Address and Clean Up Cumulative Water Pollution Impacts in Puget Sound

The Challenge

Water pollution in the marine waters and freshwater of Puget Sound comes from the introduction of toxic chemicals, pathogens, nutrients, and suspended sediments. These contaminants can harm aquatic life and pose health and safe problems in seafood, public water supplies, and beaches. There are many contaminated sites within and near Puget Sound that have resulted from past and ongoing releases of pollutants into the environment.

Water quality data indicate that the region's marine and fresh waters continue to have pollution challenges, but cleanup efforts have made some improvements.

- The Department of Ecology's Long Term Ambient Monitoring Program tracks water quality in 14 major rivers in Puget Sound using a Water Quality Index, which evaluates common pollutants such as temperature, bacteria, and dissolved oxygen, but not toxic pollutants. The Index shows that conventional water quality pollution has made small general improvements since 1995, but a majority of freshwater monitoring locations do not have good water quality (see chart).

Rivers Meeting Goals	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Duckabush	93	95	94	90	74	94	89	85	88	96	86	89
Elwha	86	88	83	76	73	74	86	67	66	81	81	78
Skokomish	95	95	94	85	70	67	92	89	89	94	86	87
Snohomish	92	91	89	81	74	75	89	75	81	85	76	83
Borderline Rivers	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Cedar	87	76	60	78	72	84	81	79	79	81	77	78
Upper Skagit	87	86	59	85	64	81	84	75	75	81	56	76
Lower Skagit	89	91	71	76	61	73	77	77	75	76	74	76
Deschutes	62	72	70	73	61	83	88	88	83	76	74	75
Nisqually	40	60	79	79	69	71	74	75	91	74	83	72
Rivers Not Meeting Goals	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Green	82	73	66	67	75	49	72	68	60	69	63	68
Nooksack	65	68	58	57	52	54	61	51	60	69	56	59
Puyallup	60	58	57	55	51	58	59	58	61	49	62	57
Samish	86	75	32	49	34	71	67	74	59	80	63	63
Stillaguamish	81	60	44	72	55	67	71	69	75	75	71	67

Note: The Water Quality Index (WQI) is an aggregation of monthly measurements of typical water pollutants reported on a scale of 1 to 100. A higher number indicates better quality. An index score of 80 or above indicates that water quality is generally meeting our goals; between 70 and 80 is considered "fair" or "borderline;" 40-70 is failing to meet water quality goals and less than 40 is "poor."

Source: River and Stream Ambient Monitoring Program, Washington State Department of Ecology

Figure 1: Annual Water Quality Index (WQI) Scores at Freshwater Monitoring Locations, 2000–2010

- Almost half of routinely monitored beaches in Puget Sound (50–70 beaches) consistently met water quality standards every year from 2004–2010, and another third met standards every year except for one or two years. Pollution sources have been addressed at several beaches since 2004, and two permanent beach closures were lifted in Island County in 2008. Despite these efforts, problems remain. In 2010, 26 percent of monitored beaches in Puget Sound failed to meet water quality standards and thus were unsafe for swimming.
- Ecology has been working to clean up 1,419 toxic-contaminated sites located within a half-mile of Puget Sound, including 150 contaminated sediment sites. Through August 2010, Ecology, potentially responsible parties, and other entities have cleaned up 4,828 acres, or 34 percent, of the contaminated sediment sites tracked in Ecology's contaminated sites data system.[17]
- In urban bays and harbors in Puget Sound, marine sediment quality data indicate mixed trends over time. Ecology's Urban Waters Initiative represents a major effort to reduce toxics entering urban bays and prevent re-contamination of sediments at cleanup sites including Elliott Bay and the Lower Duwamish in Seattle and Commencement Bay in Tacoma. Marine Sediment Chemistry Index (SCI) scores have improved in Elliott Bay and Commencement Bay, but declined in Bellingham Bay and Bainbridge Basin from 1997–99 to 2007–10. The recent SCI scores for the Bainbridge Basin and Bellingham Bay just meet the target score of 93.3, but the scores for Elliott Bay and Commencement Bay are still below the target score.[18]

This strategy is focused on efforts to correct water quality problems related to toxic chemicals, nutrients, and pathogens by diagnostic studies and targeted cleanup activities. Implementing corrective actions to clean up impaired marine and fresh waters is essential for reducing the harm from pollution in the Puget Sound ecosystem. Sub-strategies in this section include completing total maximum daily load (TMDL) studies that serve as cleanup plans for water bodies, restoring and cleaning up contaminated sites within and near Puget Sound, addressing water quality issues at swimming beaches and recreational areas, implementing local pollution identification and correction programs, and developing a long-term effectiveness monitoring program for water quality improvement efforts.

Many of the sub-strategies presented here are important components of programs to address water quality problems that might be caused by pollution from urban runoff, wastewater discharge, and agricultural and forest runoff. Other strategies in priority C deal with efforts to reduce the release of chemicals to the environment and to control pathways by which pollutants are delivered to Puget Sound waters.

Relationship to Recovery Targets

This strategy addresses the core water quality goals of the Action Agenda. Of particular relevance to water cleanup sub-strategies are targets related to dissolved oxygen, swimming beaches, marine sediment quality, and freshwater quality. These targets include that by 2020 human-related contributions of nitrogen to Puget Sound do not result in dissolved oxygen reductions of more than 0.2 mg/L, all monitored Puget Sound beaches meet marine water quality standards for bacteria, all Puget Sound regions and bays show minimal impact from toxic chemicals in sediment, and at least 50 percent

[17] Ecology's integrated Site Information System data, as reported in Ecology's January 2011 GMAP report on Puget Sound, www.ecy.wa.gov/quality/forums/2011/Puget_Sound.pdf.

[18] Ecology's Marine Sediment Monitoring Program data, as reported in the Puget Sound Partnership's target setting brief sheet (March 23, 2011), www.mypugetsound.net/directory-llistings/documents/doc_download/83-toxics-in-sediments-target-setting-briefsheet-3-23-11-final.html.

of freshwater monitoring stations in Puget Sound have "good" Freshwater Quality Index scores of 80 or higher. Other relevant targets relate to how organisms are affected by contaminants in water, including targets for shellfish beds restored, toxics in fish, and water insects in freshwater.

C11. Address and Clean Up Cumulative Water Pollution Impacts in Puget Sound.

C11.1 Complete TMDL studies and other necessary water cleanup plans for Puget Sound to set pollution discharge limits and determine response strategies to address water quality impairments.

In Washington State, the Department of Ecology administers the water quality improvement program known as the Total Maximum Daily Load (TMDL) process under Section 303(d) of the Clean Water Act. TMDLs establish limits on pollutants that can be discharged to water bodies. For impaired waters, TMDLs serve as water cleanup plans, articulating the sources of pollution, how much pollution needs to be reduced to meet water quality standards, pollution-reduction targets, and strategies to control the pollution. The TMDL process is the primary regulatory program that EPA and Ecology use to protect and restore water bodies from the cumulative impacts of multiple sources of pollution, including point and non-point sources.

Common water quality parameters evaluated in TMDLs include dissolved oxygen and the nutrients responsible for reducing available oxygen, suspended solids, temperature, metals, pesticides, and other toxic chemicals and pollutants, all of which can harm aquatic organisms and their habitat. One of the important cumulative effects of pollution from multiple sources is reductions in the availability of oxygen in the water, known as dissolved oxygen. When an excess amount of nitrogen, phosphorus, and/or other nutrients enters a water body, it can result in a condition of depleted oxygen levels known as hypoxia that causes stress to the environment depending on the severity and duration of the event. In Puget Sound, there are chronic hypoxia zones in Hood Canal, Budd Inlet, Sequim Bay, and increasingly in areas of Whidbey Basin and Quarter Master Harbor.

The Puget Sound toxic loading study, which will be completed in October 2011, highlights threats to water quality from 17 toxic chemicals of concern; however, additional emerging contaminants may also be important toxic threats to Puget Sound. For example, there is increasing evidence of plastic pollution in Puget Sound marine and nearshore areas.[19] Plastics have the potential to strangle marine wildlife, and mammals, birds, and fish also ingest small microplastics and the toxics they contain.

This sub-strategy helps ensure that Puget Sound marine and fresh waters support aquatic life and provide for other beneficial uses by ensuring that Ecology implements its responsibilities to develop and implement TMDLs so that pollution sources are identified and corrective actions are taken to address problems. These efforts to implement water cleanup plans to improve water quality in specific water bodies through the TMDL process complement the source-specific strategies discussed elsewhere in the Action Agenda. In particular, strategies to control the sources and pathways that excess nutrients and toxic chemicals enter Puget Sound include toxics source reduction (C1), stormwater runoff (C2),

[19] Since 2006, the Port Townsend Marine Science Center, with funding from a 2007 grant from Ecology, has led a Plastics Project examining plastics contamination in the Puget Sound region; this has included a sampling effort at over 30 beaches in 12 counties and a gull bolus study.

agricultural runoff (C3), and wastewater (C5, C6, C7 and C8strategies. These strategies outline particular requirements, best management practices, assistance, enforcement, and education efforts to reduce sources of toxic pollutants, pathogens, nutrients, and other contributors to water quality issues in Puget Sound and its watersheds.

Ongoing Programs

Ecology and EPA's water quality programs are key ongoing programs that advance this sub-strategy to address water quality impairments in Puget Sound. These include the programs to develop and implement TMDL studies for dissolved oxygen, temperature, suspended solids, and other water quality contaminants; state and federal water quality financial assistance programs; and state and local non-point source control programs. Puget Sound-specific funding to advance this sub-strategy may be available from the Pathogens Lead Organization grant award from EPA to DOH and Ecology and the Toxics and Nutrients Lead Organization grant award from EPA to Ecology.

Overall, there is a backlog of TMDLs needing to be completed, and Ecology is also in the process of prioritizing future TMDL studies and implementation plans. Ecology's ongoing TMDL development and implementation activities in Puget Sound include the following:

TMDL Development (Continuing work to complete a TMDL)

- Bacteria TMDLs for Sinclair-Dyes Inlets and Liberty Bay
- Dissolved Oxygen TMDL for Clark's Creek
- Temperature TMDLs for Cranberry, Johns, Mill, and Soos Creeks
- pH TMDL for White River
- Multi-parameter TMDL for Deschutes River/Budd Inlet

TMDL Implementation (Ongoing staff support for implementation plan activities for a completed TMDL)

- Bacteria TMDLs for Henderson Inlet Watershed, Puyallup River, Skokomish River, Nisqually/McAllister Creek, Oakland Bay, South Prairie Creek, Lower Skagit River Watershed, Samish Basin, Union River, North Creek, Swamp Creek, Piper's Creek, Issaquah Creek Basin, Little Bear Creek, and Fauntleroy Creek
- Temperature TMDLs for Upper White River, Skagit River, Snoqualmie River, Green River, and Newaukum Creek
- Ammonia TMDL for Duwamish and Lower Green Rivers
- Phosphorus TMDLs for Campbell and Erie Lakes, Lake Sammamish, Lake Ballinger, Cottage Lake, Lake Sawyer, and Fenwick Lake
- Water bodies with multiple TMDLs:
    - Bacteria and temperature TMDLs for tributaries to Totten, Eld, and Skookum Inlets
    - Multi-parameter and temperature TMDLs for Stillaguamish River
    - Multi-parameter and bacteria TMDLs for Snoqualmie River
    - Biological oxygen demand and ammonia TMDLs for Snohomish River estuary and bacteria TMDL for Snohomish River tributaries
- Bacteria, dissolved oxygen, and temperature TMDLs for the Bear-Evans watershed

Other Studies

- South Puget Sound Dissolved Oxygen Study (It has not been decided whether this study will result in a TMDL or if nutrient reductions will be made directly through the NPDES permit process.)
- Quartermaster Harbor Dissolved Oxygen Study (Ecology has determined that a TMDL is not needed, but other appropriate, but less resource intensive actions will be taken.)

Key Ongoing Program Activities

- Ecology will continue ongoing work to complete TMDL assessments for high-priority water bodies in Puget Sound watersheds. Ecology also will continue to support implementation plan activities for completed TMDLs for Puget Sound and adjacent watersheds.
- Ecology will complete the South Sound Dissolved Oxygen Study by August 2012. If the study shows that something needs to be done to protect dissolved oxygen levels in South Puget Sound, Ecology will initiate a plan to improve water quality. Ecology will complete the Puget Sound Dissolved Oxygen Model in 2012, which will identify any other areas of concern in Puget Sound.
- Ecology will accelerate other ongoing efforts, including prioritizing watersheds needing TMDLs, to identify areas where enhanced wastewater treatment may be needed. In Puget Sound, results from TMDLs and water cleanup plans for Budd Inlet/Deschutes River will be available in 2013.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs.

C11.2 Clean up contaminated sites within and near Puget Sound.

This sub-strategy helps reduce the harm caused by toxic chemicals in the Puget Sound ecosystem by cleaning up contaminated sites, focusing on aquatic sites with contaminated sediment and contaminated upland sites near marine and freshwater in the Puget Sound basin. Sediment sites are contaminated with chemicals that have built up over time. These pollutants can enter the food chain and contaminate fish, shellfish, seals, orcas, and humans that eat the fish and shellfish. Sediment sites also contain contaminants that harm or kill the benthic community affecting the aquatic ecosystem and food sources of other animals. Contaminated sites along Puget Sound shorelines and in upland areas of watersheds also contribute to pollution in Puget Sound, since stormwater runoff from those sites can contain toxic chemicals and contaminants can leach into groundwater. Several regulatory programs govern the cleanup of contaminated sites, including the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, known as Superfund) for cleanup of hazardous waste sites and the Resource Conservation and Recovery Act (RCRA) governing the management and disposal of wastes, as well as the state cleanup program administered under the Model Toxics Control Act (MTCA) and the state Sediment Management Standards. Washington DNR oversees cleanup activities on state-owned aquatic lands, while Ecology is the primary regulatory authority for other sediment and upland cleanup efforts.

Cleanup activities are made more effective and efficient by efforts to (1) integrate with source control (e.g., in agency water quality programs) to facilitate and protect investments in cleanup, and (2) link cleanup activities and habitat restoration efforts. This linkage can be accomplished through Shoreline Management Act (SMA) restoration plans, Natural Resource Damage Assessment actions, and Water Resource Inventory Area (WRIA) restoration actions. However, there are significant barriers to optimally integrating source control, cleanup, and restoration activities—for example, source control efforts on private property (e.g., private pipes that connect to sewer systems) tend to be limited, funding is very limited for SMA and WRIA activities (among other agency programs), and NRDA trustees can be resistant to accept habitat related to cleanup sites as creditable habitat for NRDA purposes.

Since 1988, a total of 767 contaminated sites (both upland and sediment sites) have been cleaned up within a half mile of Puget Sound, including nearly 100 since the Puget Sound Initiative began in 2006. A specific emphasis has been placed on contaminated sediment sites in Puget Sound. Eighty-six percent (93 of 108) of the known contaminated sediment sites in Puget Sound have been cleaned up or are in the process of being cleaned up.[20] One hundred percent of publicly funded toxic site cleanups are currently on schedule, exceeding the 90 percent target. The number of cleanups that are completed each year has been declining over time, however. One contributor to this decline may be the reduced availability of private-sector funding to voluntarily clean up sites; another factor may be that many sites that had cleanup activities initiated in the late 1990s and 2000s have now entered extended and often contentious public and agency review periods.

One of the ways that contaminated soils and sediment can accumulate in certain areas of Puget Sound is through disposal of dredged material. Dredging supports site cleanup activities or other purposes, such as navigation and maritime commerce. The Washington Dredged Materials Management Program, an interagency program of the U.S. Army Corps of Engineers (Seattle District), EPA Region 10, Ecology, and Washington DNR, works to facilitate navigation and marine commerce while also protecting the aquatic environment. DNR manages and monitors 12 aquatic land disposal sites for dredged materials on state-owned aquatic land, including eight in Puget Sound and the Strait of Juan de Fuca. Statewide, annual volumes of dredged material disposal range from 120,000 cubic yards to over 1.5 million cubic yards. The program implements sediment sampling, chemical and biological testing, and test interpretation to evaluate the suitability of dredged material before approving it for in-water disposal.

Ongoing Programs

Major ongoing programs related to this sub-strategy include Ecology's Toxics Cleanup Program and EPA's cleanup programs including Superfund and RCRA. These programs include targeted work within the Puget Sound basin as well as base program cleanup activities that occur elsewhere around the state and nation. Funding for contaminated site cleanup comes from the federal Superfund program, the State and Local Toxics Control Accounts established by state law, and responsible parties. Efforts are underway to update the fish consumption rate used for state cleanups MCTA; this will result in changes to sediment cleanup and other standards.

One of initiatives highlighted in EPA's 2011–15 Strategic Plan is an Urban Waters effort in which the cleanup and reuse of contaminated land in urban watersheds is coordinated with regional water quality improvement efforts including TMDLs, CSO long term control plans, and green infrastructure to reduce stormwater pollution, thereby connecting source-control efforts with cleanup and restoration efforts.

[20] Information provided by Ecology Toxics Cleanup Program, September 2011.

Ecology's Urban Waters Initiative, which originated with $2.7 million in funding from the State Legislature in 2007, focuses specifically on addressing the contamination of three major urban waters—the Lower Duwamish and Commencement Bay in Puget Sound, as well as the Spokane River. Federal, state, tribal, and local cleanup activities are also occurring throughout the Puget Sound region, including major cleanup locations in Bellingham, Bremerton, and Elliott Bay and the Lower Duwamish Waterway in the Seattle area. In Bellingham Bay, for example, a partnership of 15 federal, state, tribal, and local stakeholders are working to expedite sediment cleanup, source control, and habitat restoration for cleanup sites around the bay through the Bellingham Bay Demonstration Pilot organized by Ecology in 1996. Ecology has also identified a series of "priority bays" for accelerated cleanup and restoration efforts for the Puget Sound Initiative, these include:

- Anacortes Area (Fidalgo/Padilla Bays)
- Budd Inlet
- Dumas Bay
- Everett Area (Port Gardner Bay)
- Oakland Bay
- Port Angeles Bay
- Port Gamble Bay

In recent years, funding set aside for the State and Local Toxics Control Accounts to support remediation and related activities has also been used to support other causes related to the general fund. For the 2011–13 fiscal biennium, for example, the state legislature specified that the Local Toxics Control Account could be used for shoreline update grants and actions for reducing public exposure to toxic air pollution; this means that there has been less money remaining to support site cleanup activities.

Key Ongoing Program Activities

- Ecology will continue to implement ongoing, high-priority, state-funded remediation and cleanup projects, keeping at least 90 percent of Remedial Action Grant, Puget Sound Initiative, and Clean Sites Initiative projects on schedule.
- Performance measures for EPA include number of remedial action projects completed at Superfund National Priority List sites, number of Superfund remedial site assessments completed, number of brownfields properties cleaned up using brownfields funding (and other brownfields measures), and RCRA cleanup measures such as control migration of contaminated groundwater and complete construction of final remedies.
- Ecology will continue to work with other organizations to identify, clean up, and restore contaminated sites located within one-half mile of Puget Sound. This includes the following "priority bays" for the Puget Sound Initiative: Anacortes Area (Fidalgo/Padilla Bays), Budd Inlet, Dumas Bay, Everett Area (Port Gardner Bay), Oakland Bay, Port Angeles Bay, and Port Gamble Bay. It also includes the following other major Puget Sound cleanup locations: Bellingham Bay, Bremerton area (Port Washington Narrows), Elliott Bay, and Lower Duwamish Waterway. Ecology will consult with DNR regarding cleanup activities on state-owned aquatic lands. Ecology will also ensure that these and other cleanup sites within the Puget Sound area have post-construction monitoring plans in place that provide data on the effectiveness of cleanup actions over time.
- Ecology with state and local partners will work to maintain adequate funding to assure continued, timely cleanup and remediation of toxic sites. Assure that Ecology is able to provide

an appropriate level of state match to approved Remedial Action Grant projects and that the LTCA is protected for its intended statutory purposes.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs.

Local Actions

The South Central area identified the restoration and protection of the Local Toxics Account under the Model Toxics Control Act (MTCA) to continue cleanup and remediation of toxic sites as a priority action. This includes a component on education legislators about the importance of assuring adequate state funding is available to move remedial actions forward in a timely manner.

C11.3 Restore and protect water quality at swimming beaches and recreational areas.

Swimming in water contaminated with pathogens and other pollutants can cause illness in humans, as can contact with contaminated water through water-based recreational activities such as surfing, paddle boarding, kayaking, kite boarding, and scuba diving. Water at beaches can be contaminated by fecal matter, which can contain harmful bacteria, parasites, and viruses. Sources of contamination vary and include improperly disposed diapers or animal waste, stormwater runoff containing human or animal waste, malfunctioning septic systems or sewage treatment plants, and CSOs (issues with stormwater pollution, on-site sewage systems, and centralized wastewater treatment systems are discussed in strategies C5–C8. Marine waters can be contaminated through pollution carried by freshwater streams as well as through other pathways. While swimming beaches are most often used by bathers during warmer months of the year, other popular water-based recreational activities like surfing, scuba diving, and kite boarding occur throughout the year in Puget Sound. As noted in the Challenge section above, 26 percent of monitored marine beaches in Puget Sound failed to meet water quality standards in 2010, and others have failed to meet the standards in some of the last few years.

Ongoing Programs

Ecology's and EPA's water quality programs, including the programs to develop and implement TMDL studies, state and federal water quality financial assistance programs, and state and local non-point source control programs are key ongoing programs that advance this sub-strategy. Under the TMDL program, Ecology completes a Water Quality Assessment for EPA every two years that produces a list of water bodies (called a 303[d] list) that do not meet water quality standards. In 2010, this assessment focused on marine waters, and in 2012 the assessment will focus on fresh water. The DOH- and Ecology-administered BEACH program, as noted above, is the primary state program for monitoring and notification of water quality contamination at marine beaches.

Beach environmental Assessment, Communication & Health Program

Ecology and DOH jointly administer the Beach Environmental Assessment, Communication, & Health (BEACH) program to protect people who enjoy Washington's saltwater beaches. The BEACH program monitors marine beaches for fecal bacteria, notifies the public when the results are high, and educates the public on how to avoid getting sick from playing in saltwater. There is no comparable statewide program for freshwater beaches; however, local public health agencies may have their own programs for freshwater areas. This sub-strategy helps ensure that swimming and other contact recreational activities in both marine and fresh waters in Puget Sound does not pose risks to human health. It provides for corrective actions to address pollution problems that cause swimming beaches and other contact recreation areas to not meet water quality standards for pathogens or other forms of contamination.

Near-Term Actions

C11.3 NTA 1: **Ecology and DOH, and the Steering Committee for the Puget Sound Assessment and Monitoring Program, will develop a program for coordinated environmental monitoring and notification of public health threats from contaminated water at freshwater swimming beaches. The Steering Committee will discuss a proposed approach for a beach monitoring program for the Puget Sound region by 2014.**

Performance measures: Development and adoption of a freshwater beach assessment and monitoring program

C11.3 NTA 2: **Ecology and DOH will evaluate options for focusing or prioritizing the marine BEACH program to address potential water-contamination issues faced by all recreational users of Puget Sound, including surfers, paddle boarders, kayakers, kite boarders, and scuba divers. The agencies will expand the BEACH program or take other appropriate actions to address the issues of non-swimming recreational users by 2013.**

Performance measures: Program expanded or not or other control measures instituted

In addition, near-term actions to address wastewater pollution, a key source of contamination of swimming beaches, are discussed in strategies C5–C8 Sub-strategies C11.1 (covering TMDLs) and C11.4 (covering local and tribal pollution identification and control programs) also are very important for addressing water quality and public health issues at swimming beaches and recreational areas.

C11.4 Develop and implement local and tribal PIC programs.

Local agencies and tribes across Puget Sound implement pollution identification and correction (PIC) programs to determine the causes and sources of water pollution in specific geographical areas, and to take corrective actions to address the pollution sources, such as outreach and education, technical assistance, incentives for best management practices, and enforcement. For example, the Kitsap County Health District's PIC program, which is funded by the County's Surface and Stormwater Management program and grants from Ecology, developed a 2010 priority area work list to identify priority PIC project locations to address bacterial water pollution, thereby protecting public health, protecting shellfish resources, and restoring surface water quality. This sub-strategy helps ensure that Puget Sound marine

and freshwaters support aquatic life and provide for other beneficial uses by ensuring that pollution sources are identified and corrective actions are taken to address problems. These activities are closely associated with state requirements for local health jurisdictions to carry out comprehensive plans to ensure that on-site sewage systems are properly managed to protect public health and sensitive waters; sub-strategies and actions related to on-site sewage systems are further discussed in strategy C5.

Ongoing Programs

With funding from EPA available from November 2011 through September 2014, DOH Ecology are offering grants to county governments, local health jurisdictions, and tribal governments adjacent to Puget Sound to establish or enhance PIC programs to identify and address pathogen and nutrient pollution from a variety of nonpoint sources, including on-site sewage systems, farm animals, pets, sewage from boats, and stormwater runoff. Although this grant opportunity is focused on pathogens, PIC programs can also be an important way that local communities can monitor and protect against other pollutants, including toxic chemicals. The goal with federal funding of PIC programs is support for the establishment and/or enhancement of programs that can eventually be sustainable programs that integrate across various local water quality programs, interests, and concerns. Local and tribal water quality improvement programs funded from utility fees, Ecology and EPA's water quality programs, and other water quality financial assistance may have similar objectives of identifying and addressing water pollution issues.

Key Ongoing Program Activities

- Local jurisdictions and tribes will establish or enhance PIC programs to identify and address pathogen, nutrient, and toxic pollution problems in specific geographical areas that may arise from a variety of sources, including on-site sewage systems, stormwater runoff, agricultural sources, and other nonpoint sources. Grant funding available through 2014 can help these agencies to design programs that integrate across multiple local water quality interests.
- Ecology will continue to provide guidance and financial assistance to local governments to establish and carry out PIC programs.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs.

C11.5 Develop and implement a monitoring and evaluation program.

The Puget Sound toxics loadings study was critical to understanding the current state of water quality threats to Puget Sound, the amounts of different toxic chemicals being released to Sound, key sources of those pollutants, and where significant data gaps exist. The strategies and actions in the Action Agenda are guided by both the recovery targets and this baseline information about threats to the recovery targets. While TMDL cleanup plans, SIPs for air quality improvements, and other programs can help chart the course for improvements, a robust system of effectiveness monitoring is needed to ensure that the threats to Puget Sound water quality are being reduced and recovery targets are being achieved. This sub-strategy focuses on establishing a program for monitoring and evaluating the effectiveness of water-quality improvement efforts associated with Puget Sound recovery.

Near-Term Actions

C11.5 NTA 1: **PSP will work with Ecology, DNR, DOH, other key implementation agencies, and stakeholders for the Action Agenda to develop a program for monitoring the effectiveness of activities to reduce water pollution to Puget Sound and monitoring progress towards ecosystem recovery targets for water quality. (This will be done through the activities described in the cross-cutting strategy D, Implement a Coordinated, Integrated Ecosystem Monitoring Program.)**

Performance measure: Effectiveness monitoring program established or not

Emerging Issues and Future Opportunities

Specific longer-term activities to address Puget Sound water quality impairments that were identified during the Action Agenda update process include the following:

- **Microplastics**. Ecology will work with the Port Townsend Marine Science Center and other partners to continue to assemble information on plastics pollution and microplastics, including any data specific to Puget Sound, and will recommend actions to (1) better understand the threats to Puget Sound, and then (2) address the highest priority problems.
- **Dredged Materials Management**. DNR, in coordination with other agencies involved in the Dredged Materials Management Program (Ecology, EPA Region 10, and U.S. Army Corps of Engineers Seattle District), will determine whether any changes are needed to the evaluation standards for dredged material disposal (including sediment sampling and chemical/biological testing requirements) to reduce toxic chemicals entering Puget Sound, based on the findings of the Puget Sound Toxic Loadings Study. The Dredged Materials Management Program agencies will then adopt these standards.
- **Additional Puget Sound Initiative Sites**. Ecology will evaluate whether additional contaminated sites should be added to the list of priority sites for cleanup and restoration for the Puget Sound Initiative. This could include examining contaminated sites along the Strait of Juan de Fuca that may threaten aquatic life and public health. As appropriate, Ecology will initiate cleanup planning, implementation, and monitoring activities for those contaminated areas.
- **Interagency Coordination**. Ecology, DNR, DFW, and other agencies will seek to remove barriers and conflicts between programs with similar goals—including the MTCA and NRDA cleanup programs and the SMA and WRIA restoration efforts—to facilitate improved integration of habitat restoration and cleanup activities in and near Puget Sound. This will include examining whether NRDA credits can be more easily obtained for work completed under other restoration and cleanup programs.

Target View: Toxics in Fish

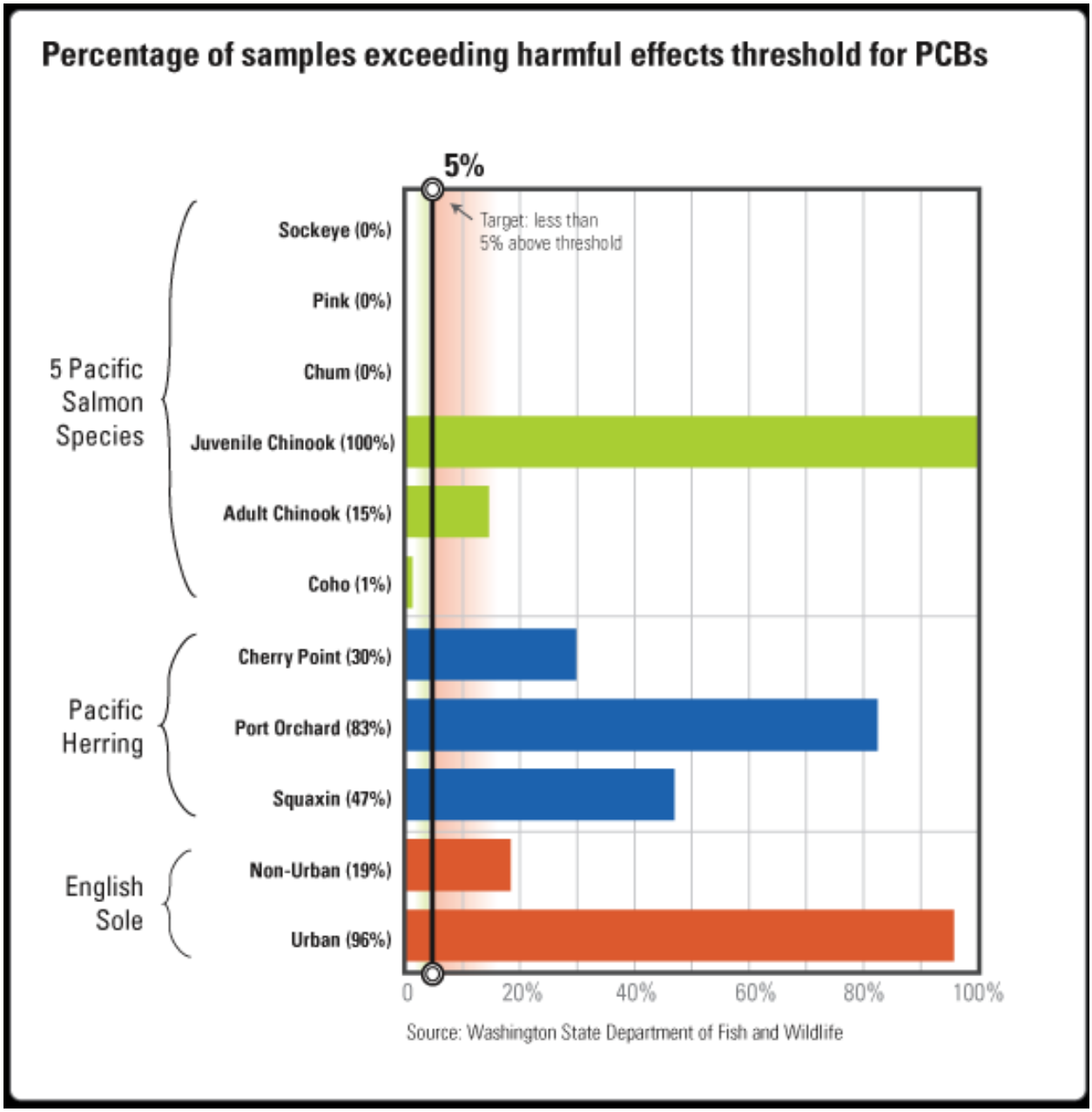
Toxic pollutants in Puget Sound bays, rivers and streams can show up in native fish, causing them to become diseased and posing a health threat to humans if consumed. One of the most worrisome pollutants in the Puget Sound ecosystem is a group of chemicals called PCBs (polychlorinated biphenyls). Concern over these chemicals in Puget Sound is high because they are toxic, they last for a long time in the ecosystem, and their levels increase in predators as the chemicals move up the food chain. Measuring these pollutants in fish tissues tells us whether present-day levels are harmful to the fish or the predators that consume them, and whether they are safe for us to eat.

PCBs were originally used in many industrial applications, but were banned in the US in the 1970s. Although PCB levels have decreased in some fish since then, they remain high in certain areas and species. In Puget Sound, PCBs are high in bottom fish that live near urban or industrial areas with contaminated sediments. Surprisingly, PCBs are also high in many species from Puget Sound's pelagic, or open-water food web, including herring, salmon, seals, and orcas. Exposure to PCBs may be harming these species, and concern over this contamination has led the Washington Department of Health to issue consumption advisories for some Puget Sound salmon and bottom fish. Scientists have been tracking PCBs and other chemicals in Puget Sound fish since 1989, and have established threshold limits for these chemicals in fish tissues. These thresholds provide a guideline for the level of toxic chemicals that fish can tolerate, before they become diseased or show other harmful effects.

There is a suite of individual targets that together comprise the recovery target for toxics in fish. They are:

- Reducing levels of PCBs and related compounds in salmon, herring, and English sole (a bottom-dwelling flatfish) below:
    - a threshold related to fish health, and
    - a threshold related to human health.
- Reducing concentrations of two other classes of toxic contaminants (abbreviated as PAHs and EDCs), in herring and English sole below several different thresholds for harmful effects in fish.

Current data on contaminants in Puget Sound fish is displayed in the graph below.

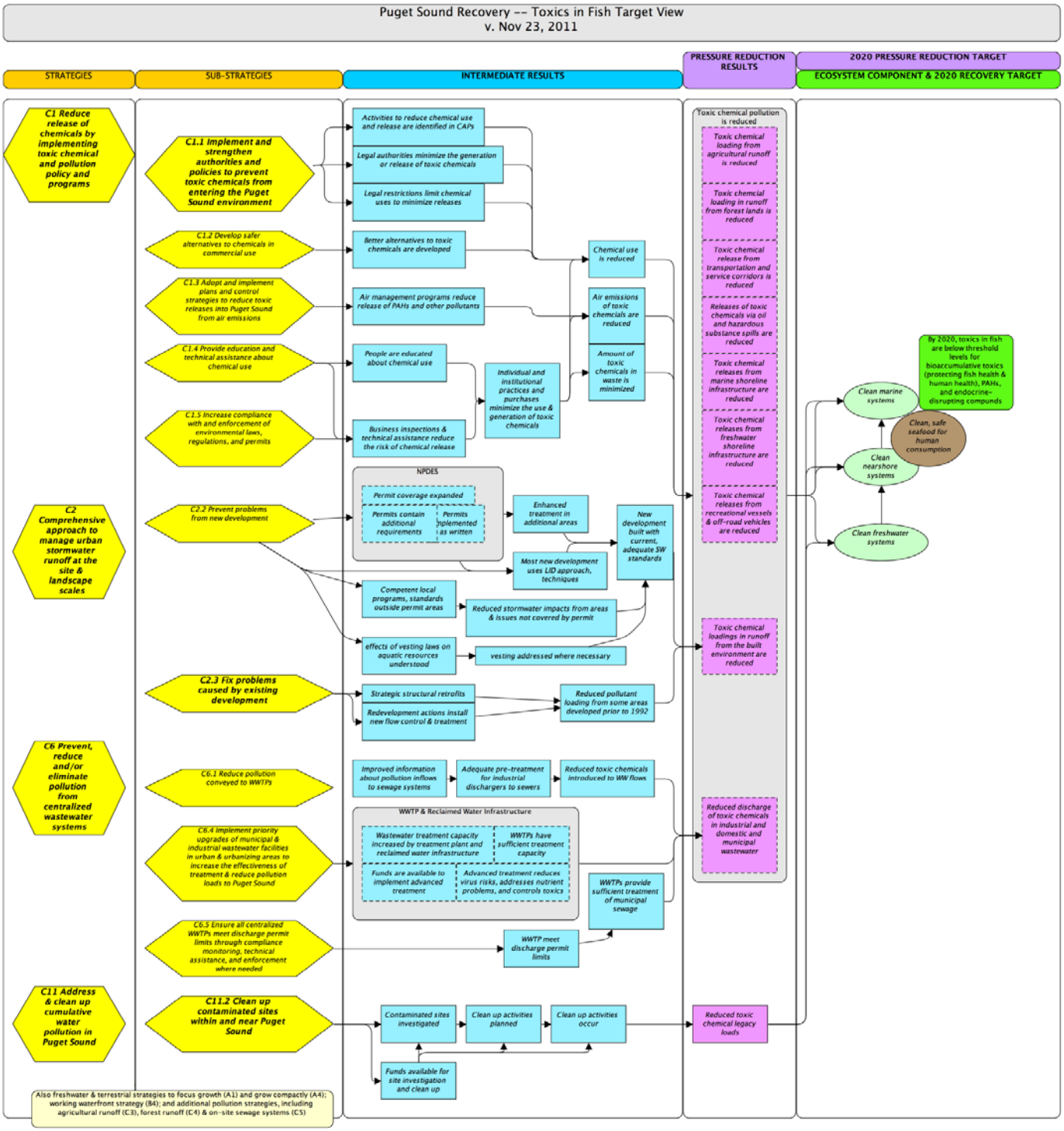


Average concentration of PCBs as a summation of congeners, compared to a tissue threshold of 2400 ng PCBs/g lipid. English sole data from 2007, 2009, n=137; herring data from 2007-2010, n=70; Coho data from 2006, 2008, n=86; adult Chinook data from 2003, 2004, n=48; juvenile Chinook data from 2010, n=5; pink, chum, and sockeye salmon data from 2003, 2004, n=5 each.

The three Action Agenda strategies most related to achieving the recovery target for toxics in fish are:

- Implement and strengthen authorities and programs to prevent toxic chemicals from entering the Puget Sound environment (C1.1)
- Clean up contaminated sites within and near Puget Sound (C11.2)
- Fix problems caused by existing development (structural upgrades; regular and enhanced maintenance) (C2.3)

In the following results chain, or logic model, yellow polygons identify strategies and actions from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery targets.



Target View: Marine Sediment Quality

In a healthy, well-functioning estuary, marine sediments support an important and healthy biological community. But in Puget Sound and many estuaries around the world, sediments have become contaminated with toxic chemicals from industrial discharges, contaminated run-off from urban streets and roads, discharges from wastewater treatment plants, agricultural and forest chemicals carried down rivers and streams, oil spills, and even chemicals carried long-distances through the atmosphere that eventually fall out of the sky with our rain. As the forests around Puget Sound have been logged, streams and rivers channelized, and towns and cities built up, the amount, rate, and quality of sediment deposited into Puget Sound has changed dramatically.

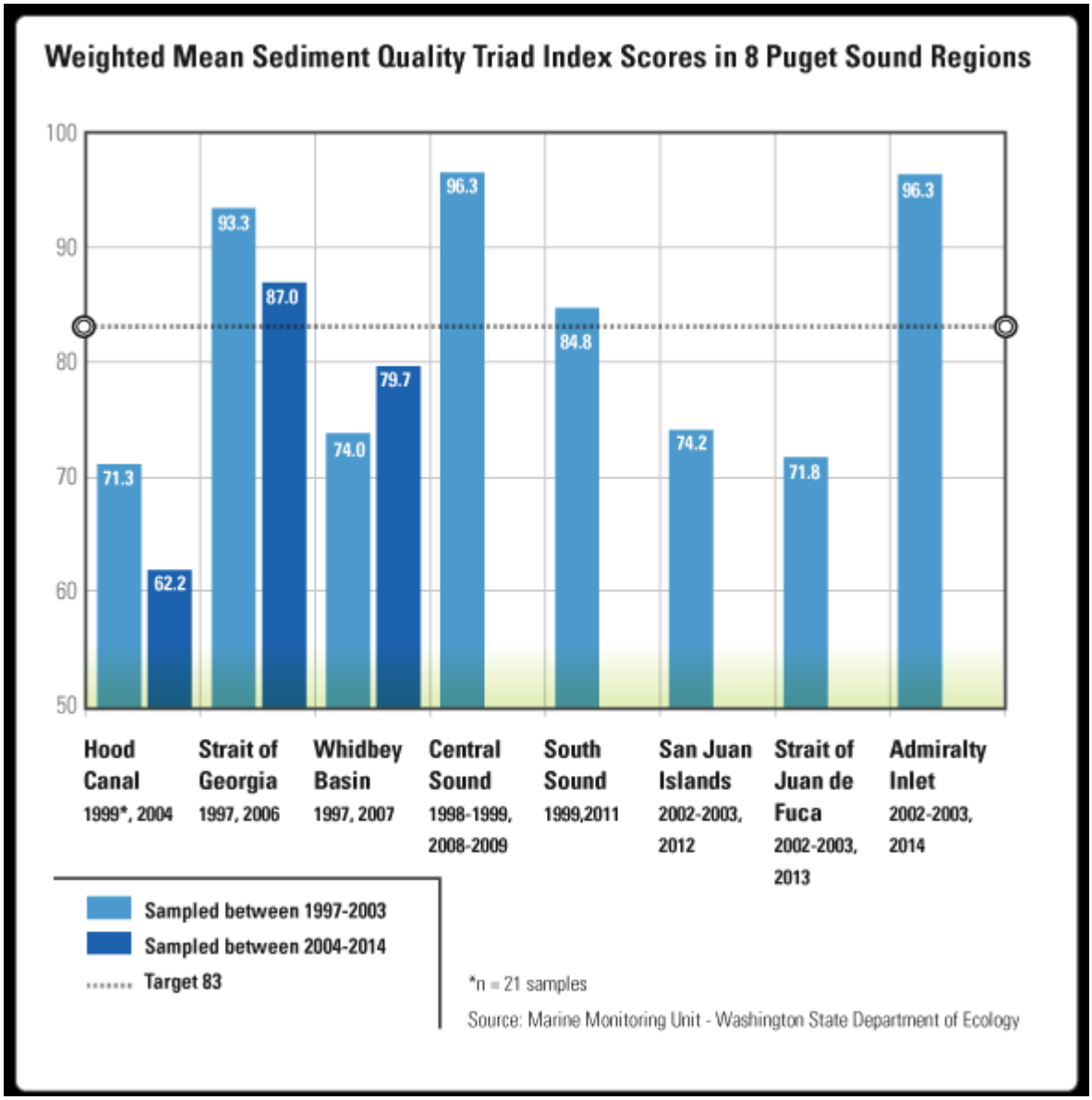
A functioning, resilient ecosystem includes sediment quality that supports functioning, healthy communities of sediment dwelling invertebrates. The 2020 recovery target for marine sediment quality is:

By 2020, all Puget Sound regions and bays should:

- Have sediment chemistry measures reflecting "minimum exposure", as defined by having a Sediment Chemistry Index (SCI) score of >93.3.
- Have combined measures of sediment chemistry, toxicity, and the health of bottom-dwelling marine life reflecting "unimpacted" conditions, as defined by having a Sediment Quality Triad Index (SQTI) score of >83.
- Have no measurements exceeding the Sediment Quality Standard values set in Washington State

All eight regions of Puget Sound monitored from 1997-2009 demonstrated minimum exposure to toxic chemicals in sediment. Four of eight regions demonstrated unimpacted benthic invertebrate communities. The other four regions demonstrated likely impacted communities. Two of four Puget Sound urban bays monitored from 1998"2010 demonstrated minimum exposure to toxic chemicals in sediment. The other two urban bays that have been monitored showed improving chemistry index scores but low levels of exposure. Benthic community results are available for only three urban bays: One appears unimpacted, one has likely impacted communities and the third is on the border of unimpacted-likely impacted.

The current data on marine sediment chemistry is shown in the graph below.

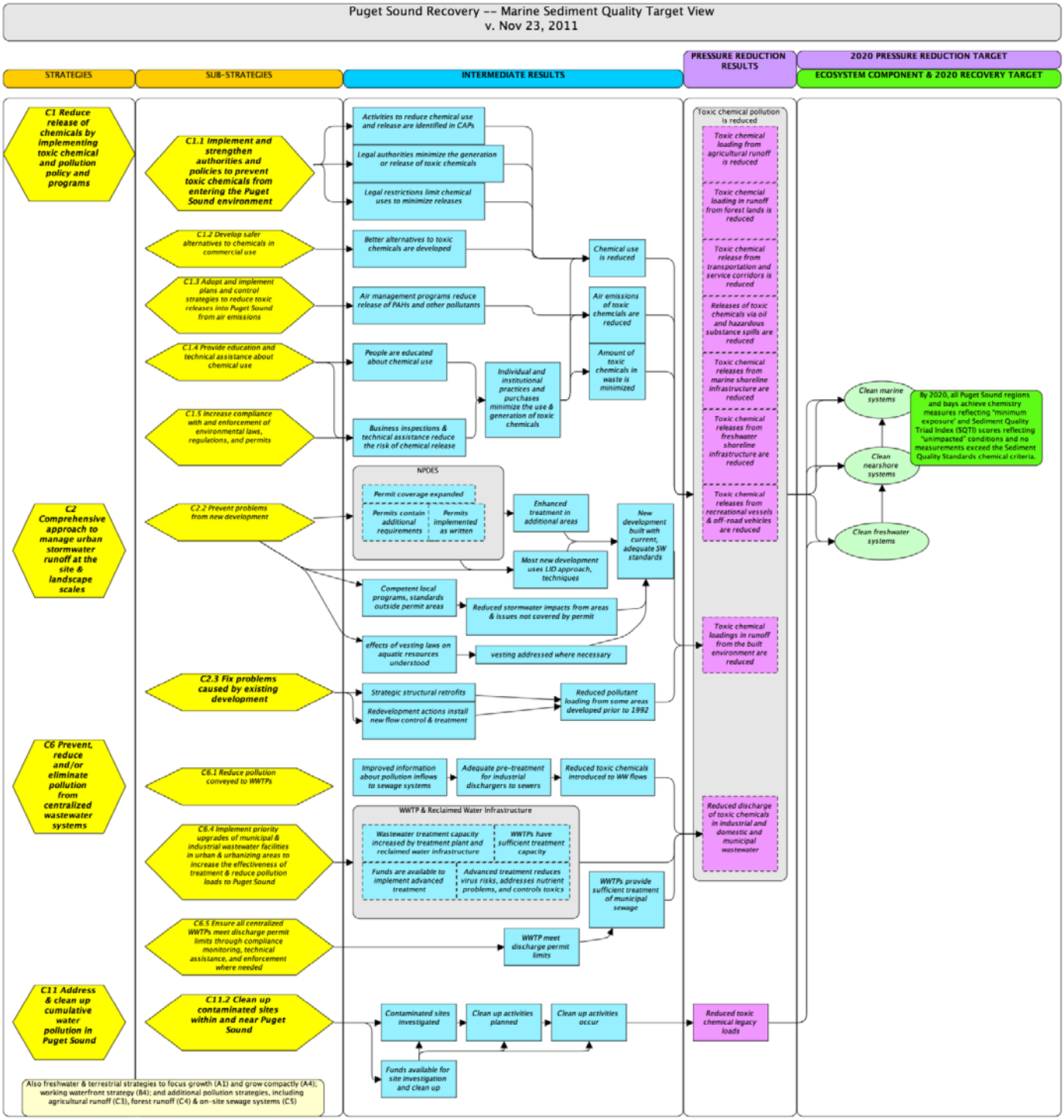


The light blue bars show the overall SQTI scores for samples collected in eight sediment monitoring regions sampled between 1997-2003. During that period, four of the eight regions sampled met or exceeded the target value for sediment quality. The dark blue bars show results for three regions re-sampled since 2004. Of those, two (Hood Canal and Strait of Georgia) showed declining SQTI scores due to poor biological community values. Only one of the three (Whidbey Basin) showed an improvement. Results are not yet available for Central or South Puget Sound. The remaining basins are scheduled for sampling in 2012-2014.

The three Action Agenda strategies related to achieving the recovery target for marine sediment quality are:

- Implement and strengthen authorities and programs to prevent toxic chemicals from entering the Puget Sound environment (C1.1)
- Clean up contaminated sites within and near Puget Sound (C11.2)
- Fix problems caused by existing development (structural upgrades; regular and enhanced maintenance) (C2.3)

In the following results chain, or logic model, yellow polygons identify strategies and actions from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery targets.


Puget Sound Recovery -- Marine Sediment Quality Target View
v. Nov 23, 2011
STRATEGIES
SUB-STRATEGIES
INTERMEDIATE RESULTS
PRESSURE REDUCTION RESULTS
2020 PRESSURE REDUCTION TARGET
ECOSYSTEM COMPONENT & 2020 RECOVERY TARGET
C1 Reduce release of chemicals by implementing toxic chemical and pollution policy and programs
C1.1 Implement and strengthen authorities and policies to prevent toxic chemicals from entering the Puget Sound environment
C1.2 Develop safer alternatives to chemicals in commercial use
C1.3 Adopt and implement plans and control strategies to reduce toxic releases into Puget Sound from air emissions
C1.4 Provide education and technical assistance about chemical use
C1.5 Increase compliance with and enforcement of environmental laws, regulations, and permits
C2 Comprehensive approach to manage urban stormwater runoff at the site & landscape scales
C2.2 Prevent problems from new development
C2.3 Fix problems caused by existing development
C6 Prevent, reduce and/or eliminate pollution from centralized wastewater systems
C6.1 Reduce pollution conveyed to WWTPs
C6.4 Implement priority upgrades of municipal & industrial wastewater facilities in urban & urbanizing areas to increase the effectiveness of treatment & reduce pollution loads to Puget Sound
C6.5 Ensure all centralized WWTPs meet discharge permit limits through compliance monitoring, technical assistance, and enforcement where needed
C11 Address & clean up cumulative water pollution in Puget Sound
C11.2 Clean up contaminated sites within and near Puget Sound
Activities to reduce chemical use and release are identified in CAPs
Legal authorities minimize the generation or release of toxic chemicals
Legal restrictions limit chemical uses to minimize releases
Better alternatives to toxic chemicals are developed
Air management programs reduce release of PAHs and other pollutants
People are educated about chemical use
Business inspections & technical assistance reduce the risk of chemical release
Individual and institutional practices and purchases minimize the use & generation of toxic chemicals
Chemical use is reduced
Air emissions of toxic chemicals are reduced
Amount of toxic chemicals in waste is minimized
NPDES
Permit coverage expanded
Permits contain additional requirements
Permits implemented as written
Enhanced treatment in additional areas
Most new development uses LID approach, techniques
New development built with current, adequate SW standards
Competent local programs, standards outside permit areas
Reduced stormwater impacts from areas & issues not covered by permit
effects of vesting laws on aquatic resources understood
vesting addressed where necessary
Strategic structural retrofits
Redevelopment actions install new flow control & treatment
Reduced pollutant loading from some areas developed prior to 1992
Improved information about pollution inflows to sewage systems
Adequate pre-treatment for industrial dischargers to sewers
Reduced toxic chemicals introduced to WW flows
WWTP & Reclaimed Water Infrastructure
Wastewater treatment capacity increased by treatment plant and reclaimed water infrastructure
WWTPs have sufficient treatment capacity
Funds are available to implement advanced treatment
Advanced treatment reduces virus risks, addresses nutrient problems, and controls toxics
WWTPs provide sufficient treatment of municipal sewage
WWTP meet discharge permit limits
Contaminated sites investigated
Clean up activities planned
Clean up activities occur
Funds available for site investigation and clean up
Toxic chemical pollution is reduced
Toxic chemical loading from agricultural runoff is reduced
Toxic chemcial loading in runoff from forest lands is reduced
Toxic chemical release from transportation and service corridors is reduced
Releases of toxic chemicals via oil and hazardous substance spills are reduced
Toxic chemical releases from marine shoreline infrastructure are reduced
Toxic chemical releases from freshwater shoreline infrastructure are reduced
Toxic chemical releases from recreational vessels & off-road vehicles are reduced
Toxic chemical loadings in runoff from the built environment are reduced
Reduced discharge of toxic chemicals in industrial and domestic and municipal wastewater
Reduced toxic chemical legacy loads
Clean marine systems
Clean nearshore systems
Clean freshwater systems
By 2020, all Puget Sound regions and bays achieve chemistry measures reflecting "minimum exposure" and Sediment Quality Triad Index (SQTI) scores reflecting "unimpacted" conditions and no measurements exceed the Sediment Quality Standards chemical criteria.
Also freshwater & terrestrial strategies to focus growth (A1) and grow compactly (A4); working waterfront strategy (B4); and additional pollution strategies, including agricultural runoff (C3), forest runoff (C4) & on-site sewage systems (C5)