction of chemical and nutrient pollution will be an important step in ensuring their prey resource remains stable and healthy.

Conclusion

Pollution from the Everett Water Pollution Control Facility is releasing toxic chemicals and nutrient pollution into Puget Sound which threatens the health of salmon, orcas, gray whales, and the entire marine food web. We urge you to be a leader in environmental protection by implementing stronger requirements and monitoring to reduce pollution and ensure a healthier future for Puget Sound marine life.

Sincerely,

Cindy Hansen   Susan Berta   Howard Garrett

Cindy Hansen, Education & Advocacy Coordinator cindy@orcanetwork.org
Susan Berta, Executive Director susan@orcanetwork.org
Howard Garrett, Board President howard@orcanetwork.org

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[12] https://orca.wa.gov/progress/all-recommendations/
[13] https://www.fisheries.noaa.gov/national/marine-life-distress/2019-gray-whale-unusual-mortality-event-along-west-coast.
[14] Eguchi et al. 2023. NOAA Technical Memorandum. Abundance of eastern North Pacific gray whales 2022/2023
[15] Stewart et al. 2023. Boom-bust cycles in gray whales associated with dynamic and changing Arctic conditions.
[16] Cascadia Research Collective, Orca Network. 2023. A Guide to the Gray Whales of North Puget Sound.

Everett WWTP NPDES Permit Comments
January 2024
Washington State Department of Health, Shellfish Growing Areas

The Department of Health, Shellfish Growing Area Program appreciates the opportunity to provide comments to the NPDES Waste Discharge Permit No. WA0024490 for the City of Everett Water Pollution Control Facility. The Shellfish Growing Area requests that permit section S3.F.3 be modified as shown in the below redline version. These changes are needed to ensure that the Shellfish Growing Area Program is notified in a prompt manner when conditions that may affect shellfish harvest occur.

S3.F Reporting permit violations

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3. Immediate reporting

The Permittee must **immediately report**:

a.) To Ecology and the Local Health Jurisdiction at the numbers listed below, all:
- Failures of the disinfection system.
- Plant bypasses resulting in a discharge to a waterbody.
- Any upset that causes an exceedance of an effluent limit in the permit (see G.15, “Upset”).
- Collection system overflows.
- Any other failures of the sewage system (pipe breaks, etc.)

  Northwest Region Office: 206-594-0000

  Snohomish County Health Department: 425-339-5250 (business hours), 425-339-5295 (after business hours)

b.) To the appropriate MS4 owner or operator:
- Any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4)

c.) To the Department of Health, Shellfish Program at the number listed below:
- ~~Any reportable violation that impacts marine waters.~~ Any of the situations in permit section S3.F.3.a. that impact marine waters, including the Lower Snohomish River Estuary.

  Department of Health, Shellfish Program: ~~360-236-3330 (business hours)~~; 360-789-8962 ~~(after business hours)~~

THE TULALIP TRIBES

6406 Marine Drive
Tulalip, WA 98271-9694
(360) 716-4500
FAX (360) 716-0642

The Tulalip Tribes are the successors in interest to the Snohomish, Snoqualmie, and Skykomish tribes and other tribes and band signatory to the Treaty of Point Elliott

January 31, 2024

SUBMITTED VIA ELECTRONIC MAIL

Tricia Miller, Permit Administrator
Washington State Dept of Ecology - NWRO
PO Box 330316
Shoreline, WA 98133-9716

RE: National Pollutant Discharge Elimination System (NPDES) Wastewater Discharge Permit WA00024490

Dear Administrator Miller,

I write you on behalf of the Tulalip Tribes of Washington ("Tulalip") regarding the Washington State Department of Ecology, Northwest Regional Office ("Ecology") Draft National Pollutant Discharge Elimination System Waste Discharge Permit No. WA00024490 ("Draft Permit") for the City of Everett Water Pollution Control Facility ("Everett Facility"). Tulalip is a federally recognized Indian tribe comprised of the Snohomish, Snoqualmie, Skykomish people and allied bands who reside on the Tulalip Indian Reservation. The Tulalip Indian Reservation was established pursuant to the Treaty of Point Elliott on January 22, 1855 (12 Stat. 927) and Executive Order of December 23, 1873. Through the Treaty of Point Elliott, Tulalip reserved its immemorial right to fish throughout its ancestral fishing areas—denoted as "Usual and Accustomed grounds and stations" in the Treaty—these areas include, but are not limited to, the Snohomish River Basin and Port Gardner Bay.

The people of Tulalip are the Salmon People and the cultural significance of salmon to Tulalip cannot be overstated. Since colonization, the once abundant returns of anadromous salmon and steelhead have dwindled to imperiled levels, leading to the listing of Puget Sound Chinook and Puget Sound Steelhead populations as threatened under the Endangered Species Act. In addition to providing an integral food source for Tulalip, Chinook salmon are also the primary prey for another species of paramount importance to Tulalip—the endangered Southern Resident Killer Whale. In an effort to stave off extinction of these important species, Tulalip has invested significant resources throughout the Snohomish River Basin.

Tulalip fully supports and incorporates the comments submitted by Earthjustice and submits its own comments to highlight Tulalip's grave concerns about the ongoing harms to Chinook salmon that are being caused by unprecedented levels of Polybrominated Diphenyl Ethers ("PBDEs"). The Draft Permit is unacceptable because, among other reasons, it fails to reduce, let alone prevent, the discharge of PBDEs into Tulalip's ancestral waters. The concentration of PBDEs in the lower Snohomish River—an area that provides crucial rearing habitat—harms juvenile Chinook salmon by suppressing the immune systems' ability to fend off naturally occurring diseases.

The State of Washington and its agencies and subdivisions, such as Ecology and the City of Everett, are bound by the Treaty of Point Elliott to refrain from destroying salmon habitat and Tulalip's immemorial right to fish, which "would be worthless without harvestable fish."[1] The permitting of and actual discharge of toxics that are known to harm ESA-listed Chinook salmon into critical spawning, rearing, and migration habitat, appear to violate the Treaty of Point Elliott and the Endangered Species Act take prohibition. Moreover, the status quo perpetuated by the Draft Permit continues to violate the State's water quality standards which protect the Snohomish River from introducing toxic substances at levels which may have the potential" to "adversely affect" salmon spawning, rearing, and migration.[2]

While Ecology has long been aware that PBDE pollution from the Everett Facility is harming salmon,[3] Ecology located sources through influent screening in 2021 when it identified two industrial users (IU) subject to NPDES requirements, an industrial laundry and landfill, discharging influent containing alarming levels of PBDEs into the Everett Facility.[4] Despite Ecology's location of two significant sources of these toxic pollutants, the Draft Permit requires mere information gathering during this permit cycle and does not require either known PBDE source IU (or any other source of PBDE pollution) to take any action to reduce PBDE discharge.

Accordingly, Ecology must mandate pretreatment pollution reduction actions for the pretreatment permits of the known sources of PBDE pollution to prevent harm to Chinook salmon during this permit cycle. Further, Ecology must mandate that pretreatment permits be modified to require pretreatment pollution reduction actions for all IUs that, through effective monitoring, become known sources of PBDE discharge. Tulalip also insists that Ecology mandate a toxic reduction plan similar to that required under the Ecology-issued NPDES permit for the City of Spokane's Riverside Park Water Reclamation Facility. Importantly, the requisite toxic reduction plan must require adaptive management based on effective monitoring to ensure the efficacy of toxic reduction actions.

In addition to influent controls, Ecology should analyze potential effluent limits and technology for reducing PBDEs from the Everett Facility outfalls, especially in light of the known available technology, such as the system at the City of Spokane's Riverside Park Water Reclamation Facility. Effluent controls must be implemented to prevent harmful concentrations of PBDEs from passing through the Everett Facility. Relatedly, while the Everett Facility effluent discharge should continue to be routed through the Port Gardner Bay deep-water outfall during the Chinook salmon outmigration, effective monitoring at

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[1] *United States v. Washington*, 853 F.3d 946, 965-66 (9th Cir. 2017).

[2] WAC 173-201A-240(1); *see also* WAC 173-201A-602; and 310(1).

[3] Carey, A.J., West, J.E., Fisk, R.J., Langness, M., Ylitalo, G.M., and O'Neill, S.M. (2019) Location Source of PBDE exposure of juvenile Chinook salmon along their out-migrant pathway through the Snohomish River, WA. p. 17 in 2018 Salish Sea Toxics Monitoring Synthesis: A Selection of Research. Edited by C.A. James, R. Jordan, M. Langness, J. Lanksbury, D. Lester, S. O'Neill, K. Song, and C. Sullivan. Puget Sound Ecosystem Monitoring Program. Tacoma, WA. 88 pp: https:// www.eopugetsound.org/articles/2018-salish-sea-toxics-monitoring-synthesis. (Jan 29, 2024); Sandra M. O'Neill, *et al.*, Toxic contaminants in juvenile Chinook salmon (*Oncorhynchus tshawytscha*) migrating through estuary, nearshore and offshore habitats of Puget Sound 58 (2015); Sloan et al. *PBDEs in juvenile* Chinook Arkoosh et al. *Disease susceptibility of salmon exposed to PBDEs Disease susceptibility of salmon exposed to polybrominated Diphenyl Ethers* Aquatic Toxicology 98 (2010) 51–59.

[4] Wong, S. 2022. Chemicals of Emerging Concern in Pretreated Industrial Wastewater in Northwestern Washington State: Screening Study Results, 2021. Publication 22-03-013.

this outfall must be required to determine the environmental impacts, including those impacts associated with PBDEs. Further, Tulalip opposes the spreading of biosolids from the Everett Facility onto agricultural fields and insists that such biosolids be effectively monitored, similar to influent and effluent monitoring.

Finally, Tulalip insists that Ecology require that all monitoring data and the toxic reductions plan (subsequent updates and evaluations) be made publicly available.

Thank you for taking the time to listen to consider our recommendations. Should you have any questions or need further follow up, please contact the Natural and Cultural Resources Executive Director, Jason Gobin at jgobin@tulaliptribes-nsn.gov or Tyler J. Eastman at teastman@tulaliptribes-nsn.gov.

Sincerely,

Jason Gobin

cc: Tulalip Tribes Board of Directors
Tyler J. Eastman, Reservation Attorney

Snohomish County Indivisible

Greetings,
This is a continuation of my comment at the public hearing January 11. Snohomish County Indivisible is concerned the draft permit in its current form does not provided the city of Everett a strong enough mechanism to effectively address this problem. As mentioned at the hearing there needs to be source monitoring of industrial effluent on an ongoing basis to establish current baseline and trends; the monitoring frequency stated in the current report is not adequate. Further, target levels and intervention plans for PBDE reduction must be established with the monitoring data used to evaluate results and compliance. Thank you for your work on this important issue.

Derek Benedict

I'm just an ordinary senior citizen who lives alone but greatly cares about the eco-enviro health of the Puget Sound/Salish Sea region.

And from what scientific reports have stated --- even if we cut air, land, water pollution today --- right now --- this crap will pollute our precious Pacific NW biome for decades to come.

Please stop all of this toxic nonsense and let's get to work on making the polluters clean up their mess. The futures of my grandchildren are depending on your decisions!

Sonja Bodge

I am in support of the City of Everett's efforts to mitigate the flow of PBDEs into the environment.
Thank you!

Sharon Burke

You must stop the discharge of PFAS chemicals, oxygen-killing nitrogen and other toxic chemicals coming from the Everett Wastewater Treatment Plant. These harmful chemicals have been detected in much of our marine life, including our endangered salmon and orcas. They are showing up in humans as well. Stopping these dangerous discharges should be a no-brainer for the Department of Ecology. The damage that we humans have done, and are continuing to do, to the planet"s biodiversity is reaching a tipping point. Even the UN recognizes that we are on the verge of a mass extinction event caused solely by human activity, so why aren"t we doing more to prevent this? Between global warming and rampant chemical pollution, we seem to be on a path to annihilate life on the planet. Shame on us. I hope you will give us some hope out here and do the right thing concerning the Everett Wastewater Treatment Plant.

Mary Ferm

It is vitally important that the City of Everett cease discharging harmful pollutants into Puget Sound. Personally, I am concerned about the health of my young grandchildren, who use the beaches in Edmonds, the Kitsap Peninsula and the San Juans. As a concerned citizen who values our Northwest wildlife, I am concerned about fish (including salmon) that we eat, and the magnificent Orcas, who are struggling with a huge toxin load accumulating in their bodies. City of Everett, this has gone on too long, and it's time to step up.

Katherine German

I'm writing to request that you require Everett Wastewater Treatment Plant to clean up what they are discharging into Puget Sound. PBDEs, PFASs and nutrient pollution should be kept out of our waterways. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. So much effort is being put into protecting salmon and orcas so we don"t lose them - this is an important step in making sure they have somewhere clean to live. There is no point in spending billions of dollars to repair culverts for salmon and protect orcas if we are just going to poison them. There is a reason PFAS are called "forever chemicals" - they don"t breakdown and there is no safe level of exposure. I have a son with autism and the incidence of this disability is increasing. We have to stop dumping chemicals into our environment thinking they are safe and then trying to clean them up later - we are all paying for this pollution even if only through higher taxes to support people who are unable to work because of disability. Please get tougher and stop the discharge of pollutants into our environment . The permit renewal to the Everett Wastewater Treatment Plant is a great place to make changes to the process. Thank you.

Aimee Hamilton

Adding my voice to others also requesting that the Department of Ecology require the City of Everett Water Pollution Control Facility and its industrial users do more to reduce three main pollution streams that are known to be harmful to aquatic wildlife and humans.

Discharges of PBDEs (polybrominated diphenyl ethels): These chemical compounds used in flame retardants in consumer and industrial products including textiles, foam, insulation, and plastics are known to persist in the environment and accumulate in the bodies of wildlife and people. While many uses of PBDEs have been largely phased out, these chemicals continue to be found in discharges from the plant and its industrial users. Scientific research has identified a hot spot of these chemicals in the lower Snohomish River that is harming salmon by suppressing their immune systems and increasing their susceptibility to disease. Decreased salmon populations in turn affect orcas, whose main prey is Chinook salmon.
Contamination from PFAS or "forever chemicals": Wastewater treatment plants across the country have been identified as a primary source of PFAS releases. PFAS is short for per- and poly-fluoroalkyl substances, which includes thousands of chemicals found in a wide range of consumer, commercial, and industrial products. Some of these compounds are linked to human and animal harm, including increased cancer risk, higher cholesterol levels, and negative effects on the liver, thyroid, immune system, and fetal development.
Nutrient Pollution: The Everett plant is one of the largest sources of nutrient pollution in Puget Sound. Nutrient pollution can increase algal growth, which reduces levels of dissolved oxygen and can cause toxic algae blooms, both harmful to aquatic life. Parts of Puget Sound, including the lower Snohomish River, have been found to have impaired water quality due to low oxygen levels.

Please require new measures to monitor and reduce discharges of these three pollutants and thereby prevent further water quality violations to protect salmon populations and, by extension, protect the vulnerable Orca population.

Thank you

Gayle Janzen

It sounds as though the City of Everett and the DOE are concerned and have been taking actions to reduce the number of PBDE's that continue to be released into the Snohomish River and Puget Sound. Unfortunately, much more needs to be done to keep them out of our waterways.

It sounds as though there are no easy answers, but I hope you will consider strengthening your permit by doing the following:

* Ensuring a transparent and robust pretreatment program through specific requirements
* Using the City of Everett's Water Pollution Control Facility to minimize PDBE discharge, especially during the Chinook outmigration period (February-July with the peak in April and May)
* Assessing progress using ongoing Chinook sampling and analysis from the Washington Department of Fish and Wildlife
* Investigating the potential for more advanced treatment to better control the discharge of PBDEs and other pollutants
* Minimizing costs associated with PBDE pollution that are currently being shouldered by the least willing to pay.

It's long past time to start looking into newer and more effective treatments that are better able to remove PBDE's and other pollutants as the current technology just isn't enough and never has been. I don't think most of our treatment facilities were ever set up to be able to remove the dangerous pollutants that have been ignored and released for years and years. It's time to pay the piper.

Thank you again for taking actions to mitigate this problem, but I hope you will do much more. Our salmon are having a difficult enough time surviving these days.

Natalie Lawrence

It has come to my attention that PBDE's, a type of flame retardant, are making their way into estuaries in Snohomish. These dangerous chemicals are harming our young Chinook salmon, and we need to do everything in our power to support their recovery. So much of our ecosystem depends on their survival, and any chance we can help give them is one we need to take. Even if this proposal says "treated" water to be dumped, I do not support it and urge Everett's Water Pollution Control facility to find a more safe and salmon friendly way to handle this. We all have a role to play in the health of our salmon! Support their survival!

priscilla martinez

We need to take better care of what is left of our environment, for wildlife, marine life, plant life, and people.

Max McDermott

Everett wastewater facility must do better to prevent PBDEs entering the watershed and harming chinook. It is unacceptable that this facility should be allowed to pollute our waters and work counter to the enormous investments of time and money our state and its citizens have contributed to the restoration of pacific salmon. Fix it!

Chris Rich

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants.

Alun Vick

I'm writing to encourage you to implement strong measures in the wastewater discharge permit for the Everett Wastewater Treatment Plant that will be effective in reducing harmful discharges of PBDEs, PFAS, and nutrient pollution. Wastewater treatment plants are a primary source of these pollutants. In Puget Sound, high levels of PBDEs have been found in salmon, orcas, and also in human breast milk. PFAS and nutrient pollution are pervasive nationwide, including in our beloved waterways. The science is clear on this matter – these pollutants are causing harm to threatened salmon, endangered orcas, and people – and more must be done to prevent these waste streams from harming our communities and aquatic ecosystems. For PBDEs, Ecology should require that pretreatment agreements with each of the plant's industrial users include quarterly monitoring of PBDE discharges and with concrete steps to reduce these discharges. For PFAS contamination, the permit should set deadlines for industrial users to conduct initial sampling and reporting, and to implement monitoring and pollution prevention and reduction practices. The permit should also require that industrial users conduct EPA-recommended ongoing quarterly sampling. Further, the permit should require the plant itself to evaluate strategies to reduce PFAS if source control efforts aren't sufficient to bring PFAS levels down. For nutrient pollution, the permit should set limits on the levels of nitrogen and phosphorous that can be discharged. Scientists have already established limits that are are achievable and will help address Puget Sound's persistent nutrient pollution problems – Everett and Ecology just need to listen to the experts. The Department of Ecology has an opportunity through the renewal of this permit to do more to protect our marine environment, salmon, orcas, and people. We hope Washington State can become a leader in these efforts by issuing a permit that will reduce our exposure to these pollutants. I'm Required to maintain my septic system and have it professionally checked every two years. And if there are any problems I have to fix it. How can you get away with not doing your job and obligation.