Pressure Reduction Conceptual Model Summary - Wastewater

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This document summarizes work-to-date on a conceptual model representing the current context of wastewater pressures to ecosystems, species, ecological processes and people in the Puget Sound Basin. The direct pressures addressed in this model include **Inadequately treated discharges from Onsite Sewage Systems (OSS)** and **Inadequately treated discharges from municipal & industrial Wastewater Treatment Plants (WWTP).**

Summary of Conceptual Model Development and Next Steps

Model Overview

The general conceptual model presented here was based on a similar model developed in support of the 2009 State of the Sound reporting. The 2011 wastewater interdisciplinary team (see WW-OSS team members, Table 1) broadened the scope of the original model to capture the complexity of wastewater treatment systems ranging from the small, individual home level up to the large, advanced, municipal wastewater treatment plants.

Figure 1 is an overview graphic depicting a simplified general model covering all topic areas addressed by the WW-OSS team. It includes some specific areas that are admittedly important to the health of Puget Sound, but outside the context of the current work plan, such as toxics reduction and Combined Sewer Overflows (CSOs). In some cases, such as toxics, ecosystem recovery objectives are being developed in a related target-setting effort by PSP and its partners. Figures 2 and 3 are detailed conceptual models showing further development of the OSS and WWTP conceptual models, respectively. Although Large OSS (LOSS) is included in the overview model, at this point the WW-OSS team has decided not to develop a conceptual model specifically addressing LOSS. The primary reason for calling more attention to OSS rather than LOSS is the relative number and potential risk associated with the more than 500,000 OSSs in Puget Sound as compared to the roughly 200 LOSS. The WW-OSS team also felt that the same kind of management structure exists for both LOSS and OSS so strategies and actions addressing OSS could likely be adapted to address LOSS at a later date.

In general, the team found that many of the contributing factors driving wastewater pressures in Puget Sound Basin are common to both OSS and WWTP and this is reflected in the conceptual models presented. As the WW-OSS team continues to develop the conceptual model and define strategies and actions, we expect to identify more factors specific to each system type and associated laws and regulations. For additional details on some of the strategies and factors in the conceptual model see Table 2 below.

Outstanding Concerns

In order to meet the timeline for the Science Panel's review, many interdisciplinary team members have not had time to adequately review the summary model and the two detailed models for WW and OSS. Initial reactions to the models are mixed, reflecting the current status of the model as a work in progress.

One major concern raised is that the conceptual model unfairly or inaccurately depicts the status of current onsite management programs administered by the LHJs. Clearly, the state of current regulations for new systems, for those OSS systems installed over the past 15 to 20 years are far superior to older systems, where good records are often not available unless upgrades have been made since initial installation. Old systems often were installed when no regulations existed, and in some cases small septic tanks were not connected to drainfields. These systems have mostly been updated, repaired or replaced, but not in all cases.

As updated OSS management plans account for inventory, inspection and updated operation and maintenance of all systems, our certainty about reduction in these pressures on Puget Sound's water quality will improve greatly. Similarly, as modeling studies of nitrogen sensitive areas such as south sound, Hood Canal and the Whidbey Basin are completed, we can assess the need and schedule for more advanced WWTPs to reduce nitrogen from wastewater.

Next Steps

The interdisciplinary WW-OSS team will reconvene on June 8 to finalize the draft conceptual model(s) and begin development of strategies and actions that would be aligned with the pressure reduction targets.

Process and Interdisciplinary Team

The interdisciplinary WW-OSS team (Table 1) met in early 2011 to draft a conceptual model for Wastewater and Onsite Sewage Systems. The team met twice to develop and revise the WW-OSS conceptual model before shifting to focus on development of specific pressure reduction objectives, or target options, in support of the PSP's target-setting efforts. For the bulk of the last few months, the WW-OSS team has focused on development of two 2020 target options for wastewater; one each for wastewater - in the general context of larger wastewater treatment facilities and treatment of pathogens and nitrogen - and OSS - mostly in the context of OSS regulations and management programs administered by local health jurisdictions (LHJs), and regulated by Washington Department of Health. The conceptual models presented in this summary reflects the early work done by the WW-OSS team, prior to development of the 2020 pressure reduction target options.

Table 1. WW-OSS Interdisciplinary Team Members

PSP staff	Interdisciplinary Team Members
PSP Staff Lead: Duane Fagergren **PSP Staff Advisor:** Scott Redman, PSP **Technical Support:** Caroline Stem, Foundations of Success Nick Salafsky, Foundations of Success Kari Stiles, consultant	Dave Bergdolt, Brown & Caldwell Michael Brett, UW Dept of Civil and Environmental Engineering John Eliasson, WA Dept of Health Stuart Glasoe, WA Dept of Health Keith Grellner, Kitsap Health Julie Horowitz, Hood Canal Coordinating Council Terry Hull, Enterprise Cascadia Andrew Kolosseus , WA Dept of Ecology Mindy Roberts, WA Dept of Ecology Randy Shuman, King County David Stensel, UW Dept of Civil and Environmental Engineering Mark Toy, WA Dept of Health Greg Zentner , WA Dept of Ecology Bob Hager, Citizen and Lower Hood Canal

	Watershed Coalition co-chair Sue Davis, Thurston County Environmental Health

Details and Comments on Strategies and Contributing Factors

This section summarizes additional information associated with draft strategies and contributing factors included in the detailed Draft Wastewater Conceptual Models for Onsite Systems (Figure 2) and Wastewater Treatment Plants (Figure 3). For an overview of the relationship between OSS and WWTP, please see Figure 1.

Note: Contributing factors represent the major forces contributing to Wastewater as a direct pressure to Puget Sound ecosystems and people. Contributing Factors can include indirect pressures (or threats), enabling conditions, or opportunities.

Table 2. Strategies and Contributing Factors

	Strategy or Contributing Factor	Details and Comments
Onsite Systems		
DRAFT Strategy I	Implement OSS management plans	Developed 2 years ago, implementing now. Activities include O&M inspection, identification of high risk areas, record keeping about systems & representation in GIS
DRAFT Strategy II	Support infrastructure improvement of on-site system	
	1. Lack of understanding related to need and opportunities to update systems	
	2. Perception that individual systems only minimally responsible for OSS problem	It is the cumulative effect that becomes a problem with expanding population, especially in sensitive areas.
	3. Fear of individual repairs being costly	Somewhat relates to item 5 below
	4. Lack of standards addressing right design for right place	LHJs and DOH are working to license and certify systems and technologies
	5. Owners lack funds or incentives to update on-site systems	Funding through State Revolving Loan programs or Enterprise Cascadia have good track records for funding repair or replacement of OSSs
	6. Owners do not maintain or update systems voluntarily	Current OSS management plans help in a major way.
	7. On-site sewage systems old & out-dated	Should this be all systems? not just old and outdated
	8. OSS not properly sited or designed for high risk areas	consider seasonal high water failures includes Hood Canal shorelines more about the right design in the right place or adequate available area to

	Strategy or Contributing Factor	Details and Comments
		allow for soil treatment or vegetation uptake
	9. Comprehensive PIC Programs costly for counties	Comprehensive PIC programs such as Kitsap's are proven effective models
	10. Lack of Pollution Identification and Correction (PIC) programs in some areas	See #9
	11. On-site systems not inspected regularly	There is a wide range in inspection programs and a variety of schedules depending on the type of OSS
	12. Poor operation & maintenance of systems	The historic challenge is being addressed by OSS management plans
	13. Lack of political will to drive updates	
	14. Lack of effective overarching OSS management structure	to guide management of private infrastructure that is a public ammenity
	15. Lack of education in OSS profession	re. new and appropriate technologies also address licensing of professionals
Wastewater Treatment Plants		
DRAFT Strategy III	Education & stewardship about proper management practices	Many successful models for education around OSS and more advanced WWT exist, but are not 100% effective.
DRAFT Strategy IV	Improve NPDES permits	Typically municipal WWTPs are reviewed and updated on a 5-year schedule for capacity and compliance with current standards
DRAFT Strategy V	Support wastewater & water re-use infrastructure improvements	As more advanced WWTPs come on line, the high quality effluent can be used for a range of 're-use' purposes and marketing of water becomes important
DRAFT Strategy VI	Promote technologies to reduce nutrients & pathogens in wastewater	This is especially true for nitrogen reduction for small systems and individual OSSs.
	1. Regulations based primarily on human health, not environmental risk	
	2. comprehensive wastewater/sewerage plan does not exist in rural areas	
	3. Sewerage needs with OSS or WWTPs not adequately addressed	
	4. Highly developed areas historically relying on OSS cannot have WWTP connections	Many areas have developed to near urban densities without benefit of 'urban services' such as WW infrastructure. GMA requires these services are limited to urban areas.
	5. Expanding population in Puget Sound	
	6. Greater burden on OSS	
	7. Urban wastewater infrastructure	

	Strategy or Contributing Factor	Details and Comments
	overtaxed	
	8. municipal wastewater plans need to be updated	to address changing capacity needs (population growth) to address changing treatment needs to include OSS
	9. Lack of educ & awareness re. proper disposal	
	10. Toxic chemicals introduced to WW flows	Could include OSS and WWTPs
	11. Pre treatment for LOSS or WWTP lacking	for OSS for WWTP including pre-treatment
	12. Outdated WWTPs	Generally NPDES permit schedules address this reality, but economic conditions often inhibit funding of upgrades, even where infrastructure exists.
	13. Technologies for addressing pathogens & nutrients are different	Both Nutrients and Pathogens need to be treated to a high standard by whatever treatment device
	14. No regulatory framework for prioritizing pathogens & nutrients	In areas like Hood Canal, both types of pollution need to be considered in terms of human health and environmental health contexts
	15. Nutrients & pathogens not treated sufficiently in high-risk areas	Prioritization of high risk areas for both pollutants is necessary
	16. nutrient removal not available or affordable for small OSS	technology exists but not always used DOH has not yet certified non-proprietary systems for N removal
DRAFT Strategy VII	Promote BMPs to reduce water use	
	17. Wastewater not used as a water resource	reclaimed water water conservation strategies if water was treated better it would be marketable