



South Tacoma Groundwater Protection District Health Impact Assessment

Tacoma-Pierce County Health Department
April 2025



Tacoma-Pierce County
Health Department
Healthy People in Healthy Communities

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Acknowledgments

This Health Impact Assessment is a project of Tacoma-Pierce County Health Department in collaboration with Washington State Department of Health.

Assessment lead: Erin Dilworth, Tacoma-Pierce County Health Department

Email contact: hia@tpchd.org

Tacoma-Pierce County Health Department

- Suzy An
- Jessica Gehle
- Leigh Kronsoble
- Judy Olsen
- Connor Pomeroy
- Maria Sevier
- Cam Solomon
- Emily Turk
- Jerry Wood

Special thank you to Health Department Director Chantell Harmon Reed for her support of this work.

Advisory Group

- Chris Beale
- Chris Brazil
- Kimaria Howard
- Adrienne Jones
- Christney Kpodo
- Mercy Macharia
- Andromeda Robinson
- Heidi Stephens

Other Subject Matter Expertise (SME) provided by:

- City of Tacoma Planning and Development Services
- Puget Sound Clean Air Agency
- Tacoma-Pierce County Health Department Waste Management Program, On-Site Sewage and Drinking Water Resources Program, and Information Technology Division
- Tacoma Water
- Washington State Department of Ecology
- Washington State Department of Health

Executive Summary

What is a Health Impact Assessment?

The way we build our communities impacts our physical, social, and mental health. The conditions in which we live, or Social Determinants of Health (SDoH), have a far greater impact on our health than traditional medical practices and dollars spent on healthcare. These include exposure to pollution, stable and quality housing, education, access to nutritious foods, and safe places to walk and roll. Consequently, improvements in public health can only occur if we consider the impacts of SDoH in development projects, planning policies, and other government programs in non-health related sectors.

Health Impact Assessments (HIA) serve as a tool to inform decision-makers and the public of the potentially significant impacts—both beneficial and harmful—of a proposed project, policy, or program. Health Impact Assessments have been identified as effective analytical tools for promoting public health by the American Public Health Association, Centers for Disease Control and Prevention, and the National Association of County and City Health Officials, among others.¹⁰³⁻¹⁰⁵ Many technical definitions of HIAs exist, but Tacoma-Pierce County Health Department (Health Department) uses The National Research Council Committee on Health Impact Assessment's:

*HIA is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects.*¹⁰⁶

South Tacoma Groundwater Protection District HIA

City of Tacoma (the City) commissioned this HIA to provide a tool to evaluate the health impacts of the South Tacoma Groundwater Protection District (STGPD) code update.

The STGPD encompasses an area in South Tacoma that sits on top of the Central Pierce County Aquifer Area (Figure 1). This aquifer serves as an important source of drinking water for the City of Tacoma, and the larger Tacoma Water service area. It can supply up to 50% of the City of Tacoma's total water demand during periods of peak summer usage, and around 10% during typical usage.¹ Further, Environmental Protection Agency (EPA) designated this aquifer as a Sole Source Aquifer. The EPA applies this designation to aquifers that supply 50% or more of the drinking water in its service area, and there are no reasonable alternatives if it becomes contaminated.¹⁰²

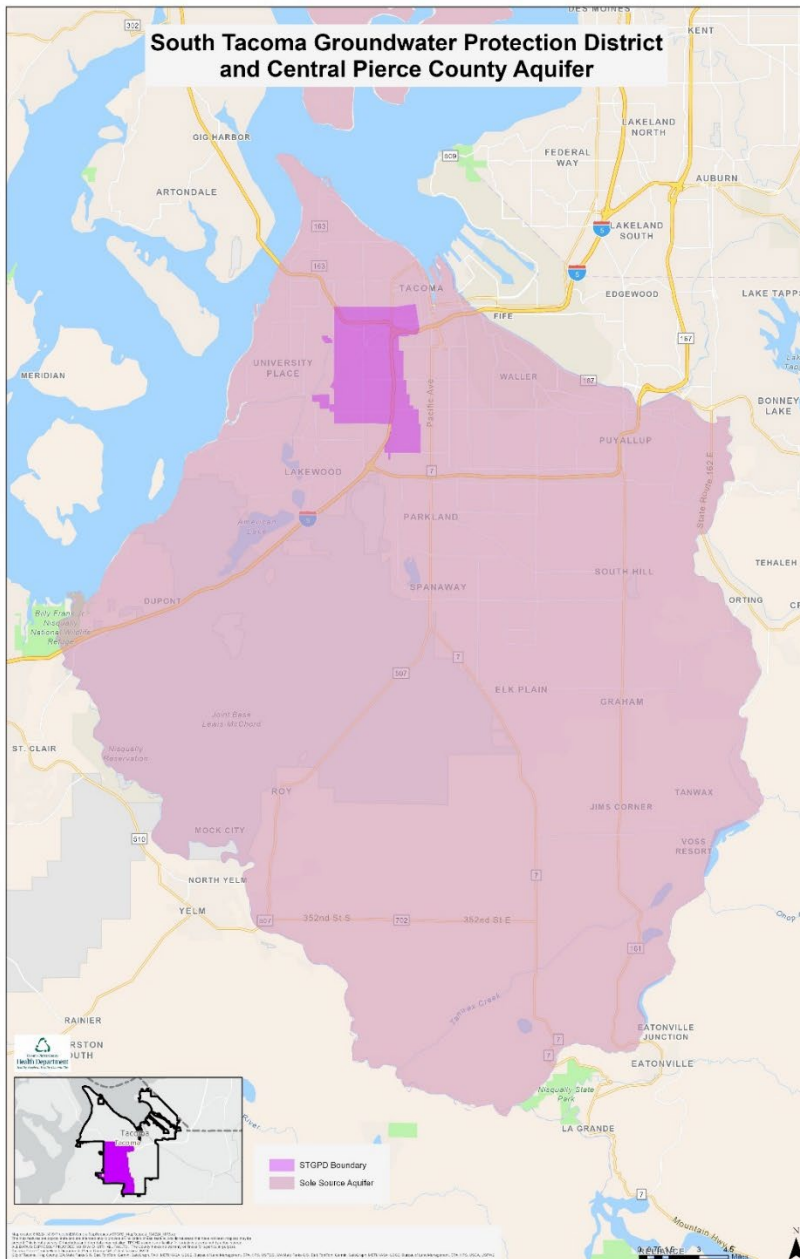


Figure 1. Boundaries of the STGPD within the Central Pierce County Aquifer.

Recognizing the importance of the aquifer resource, the risks posed by current and historical manufacturing and other heavy industry, and historical contamination by hazardous substances in the area, the City established the STGPD in 1988 to protect the aquifer from further contamination.

The purpose of the STGPD code (Tacoma Municipal Code [TMC] 13.06.070.D) is to protect the aquifer by regulating businesses that handle, store, and dispose of hazardous substances, and businesses that infiltrate their stormwater to the soil below. Additional restrictions on high-impact land use types are included to protect public health and safety.

The City initiated amending and updating the STGPD code in 2021. After discussions with Health Department staff, the City included a HIA element in the 2023 update of their STGPD work plan. The Health Department conducted this intermediate-level HIA to sufficiently understand the health impacts of the STGPD, facilitate meaningful community participation, and develop substantive public health recommendations.

City of Tacoma Planning and Development Services staff identified decision points which also helped guide the selection of assessment topics, literature review, and current health characterization:

1. **Should the City's temporary ban on new metal recycling and auto wrecking facilities be permanent?**
2. **Should the City's temporary ban on new underground storage tanks be permanent?**
3. **Are there other use types that should be further regulated or prohibited in the STGPD?**
4. **Should other policies or standards be implemented or updated?**

After careful consideration of the information provided from these inputs, we selected these topics to guide this assessment: drinking water quality and air quality.

Current Health Conditions

Compared to Pierce County, the STGPD Study Area has a higher percentage of:

- People of color.
- People living in poverty.
- People living with a disability.
- Households without a vehicle.
- People who speak English “less than well.”²⁰

Compared to the Pierce County population, people who reside in the STGPD Study Area have higher rates of:

- Asthma prevalence,²¹ asthma-related hospital Emergency Department (ED) visits, and respiratory illness ED visits.²²
- Mortality due to diabetes, circulatory disease, and heart disease.²³
- All-cancer mortality (combined mortality rate for all cancer types).²³
- Mortality due to congenital anomaly.²³
- Premature birth and low birth weight.²⁴

Because residents in the STGPD Study Area experience significantly higher rates of certain health conditions (like asthma and cancer) compared to the larger Pierce County population, they can be more sensitive to certain environmental exposures that could exacerbate symptoms or increase their vulnerability to worsened health outcomes. Further, SDoH investments in the South Tacoma community have been disproportionately low, and South Tacoma has been identified as a community overburdened by air pollution.⁴¹ Consequently, updating the STGPD code to be more protective of human health is one tool the City has to address these health disparities. These findings do not imply that the environmental conditions in and surrounding the STGPD caused these health conditions.

Protecting Public Health by Updating the STGPD Code

While there are no current drinking water violations in Tacoma Water’s system, many sources of potential contamination exist within the STGPD. Due to current protections afforded by the STGPD Code, the risk of contamination may be low, but the impact of contamination would be extremely high, given the vital role the Central Pierce County SSA plays in Tacoma’s drinking water system. Our recommendations reflect the need to more proactively protect this vital resource. An icon or multiple icons accompany each recommendation to indicate what health outcomes could be improved by the implementation of the recommendation.



Respiratory Health



Incidence of Cancer



Digestive Health



Cardiovascular Health



Neurological Health



Endocrine Health



Immune Health



Reproductive and Birth Outcomes

Metal Recycling, Auto-Wrecking, and Metal Manufacturing Facilitiesⁱ, and Steel

Foundries can emit harmful substances in their stormwater and wastewater that if ingested, can be associated with cancer, heart disease, diabetes, poor birth outcomes, and damage to the digestive, endocrine, and reproductive systems. While the air emissions associated with these types of facilities is not regulated by the STGPD, air pollution emitted by these facilities is associated with lung cancer, among other adverse health outcomes.

Recommendation: The City should make the temporary moratorium on metal recycling and auto-wrecking facilities permanent. The updated code should also include a prohibition on the expansion of existing metal recycling and auto wrecking facilities. We also recommend a prohibition on the establishment of new—and expansion of existing—metal fabrication facilities and steel foundries.



Underground Storage Tanks often hold petroleum products and fuel additives, and commonly leak over the course of their useful life. These types of products easily travel through soil and risk contaminating the groundwater below. Many of these substances are known carcinogens, and when ingested are also associated with anemia, problems with the liver, kidneys, and stomach, developmental issues in children, and neurological and reproductive issues in adults.

Recommendation: The City should make the temporary moratorium on new—and the expansion of existing—underground storage tanks permanent, no matter the volume capacity of the tank. The City should permit expansions for the express purpose of repair. This recommendation only applies to businesses that meet criteria for regulation under the STGPD code.



Vehicle Maintenance Facilities handle many hazardous substances like paint, paint strippers, antifreeze, oils, and cleaners, that if handled improperly, can contaminate stormwater, wastewater, and groundwater sources. Adverse health outcomes associated with the ingestion of these substances includes cancer and damage to the circulatory, digestive, endocrine, and reproductive systems. While the air emissions associated with vehicle maintenance facilities is not regulated by the STGPD, air pollution emitted by these facilities is associated with cancer, among other adverse health outcomes.

Recommendation: The City should prohibit new vehicle maintenance facilities in the STGPD. Existing vehicle maintenance facilities regulated by the STGPD Code that wish to relocate or change ownership in the STGPD should be exempt from this prohibition.



ⁱ Metal manufacturing facilities refers to primary and secondary metal industries that manufacture, produce, smelt, or refine ferrous and nonferrous metal from molten materials and machine shops, fabricating, metal processing with etchers and chemicals.

Septic Tanks and Wastewater Treatment Plants can leak and discharge wastewater that can contain PFAS (per- and polyfluoroalkyl substances) and nitrates. Nitrates are potentially carcinogenic, and exposure through drinking water is associated with increased risk of colorectal, bladder, kidney, ovarian, thyroid, and brain cancers, and adverse birth outcomes. PFAS are an emerging contaminant of concern in drinking water because many PFAS easily dissolve in water and many standard wastewater treatment processes do not remove PFAS. PFAS substances can transfer from mother to child both pre- and postnatally. Exposure to PFAS is associated with kidney and testicular cancer.

Recommendation: Prohibit new septic tanks and wastewater treatment facilities in the STGPD.



Dry Cleaning and Industrial Laundry Facilities use and can generate hazardous substances that can contaminate soil and groundwater. In a recent study by Department of Ecology, the pretreated wastewater of industrial laundry facilities showed the highest concentration of certain hazardous substances that if ingested, are associated cancer and damage to the circulatory, digestive, endocrine, immune, nervous, and reproductive systems.

Recommendation: To be most protective of human health, the City should prohibit new dry cleaners and industrial laundry facilities in the STPGD, and not permit any expansion that increases their capacity to handle more hazardous substances. A less protective approach would be to only permit new dry cleaners and industrial laundry facilities that use the safest chemicals.



Landfills can contaminate nearby soil and groundwater by leaking hazardous substances, especially if the landfill is unlined or inadequately lined. In the same Department of Ecology study mentioned above, the pretreated wastewater of landfills showed the second highest concentration of certain hazardous substances that if ingested, are associated cancer and damage to the circulatory, digestive, endocrine, immune, nervous, and reproductive systems.

Recommendation: Prohibit new—and the expansion of the existing—landfill in the STGPD.



Other Policies and Standards like those for stormwater infiltration, impervious surfaces, and tree canopy all have the potential to impact public health but, it is beyond the scope of this HIA to provide technical recommendations for these policies and standards. The Health Department’s Waste Management Program and the representatives from the Washington Department of Health, Washington Department of Ecology, United States Environmental Protection Agency, and the United State Geological Survey may be able to provide more technical expertise in these areas. However, consistent implementation of the current infiltration policy can protect public health by ensuring soil contaminants do not reach our groundwater and limiting impervious surface while enhancing tree canopy has many urban heat and air quality benefits.

Recommendations:

- Require soil contaminant testing for any on-site infiltration.
- Uphold the existing policy of not infiltrating through contaminated soils.
- We can't make specific technical recommendations for a tree canopy standard or impervious surface standard, but we support adoption of such standards.



Protecting Public Health Outside the STGPD Code

We identified multiple health-related issues in this assessment but they can't be addressed in the STGPD Code because of its limited scope and authority. Below, we present recommendations to address these issues through other measures.

Addressing Health Outcomes Associated with Air Quality

Washington Department of Ecology identified South Tacoma as a “community overburdened by air pollution”. Residents of South Tacoma experience higher rates of health outcomes associated with Traffic Related Air Pollution (TRAP), like asthma, cancer, poor birth outcomes, and mortality from heart disease, respiratory disease, and diabetes. The recommendations below address these health outcomes through TRAP mitigation.

Recommendations:

- The City and Health Department should collaborate to begin conversations with the Puget Sound Clean Air Agency on best next steps to adopt an Indirect Source Rule.
- The Health Department should prioritize clean air interventions like air purifiers for residents in South Tacoma that may be at risk for poor birth outcomes or asthma-onset in children.
- The Health Department should support tree planting initiatives in areas of South Tacoma that experience poor air quality.
- The Health Department and City should collaborate on the development and adoption of a residential habitability standard in the Building and Development code that include requirements for mechanical cooling such as air conditioners, or passive cooling features like green rooftops.



A Call for Collaboration

Through this assessment, we identified many health–promoting opportunities for collaboration. If adopted, these measures would enhance consistent implementation of existing regulations and reduce confusion on regulatory authority—which would lead to better public health protections because the groundwater resource would be more proactively protected.

Recommendations:

- The City, Health Department, and Tacoma Water should create a more formal mechanism between the agencies responsible for the implementation of the Stormwater Infiltration Policy, like a Memorandum of Understanding (MOU), to ensure consistent application and implementation.
- The City should collaborate with the Health Department to ensure new businesses, businesses that change use, or businesses that expand their capacity to handle hazardous substances in the STGPD are properly vetted to determine if and how they should be regulated by the STGPD Code.
- All the jurisdictions encompassed by the Central Pierce County Aquifer should collaborate to adopt a consistent set of regulations.
- The Health Department should use this HIA as a resource when it updates its *General Guidance and Performance Standards for the South Tacoma Groundwater Protection District* manual.

Introduction

What is a Health Impact Assessment?

The way we build our communities impacts our physical, social, and mental health. The conditions in which we live, or Social Determinants of Health (SDoH), have a far greater impact on our health than traditional medical practices and dollars spent on healthcare. These include exposure to pollution, stable and quality housing, education, access to nutritious foods, and safe places to walk and roll. Consequently, improvements in public health can only occur if SDoH are incorporated in development projects, planning policies, and other government programs in non-health related sectors.

Health Impact Assessments (HIA) serve as a tool to inform decision-makers and the public of the potentially significant impacts—both beneficial and harmful—of a proposed project, policy, or program. Health Impact Assessments have been identified as effective analytical tools for promoting public health by the American Public Health Association, Centers for Disease Control and Prevention, and the National Association of County and City Health Officials, among others.¹⁰³⁻¹⁰⁵ Many technical definitions of HIAs exist, but Tacoma-Pierce County Health Department (Health Department) uses The National Research Council Committee on Health Impact Assessment's definition:

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Recognizing the importance of the aquifer resource, the risks posed by current and historical manufacturing and other heavy industry, and historical contamination by hazardous substances in the area, the City of Tacoma established the South Tacoma Groundwater Protection District in 1988 to protect the aquifer from further contamination.

The purpose of the STGPD code (Tacoma Municipal Code [TMC] 13.06.070.D) is to protect the aquifer by regulating businesses for the handling, storage, and disposal of hazardous substances and for businesses that

infiltrate their stormwater to the ground below. Additional restrictions on high-impact land use types are included to protect public health and safety.

In March 2021, South Tacoma Neighborhood Council applied for an amendment consideration during the 2022 Comprehensive Plan Amendment Process. They sought to update the Comprehensive Plan (One Tacoma Plan), the Tacoma Municipal Code as applicable to the STGPD the Critical Aquifer Recharge Area code, and to transform the South Tacoma Manufacturing/Industrial Center into an Economic Green Zone. In June 2022, the City approved [Amended Substitute Resolution No. 40985](#), which included a work plan for the

STGPD code amendments and initiated the consideration of a temporary moratorium for certain uses within the STGPD while the code was being updated. In response to public concern, the City adopted [Ordinance No. 28872](#) in March 2023. This established a moratorium that prohibits new, or expansion of, existing underground storage tanks, metal recycling, and auto wrecking facilities. The City has extended the moratorium 3 times since its initial adoption and it is currently set to expire in September 2025.

After discussions with Health Department staff, the City included a HIA element in the [2023 update of their STGPD work plan](#). The Health Department and City executed a Memorandum of Understanding in March of 2024. It included the need for an intermediate-level HIA to sufficiently understand the health impacts of the STGPD, facilitate meaningful community participation, and develop substantive public health recommendations. The City funded the Health Department to complete this work.

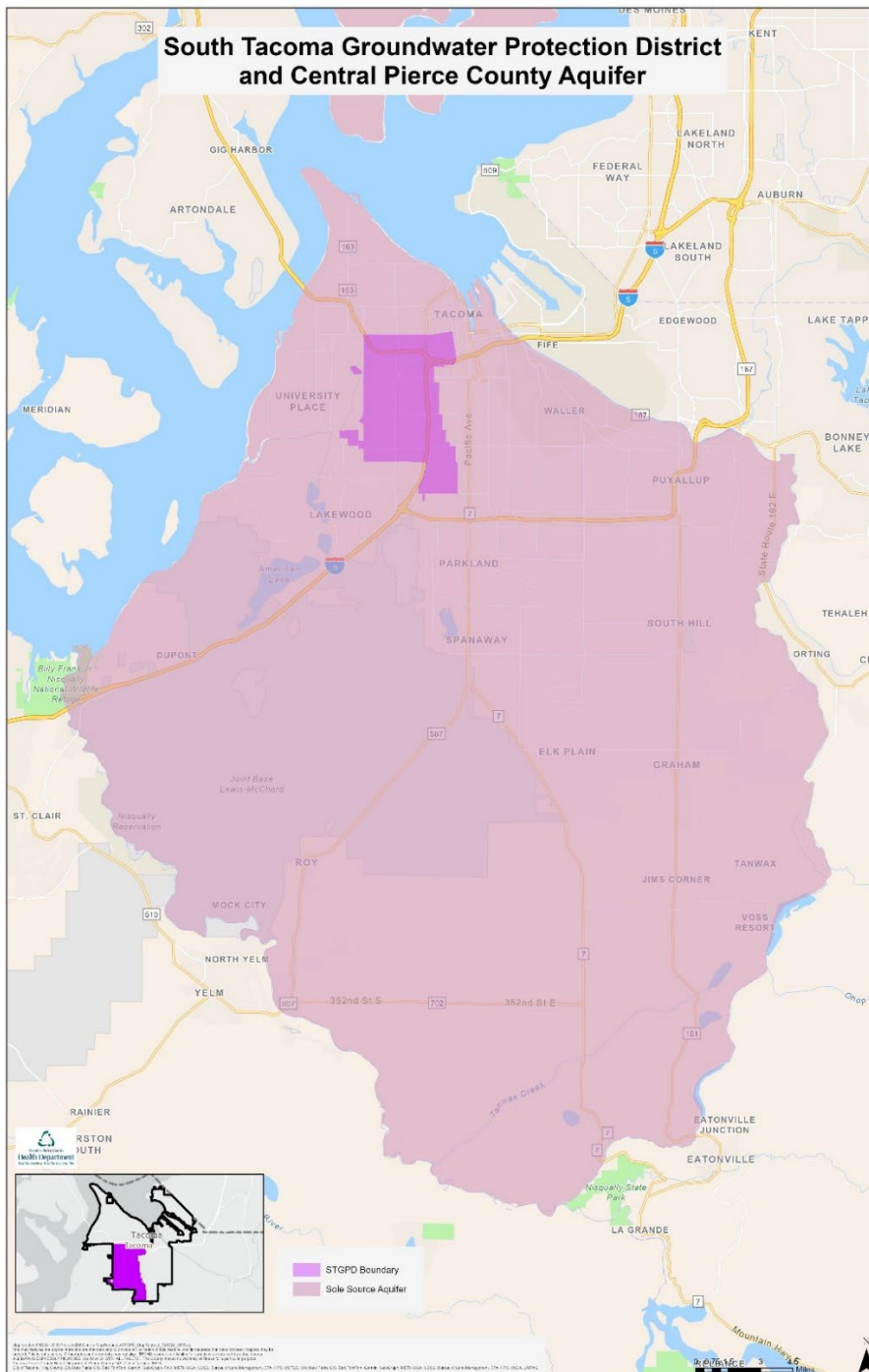


Figure 2. Boundaries of the STGPD within the Central Pierce County Aquifer.

Tacoma's Drinking Water

Most Tacoma residents receive their drinking water from Tacoma Water. This municipally-owned system supplies potable water to 108,897 residential connections and 7,251 commercial connections in Pierce and King Counties, providing water to about 353,000 people (Figure 2). In typical years, 89% of the total water supply from Tacoma Water comes from the Green River.

Roughly 11% comes from groundwater wells pulling from the Central Pierce County SSA located within the STGPD.² The proportion of the water supply that comes from these groundwater wells is expected to increase to 20% as the climate warms.¹ In atypical years—like years with extreme summer droughts—up to 50% of drinking water for the Tacoma Water service area may come from groundwater wells in the Central Pierce County SSA that are in the STGPD.² Some Pierce County residents receive their drinking water from privately-owned groundwater wells, but there are no privately-owned wells within the STGPD.

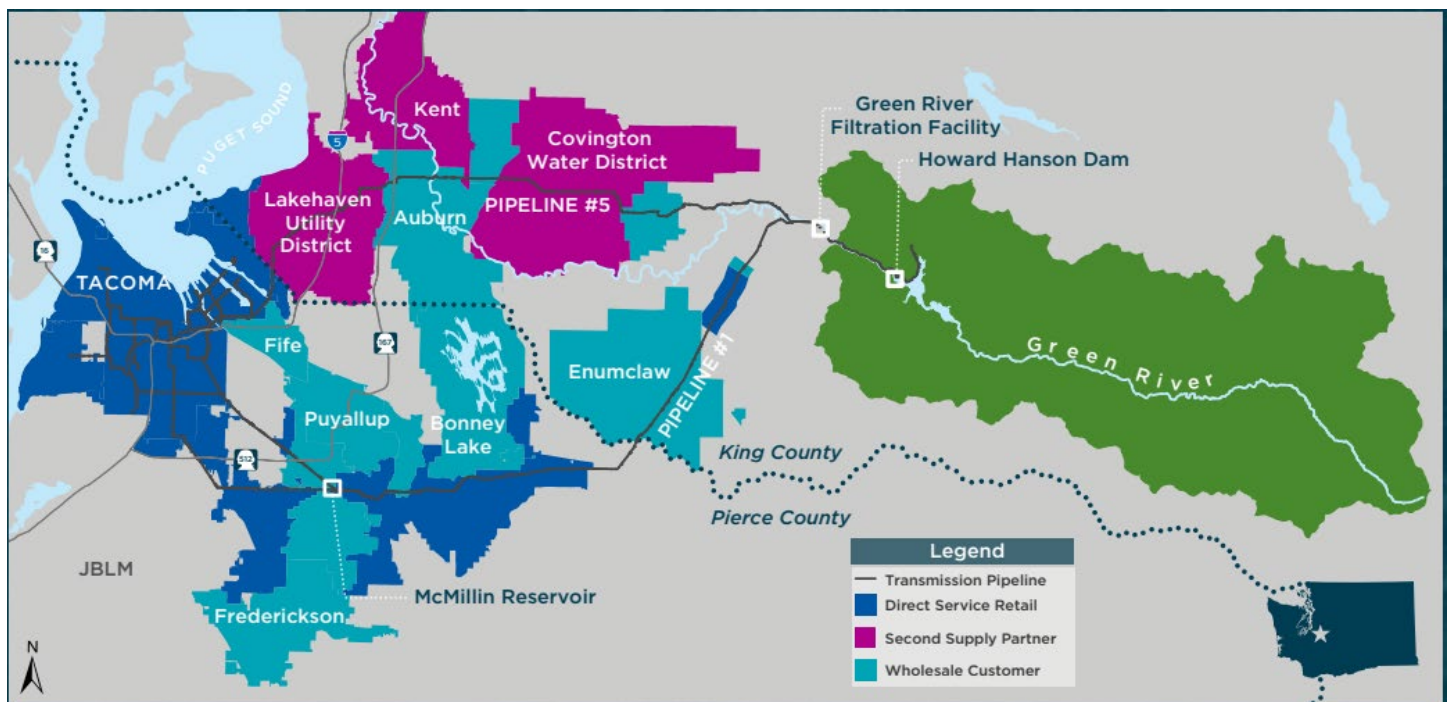


Figure 3. Tacoma Water service area and Green River watershed.³

Water from the Green River is filtered and then treated primarily with chlorine to remove potentially harmful microorganisms. Fluoride is added to the water supply from Tacoma Water in accordance with Department of Health and Human Services and Washington State Department of Health regulations. Caustic soda is used to make the water supply less acidic, reducing the chance of the water corroding lead or copper pipes present in some homes. Ozone is added to the Green River water supply to address issues of odor and taste.⁴

Tacoma Water regularly monitors and tests its drinking water supply at all points along its system from source waters, filtration and treatment plants, and throughout the distribution system. Tacoma Water tests for about 180 drinking water contaminants, including weekly tests for bacteria and adequate chlorine levels. However, not all contaminants are tested for at every point in the system.⁵

Washington State Department of Health can waive testing requirements for certain contaminants if there are no detections when sampling, and a source susceptibility assessment is conducted. If a contaminant is

consistently not detected during testing, or is only observed below allowable standards, testing frequency can be reduced to a longer time frame or can be waived for a period.

Waiving testing for certain contaminants, like nitrate, is not allowed. If a contaminant is detected above the contaminant trigger level, testing frequency increases, sometimes to a quarterly interval, and a notice is made to the public if there is a risk to public health, which may include a boil-water advisory or a do-not-drink advisory.

Privately-owned wells are not tested unless the well owner conducts the testing on their own. There are no known privately-owned wells within the STGPD.

While there are no current drinking water violations in Tacoma Water’s system, many sources of potential contamination exist within the STGPD. For this reason, the STGPD code is an important preventative tool to protect current and future groundwater resources.

Current and Historical Trends in South Tacoma

South Tacoma has a long legacy of industrial use and contamination. Over a century of both authorized and unauthorized heavy industrial uses dominated the landscape including:

- Railroad equipment manufacturing.
- Repair and maintenance
- Iron and brass foundry.
- Aircraft maintenance and refueling operations.
- Disposal area for foundry, construction, and domestic wastes.
- Unauthorized dumping areas for household and commercial wastes.
- Public utilities.
- Builders supply.⁷¹

These uses contaminated the soil and groundwater in the 2.5 square mile area of South Tacoma, which the EPA designated as the South Tacoma Channel Superfund site in 1983 (Figure 3). The site includes 3 separate cleanup areas—the South Tacoma Field, the Tacoma Landfill, and Well 12-A.⁶

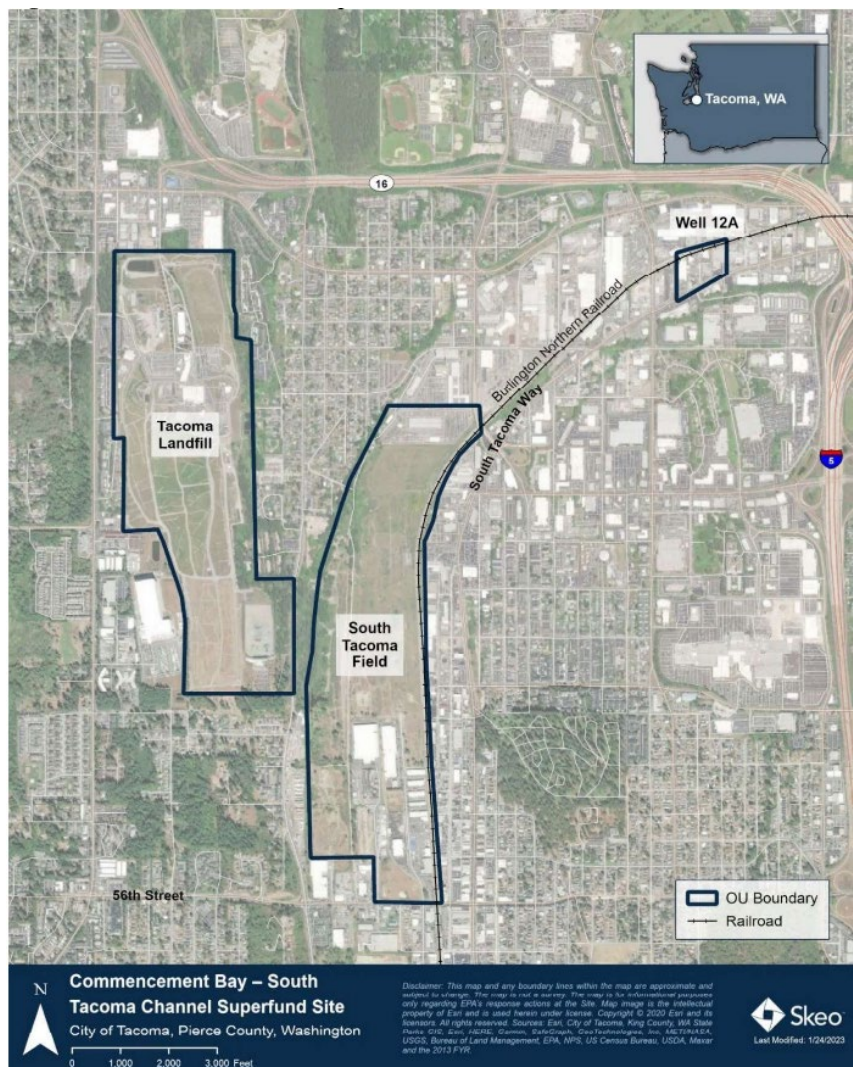


Figure 4. South Tacoma Channel Superfund Site.⁷

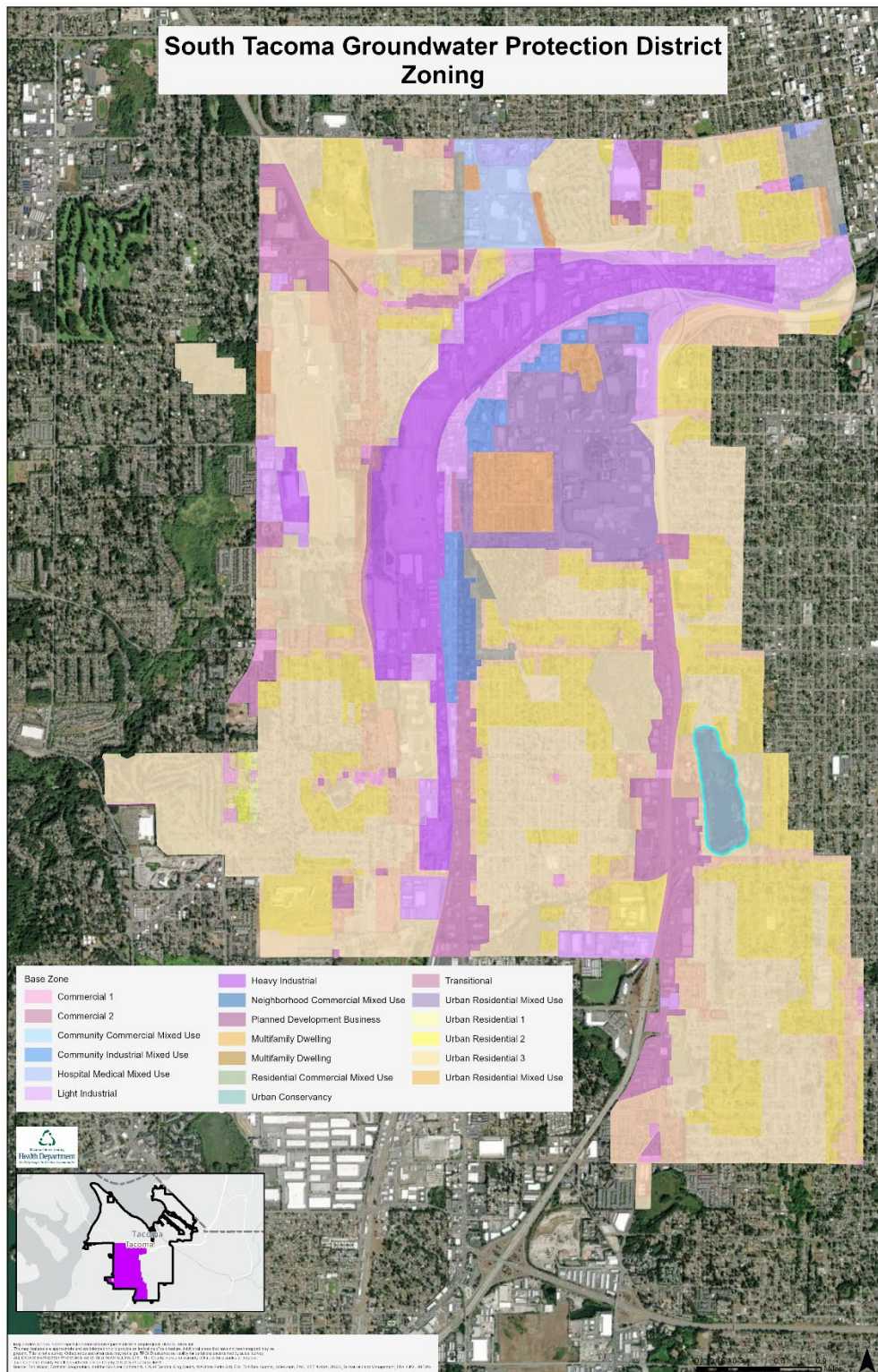


Figure 5. STGPD land use zoning.

A majority of the STGPD today is zoned for residential uses (yellow and tan areas of Figure 4), however the South Tacoma Manufacturing/Industrial Center (MIC) is a prominent feature of the area.

About 826 acres of the STGPD is zoned as Light Industrial and Heavy Industrial (light and dark purple areas in Figure 4).⁸ The types of facilities that are permitted within these zones are characterized by higher levels of noise and odors, large scale production, large buildings, extended operating hours, and heavy truck traffic. The western and southern edges of the MIC are adjacent to residential and mixed-commercial zones.

South Tacoma Groundwater Protection District Code

The purpose of the STGPD code is to protect the Central Pierce County Aquifer by imposing regulations on businesses that handle, store and dispose of hazardous substances, and for businesses that infiltrate their stormwater to the ground below. Additional restrictions on high-impact land use types are included to protect public health and safety. The Health Department is responsible for implementing the STGPD Code, while the City of Tacoma is responsible for maintaining and updating the Code. The City is also responsible for coordinating with other City Departments to ensure identification of businesses that should be regulated by the Code.

The *General Guidance and Performance Standards for the South Tacoma Groundwater Protection District* is a document managed and implemented by the Health Department. The guidance document outlines minimum acceptable best management practices and design solutions that are consistent with the requirements of the Code. The Code subsections refer to the guidance document for additional compliance requirements. A summary of the Code's regulations is below:

Applicability and Permitting

Businesses that handle or store more than 220 pounds of hazardous substances (as defined in the Washington Administrative Code [WAC] 173-303) or have infiltration systems which manage stormwater from parking lots or other industrial surfaces are required to obtain a STGPD operating permit from the Health Department. Each facility required to get an STGPD operating permit must provide an inventory of all hazardous substances used or generated and demonstrate compliance with hazardous substance management practices.

The Code applies to new and existing developments and facilities within the defined boundaries of the Protection District (Figure 2). The Code only applies to commercial and industrial businesses and does not apply to residential areas.

Prohibited Uses

The following use types are prohibited from locating within the boundaries of the STGPD:

- Chemical manufacture and reprocessing.
- Creosote/asphalt manufacture or treatment.
- Electroplating activities.
- Manufacture of Class 1A or 1B flammable liquids as defined in the Fire Code.
- Petroleum and petroleum products refinery, including reprocessing.
- Wood products preserving.
- Hazardous waste treatment, storage, or disposal facilities (as defined in WAC 173-303).
- Underground storage tanks (temporarily prohibited, moratorium expires in September 2025).
- Metal recycling/auto wrecking facilities (temporarily prohibited, moratorium expires in September 2025).

Stormwater Infiltration

Stormwater from pollution-generating surfaces may be allowed to infiltrate under specific circumstances and may be subject to additional treatment and monitoring requirements as described in City Policy ESD17-1, South Tacoma Groundwater Protection District Infiltration Policy, dated Jan. 9, 2017.

Hazardous Substance Storage and Management

The code outlines standards for hazardous substance labeling, storage, storage location, and decommissioning of storage structures.

Underground and Aboveground Storage Tanks

New underground and aboveground storage tanks must comply with design, construction, and use requirements. Existing tanks must follow code requirements for release detection, and closure/decommissioning protocols.

Inspections and Testing

The Health Department typically inspects permitted facilities every other year. Health Department staff inspect hazardous substance storage areas, tank testing or monitoring records, spill kit and spill plan procedures, and infiltration maintenance, if applicable. More frequent inspections may occur after periods of non-compliance or if a business has very large quantities of hazardous substances on site.

Spill Prevention and Management

Owners/operators of regulated facilities must prepare and submit a written spill management plan and follow a schedule for facility inspections, employee training, recordkeeping, and hazardous substances inventory.

Release Reporting, Investigation and Corrective Actions

The Health Department requires Permittees to notify the Health Department of certain types of releases (i.e., spills). The code also details protocols for investigating a release, and protocols for complying with corrective action directives from the Health Department and any other regulator.

Enforcement

Any violation requires a review of all relevant facts to determine the appropriate enforcement response. When practical, the Health Department seeks to resolve violations without resorting to formal enforcement measures. If more formal enforcement measures are necessary, the Health Department can assess civil penalties. In extreme cases, the Health Department may pursue criminal penalties.

The Code also contains sections on administrative processes like recordkeeping, waivers and exemptions, deferral, and appeals.

Agency Roles in the South Tacoma Groundwater Protection District

The Health Department is responsible for code implementation and enforcement. It permits applicable businesses to operate within the STPGD and inspects those facilities for compliance with the code and the *General Guidance and Performance Standards for the South Tacoma Groundwater Protection District*. The Health Department is jointly responsible with the City to ensure businesses that wish to infiltrate their stormwater follow the Stormwater Infiltration Policy.

City of Tacoma's Planning and Development Services Department permits land use and site development, building codes and critical areas decisions, and maintains the STGPD regulations in its municipal code. Planning and Development Services ensures businesses that wish to infiltrate their stormwater follow the Stormwater Infiltration Policy in coordination with the Health Department.

City of Tacoma Environmental Services Department administers the Stormwater Management Program, which inspects businesses for stormwater pollution and monitors for compliance with pollution prevention and the Stormwater Infiltration Policy.

City of Tacoma Fire Department administers the Fire Code as it pertains to the storage of hazardous materials and emergency response.

Tacoma Water maintains the wells that access groundwater from the Central Pierce County SSA and conducts water quality monitoring and compliance. Tacoma Water financially supports the Health Department's implementation of the STGPD code through an interagency agreement.

Additional Regulatory Framework

The City's STGPD code is just one regulatory tool that serves to protect the Central Pierce County SSA, largely through zoning constraints, use type prohibitions, and water pollution source control through the *General Guidance and Performance Standards for the South Tacoma Groundwater Protection District* and the City's Stormwater Management Program.

While the scope of this HIA is to better inform the municipal land use code to be more protective of human health, it is important to recognize many other concurrent regulatory frameworks are in place to protect environmental and human health within the STGPD. The list below captures many, but not all, of the regulatory frameworks that protect drinking water quality and supply.

Clean Water Act

The Clean Water Act (CWA), administered by the Environmental Protection Agency (EPA), regulates the release of pollutants into waters of the United States and sets quality standards for these releases. Washington State Department of Ecology (Ecology) has delegated authority to implement the CWA. Two of the main mechanisms used by the CWA to protect and maintain water quality are the National Pollutant Discharge Elimination System (NPDES) permits and State Waste Discharge (SWD) permits. Other permit types address water pollution from construction activities, boatyards, and sand and gravel mining, among others.⁹

Industrial and commercial facilities, and municipalities that discharge pollutants directly to surface waters (including stormwater) are required to obtain a NPDES permit. Industrial and commercial facilities, and municipalities that discharge pollutants directly to groundwater or to a wastewater treatment plant are required to obtain a SWD permit. Both permit types set limits on how much and what kind of pollutants can be discharged.¹⁰

The City of Tacoma's stormwater is regulated through a NPDES permit that is maintained by the Environmental Services Department. Twelve facilities within the STGPD hold industrial NPDES permits to address their stormwater and wastewater discharges.¹¹

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA), administered by the EPA, established drinking water regulations and legally enforceable drinking water quality standards for more than 90 contaminants.¹² Washington State Department of Health's (DOH) Office of Drinking Water implements the SWDA for Group A public water systems, which are groundwater wells that provide water to populations greater than 25 people or communities with 15 or more connections to the system.¹³

The Health Department implements the SWDA by regulating Group B water systems, which are groundwater wells that provide water to populations less than 25 people or communities with 2-14 connections.¹⁴ Tacoma Water implements the SDWA for populations that are connected to the municipal water supply throughout its service area (Figure 2).

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund Law, is administered by the EPA and identifies sites that have been contaminated by hazardous waste and establishes prohibitions and requirements for the cleanup and future use of the site.¹⁵ In some cases, this authority is delegated to Ecology and is implemented through the State's Model Toxics Control Act.¹⁶

Growth Management Act

The Growth Management Act (GMA) of Washington, administered by Washington State Department of Commerce, is a series of state statutes that require fast-growing cities and counties to develop actionable plans to sustainably address population growth and land development. Within the GMA are special protections for Critical Areas including:

- Wetlands.
- Areas with a critical recharging effect on aquifers used for potable water.
- Fish and wildlife habitat conservation areas.
- Frequently flooded areas.
- Geologically hazardous areas.¹⁷

Areas with a critical recharging effect on aquifers used for potable water are also known as Critical Aquifer Recharge Areas (CARA). Cities and counties that have designated CARAs within their boundaries are required to use the best available science to develop policies and regulations to protect the functions and values of critical areas.¹⁸

Health Impact Assessment Methods

This HIA used the *Minimum Elements and Practice Standards for Health Impact Assessment* from the Society of Practitioners of Health Impact Assessment.¹⁹ This methodology has 6 iterative phases.

- **Screening Phase.** Results in a decision about whether to conduct an HIA and, if moving forward, a rationale for why an HIA is an appropriate approach for the context.
- **Scoping Phase.** Results in a list of research/analysis questions, identification of the geographic focus of the HIA, and creation of a plan for the remaining phases. This phase decides which topics the HIA will focus on.
- **Assessment Phase.** Results in a baseline health characterization of affected populations and an analysis of the beneficial and adverse health effects of the proposed action(s).
- **Recommendations Phase.** Results in a list of specific, prioritized recommendations based on the findings of the assessment to manage the identified potential health and equity impacts of the proposed action(s).
- **Reporting and Dissemination Phase.** Communicates the HIA findings and recommendations to decision-makers, the public, and other affected community in a final report that can be easily understood and disseminated, and may include one-pagers, infographics, or websites.
- **Monitoring and Evaluation Phase.** Evaluates the HIA process, impact, and health outcomes (when possible). Monitoring includes strategies for how the affected community and decision-makers could sustain their involvement in the decision-making system and/or build upon successes and lessons learned through the process.

Advisory Group

We established an 8–person Advisory Group to ensure we incorporated community insights and perspectives throughout the HIA process. Members of the Advisory Group include South Tacoma residents, regulated businesses, and other Tacoma residents interested in environmental and public health.

The HIA Advisory Group was not a decision-making body. We informed the group of results of each phase of the HIA and consulted with them to identify additional concerns and gaps we need to address. We captured their feedback and integrated it into the assessment as it aligned with scoping.

Assessment Topic Selection

The HIA process began in June 2024. At that time, a draft of the updated code was not available, so we used the existing code and inputs from the sources listed below to develop the scope and assessment approach of this HIA.

We used multiple sources of information to select the assessment topics of this HIA. Discussions with the HIA Advisory Group, City of Tacoma Planning and Development Services, Tacoma Water, Washington Department of Ecology, Washington Department of Health, Puget Sound Clean Air Agency, and Tacoma-Pierce County Health Department’s Drinking Water and Solid Waste Management teams all helped inform the selection of Assessment topics.

City of Tacoma Planning and Development Services staff identified the following decision points (i.e., questions that City is considering for their update of the STGPD code), which also helped guide the selection of assessment topics, literature review, and current health characterization:

- 1. Should the City's temporary ban on new metal recycling and auto wrecking facilities be permanent?**
- 2. Should the City's temporary ban on new underground storage tanks be permanent?**
- 3. Are there other use types that should be further regulated or prohibited in the STGPD?**
- 4. Should other policies or standards be implemented or updated?**

Additionally, we gleaned information from the South Tacoma community through an online survey. Respondents identified their biggest health concerns associated with the STGPD. We provided the survey in English, Spanish, Vietnamese, and Russian. We also systematically reviewed existing public testimony from 10 separate public comment processes from June 2021 to February 2024. These public comment sessions sought input on the Comprehensive Plan Amendment process and the STGPD temporary moratorium.

After careful consideration of the information provided from these inputs, we selected the following topics to guide this assessment: drinking water quality and air quality.

Literature Review

The HIA Team conducted an extensive literature review to identify health outcomes related to the assessment topics and the decision points up for review. We used research databases including PubMed, CINAHL, Google Scholar, and Prospero to identify relevant literature. We also reviewed technical documents from relevant agencies.

Current Health Characterization

To characterize current health outcomes for the community within and surrounding the STGPD, the HIA team created a Study Area comprised of the census tracts (or zip codes, depending on the dataset) within the STGPD, and those immediately adjacent to it (Figure 5).

We selected which health outcomes to assess based on findings from the literature review and from concerns of the community. We pulled health outcome data was from publicly available datasets:

- Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE).
- Behavioral Risk Factor Surveillance System (BRFSS).
- Rapid Health Information Network (RHINO).
- Washington State Department of Health Death Certificate and Birth Certificate data.
- Washington State Cancer Registry.

We procured demographic data from the 5-year American Community Survey (ACS) provided by the U.S. Census Bureau for the years 2019 through 2023.

Assessment

Current Health Characterization

The Study Area for this assessment includes the STGPD, and the census tracts directly adjacent to the STGPD (see Figure 5 above). We retrieved demographic and health outcome data for all of Pierce County to make general comparisons. Some health outcome data allows for statistical comparison that allows for the identification of significant differences. This means there is likely a true difference between the populations, rather than random variability due to chance or sampling error. Health outcome data that was analyzed but did not show true or statistically significant differences between the STGPD Study Area and Pierce County are not reported. We noted data that shows significant differences between the populations by an asterisk.

Tables 1 and 2 show that compared to Pierce County the STGPD Study Area has a higher percentage of:

- People of color.
- People living in poverty.
- People living with a disability.
- Households without a vehicle.
- People who speak English “less than well.”

Table 1. Demographics of residents of the STGPD Study Area and Pierce County.²⁰

	STGPD Study Area		Pierce County	
	Estimate	Percent	Estimate	Percent
Population	148,825	--	924,106	--
Sex				
Male	74,598	50.1%	464,029	50.20%
Female	74,227	49.9%	460,077	49.80%
Age Groups				
Infants & Toddlers (0-4 yrs)	9,209	6.2%	57,111	6.2%
Children & Teenagers (5-17 yrs)	21,466	14.4%	157,328	17.0%
Young Adults (18-34 yrs)	40,307	27.1%	223,572	24.2%
Adults (35-64 yrs)	57,846	38.9%	352,782	38.2%
Older Adults (65+ yrs)	19,997	13.4%	133,313	14.4%
Race				
White	74,100	49.8%	577,336	62.5%
Black or African American	19,915	13.4%	62,678	6.8%
Hispanic/Latino	23,110	15.5%	115,594	12.5%
American Indian & Alaska Native	984	0.7%	6,071	0.7%
Asian	12,036	8.1%	59,584	6.4%
Native Hawaiian & Other Pacific Islander	2,098	1.4%	13,800	1.5%
Some Other Race	750	0.5%	5,018	0.5%
Two or More Races	15,832	10.6%	84,025	9.1%

Table 2. Select social determinants of health for residents of the STGPD Study Area and Pierce County.²⁰

	STGPD Study Area	Pierce County
% who speak English "less than well"	5.3	3.8
% living in poverty [†]	14.0	8.9
% living with a disability	16.2	13.7
% households without a vehicle	9.1	5.2

[†]Household income is at or below the Federal Poverty Level.

As seen in Table 3, compared to the larger Pierce County population, people who reside in the STGPD Study Area have higher rates of:

- Asthma prevalence²¹, asthma-related hospital Emergency Department (ED) visits, and respiratory illness ED visits.²²
- Mortality due to diabetes, circulatory disease, and heart disease.²³
- All-cancer mortality (combined mortality rate for all cancer types).²³
- Mortality due to congenital anomaly.²³
- Premature birth and low birth weight.²⁴

Table 3. Select health outcomes for residents of the STGPD Study Area and Pierce County.

	STGPD Study Area	Pierce County
	Percent	
Asthma Prevalence*	15.0	10.9
Premature birth*	11.9	10.6
Low birth weight*	7.9	7.0
	Rate per 10,000 ED Visits	
Asthma-related hospital ED visits [†]	613.2	548.0
Respiratory illness ED visits [†]	1,854.2	1,477.3
	Rate per 100,000 Deaths	
Diabetes mortality*	38.2	25.5
Circulatory disease mortality*	250.7	213.0
Heart disease mortality*	177.2	150.7
All-cancer mortality*	436.0	460.0
Congenital anomaly mortality*	8.9	6.7

*Significant differences exist when comparing the STGPD Study Area data to that of Pierce County.

[†]Statistical testing on these datasets was not available, but these counts show truly higher numbers of ED visits for STGPD Study Area residents compared to Pierce County residents.

This health outcome data provides a characterization of current health outcomes of the people living in and directly adjacent to the STGPD. Many factors, including social determinants of health, influence health. This health outcome data shows a snapshot in time of health in the STGPD Study Area. It does not imply that ingesting drinking water from the Tacoma Water system or exposure to environmental pollution in the STGPD caused these health outcomes.

Because residents in the STGPD Study Area experience higher rates of certain health conditions (like asthma and cancer) compared to the larger Pierce County population, they can be more sensitive to certain environmental exposures that could exacerbate symptoms and increase their vulnerability to worsened health outcomes. Further, SDoH investments in the South Tacoma community have been disproportionately low, and South Tacoma has been identified as a community overburdened by air pollution.⁴¹ Consequently, updating the STGPD code to be more protective of human health is one tool the City of Tacoma has to address these health disparities.

STGPD Code Update Decision Points

In this section, we present findings from our literature review that—in conjunction with the current health characterization—have aided in the development of policy recommendations. Findings include data on the types of contaminants certain business types emit, the potential pathways for human exposure to the contaminant, and potential health outcomes associated with that exposure. We present the information by decision point, i.e., questions that City is considering for their update of the STGPD code.

Metal Recycling and Auto Wrecking Facilities

Should the City's temporary ban on new metal recycling and auto wrecking facilities in the STGPD be permanent?

One metal recycling/auto wrecking facility exists in the STGPD. Metal manufacturing and steel foundries emit many of the same contaminants as metal recycling/auto wrecking facilities, so we included a discussion of the impacts of these facilities in this section. There are 6 metal manufacturing facilitiesⁱ and one steel foundry located in the STGPD.²⁵

Stormwater and wastewater discharges, as well as air emissions, from metal recycling, auto wrecking, metal manufacturing, and steel foundries can contain Polychlorinated biphenyls (PCBs), a class of human-made chemicals that are known to cause cancer.²⁶ While the manufacture of new PCBs has been banned in the United State since 1979, they are persistent in the environment where they have been manufactured or used, and remain present in materials that are being recycled, like automobiles.²⁷

Though most PCB exposure occurs from ingesting contaminated fish and breathing contaminated air, PCB exposure can also occur via water, soil, and house dust.^{26, 28, 29, 101} In addition to cancer, exposure to PCBs is associated with several health impacts, including skin lesions, reproductive and developmental impacts, endocrine disruption, and impacts on the health of thyroid, liver and teeth.^{26, 30} Tacoma Water tests for seven types of PCBs through a general pesticide panel at most their wells, generally once every 3 to 9 years, dependent on the susceptibility assessment.

Polycyclic Aromatic Compounds (PACs) are a broad category of chemicals that are widespread environmental contaminants and are often encountered as a byproduct of industrial processes and burning fossil fuels and can be found in water surrounding metal manufacturers and recyclers, and autobody shops.³¹⁻³⁴

ⁱ Metal manufacturing facilities refers to primary and secondary metal industries that manufacture, produce, smelt, or refine ferrous and nonferrous metal from molten materials and machine shops, fabricating, metal processing with etchers and chemicals.

For people who do not smoke and do not have significant occupational exposure, food consumption is the main source of PAC exposure, followed by inhalation. Exposure to PACs is associated with cancer, infertility, diabetes, poor fetal development, oxidative stress, cardiovascular disease, and inflammation. Some PACs can also cause skin and eye irritation, nausea, vomiting, and damage to DNA, genes, and proteins.^{28, 33-35} Tacoma Water tests for four types of PACs through a general pesticide panel at most their wells, generally once every 3 to 9 years, dependent on the susceptibility assessment.

Hexavalent Chromium (aka Chromium-6) can be emitted from various industrial processes like metal fabrication and chrome electroplating, as well as from the combustion of gasoline and diesel fuels, green glass production, and from some funeral home operations.³⁶ Electroplating activities are currently prohibited in the STGPD code.

The primary health outcome associated with inhalation of hexavalent chromium is lung cancer, followed by adverse respiratory, liver, and kidney effects.³⁶ Adverse immune, hematological, and male reproductive toxicity has also been associated with exposure to hexavalent chromium.³⁷ When ingested, hexavalent chromium can cause upset to the gastrointestinal tract, damage to liver and kidneys, and has been linked to cancer.³⁸

Currently, SWDA does not regulate hexavalent chromium. It is also not currently tested for in Tacoma Water's system. Between 2013 and 2015, many public drinking water systems across the country tested for several unregulated chemicals in their systems, including hexavalent chromium. Of the over 60,000 samples, hexavalent chromium was detected in more than 75% of the samples.³⁹

In 2014, California developed both a drinking water standard and a public health standard for hexavalent chromium. The drinking water standard is 10 parts per billion (ppb) and a public health goal of 0.02 ppb. Tacoma Water's average result for hexavalent chromium during the 2013-2015 sampling was 0.17 ppb and the highest was 0.31 ppb, which are well below California's water standard, but above California's public health goal.³⁹

While not directly associated with groundwater and drinking water, a health concern with metal recycling facilities is the particulate matter (PM) released during processing, especially recyclers that process vehicle parts. Particulate matter emissions from metal recyclers contain traces of heavy metals found in the surface coatings of the material being recycled (e.g., arsenic, chromium, mercury, lead, etc.), as well as the metal itself being recycled (e.g., iron, nickel, copper, chromium, etc.).

Studies sampling air quality near metal recyclers found various carcinogenic metal particulates in the air.⁴⁰ Inhalation of PM is associated with a variety of adverse health outcomes, including heart attacks, premature death, and increased hospital admissions and emergency room visits for respiratory and cardiovascular problems.^{36, 41, 42} Fine PM (i.e., PM_{2.5}) is easily inhaled and can penetrate deep into the lungs and even enter the bloodstream.³⁶

The Health Department recommends the City make this temporary moratorium permanent and should include a prohibition on the expansion of existing metal recycling and auto wrecking facilities. The Health Department also recommends a prohibition on the establishment of new—and expansion of existing—metal fabrication facilities and steel foundries.

Underground Storage Tanks

Should the City's temporary ban on new underground storage tanks within the STGPD be permanent?

There are 38 underground storage tanks (USTs) within the STGPD, most of which store petroleum products and additives. Currently, 25 of these tanks are leaking with cleanup in progress (Figure 6). Tanks undergoing cleanup have both confirmed and suspected contamination in soil and groundwater according to Ecology's cleanup and tank search.⁴³

The City adopted a temporarily moratorium on the installation of new USTs in the STGPD in 2023. As part of this moratorium, existing USTs cannot be expanded except for the purpose of repair. Notably, USTs that store petroleum up to 1,100 gallons are exempt from the moratorium.

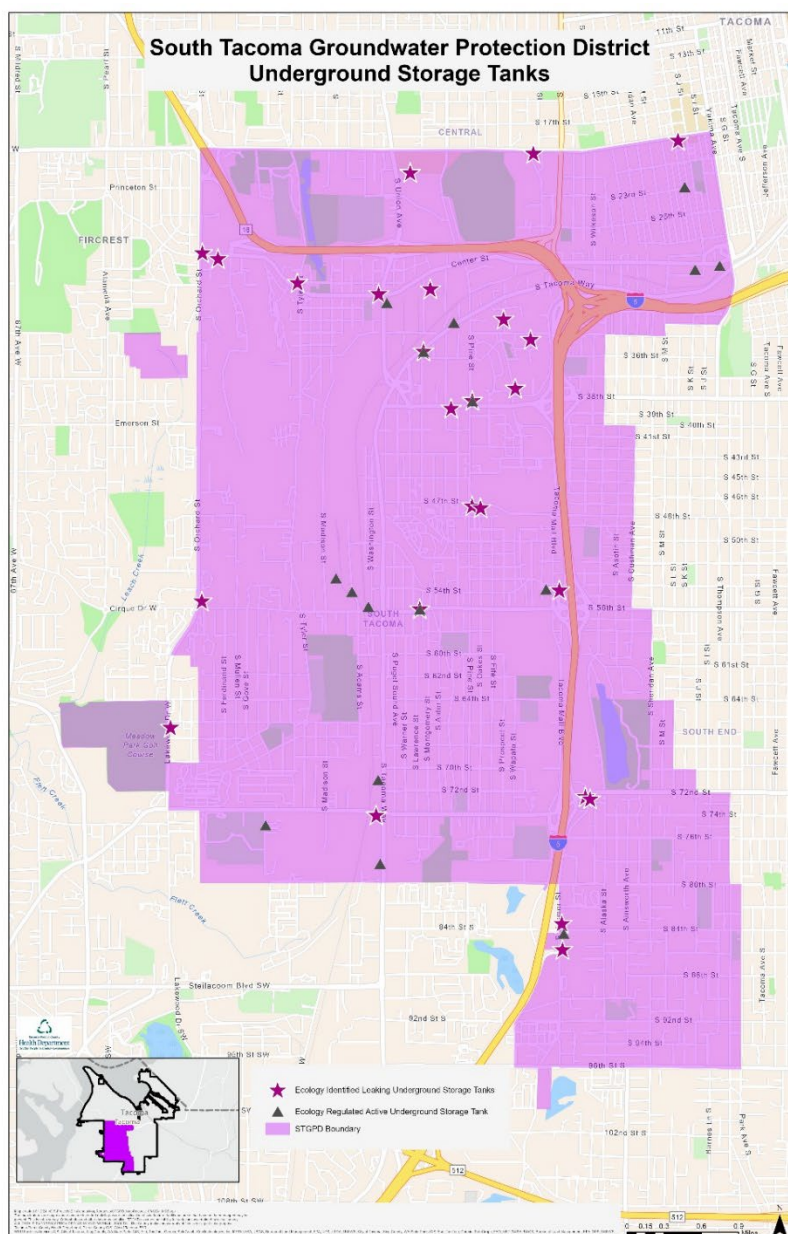


Figure 7. Intact and Leaking Underground Storage Tanks.

Underground storage tanks can contain petroleum products like gasoline, diesel fuel, waste oils, additives and petroleum byproducts like benzene, toluene, ethylbenzene, xylene, and ethylene dibromide, and methyl tertiary-butyl ether (MTBE).^{44, 45}

When these tanks fail and leak they become a human and environmental health concern because they are soluble in water and easily move through soil, making them a threat to groundwater sources.^{45, 46}

Many of these substances are known carcinogens, and are also associated with anemia, problems with the liver, kidneys, and stomach, developmental issues in children, and neurological and reproductive issues in adults.^{45, 47, 48}

Tacoma Water does not currently test for MTBE, but does test for other chemicals associated with petroleum products through a VOC test panel. Tacoma Water has been granted a 6-year VOC testing waiver at some of their wells, while other wells require testing for VOCs once a year or once every 3 years.

The Health Department recommends the City make temporary moratorium on new—and the expansion of existing—underground storage tanks permanent, no matter the volume capacity of the tank. Expansions for the express purpose of repair should be permitted. This recommendation only applies to businesses that meet the criteria for regulation under the STGPD code.

Other High Impact Uses

Are there other use types that should be further regulated or prohibited from locating within the STGPD?

Vehicle Maintenance Facilities

There are about 89 vehicle maintenance facilities (including paint, repair, and maintenance shops) in the STGPD.²⁵ Due to the toxic and hazardous chemicals used in many products at autobody shops, EPA, Ecology, and local municipalities have all created special laws to regulate them.⁴⁹ Ecology's document, *A Guide for Auto Body Shops* warns against disposal of paint waste, antifreeze, floor cleaning wastewater, spray gun waste, or used oil down any storm drain or septic tank due to their potential to contaminate groundwater.⁵⁰

Despite regulations, spills and accidents occur and have the potential to release toxic chemicals into the environment, including surface water and groundwater. Concerns from autobody shops include exposure to PCBs and Volatile Organic Compounds (VOCs). Though they have been regulated and banned in some ways since 1979, PCBs may still be present as a contaminant in some commercial uses including motor oil.⁵¹

Though most PCB exposure occurs from ingesting contaminated fish and breathing contaminated air, PCB exposure can also occur via water, soil, and house dust.^{26, 28, 29, 101} In addition to cancer, exposure to PCBs is associated with several health impacts, including skin lesions, reproductive and developmental impacts, endocrine disruption, and impacts on the health of thyroid, liver and teeth.^{26, 30} Tacoma Water tests for seven types of PCBs through a general pesticide panel at most their wells, generally once every 3 to 9 years, dependent on the susceptibility assessment.

Exposure to VOCs through ingestion is associated with liver, kidney, spleen, circulatory system and immune system damage, increased cancer risk, changes in adrenal glands, anemia, decrease in blood platelets.⁴⁴ Tacoma Water has been granted a 6-year VOC testing waiver at some of their wells, while other wells require testing for VOCs once a year or once every three years.

The EPA has identified vehicle maintenance facilities as a source of VOCs that can impact the health of employees and the community if best practices are not followed.⁵² Exposure to VOCs through inhalation can contribute to negative health impacts ranging from asthma, cardiovascular disease, respiratory disease, neurological disorders, and preterm birth. Many VOCs are known carcinogens, including formaldehyde and benzene, and can increase a person's risk of cancer.⁵³

The Health Department recommends prohibiting new autobody shops within the STGPD. Existing vehicle maintenance facilities regulated by the STGPD Code that wish to relocate in the STGPD should be exempt from this prohibition.

Septic Tanks and Wastewater Treatment Facilities

Leaking septic tanks and discharge from wastewater treatment plants are potential sources of PFAS and nitrate contamination in groundwater.^{44, 54} Nitrates are potentially carcinogenic, and exposure through drinking water is associated with increased risk of colorectal, bladder, kidney, ovary, thyroid, and brain cancers, miscarriage, birth defects, and infant methemoglobinemia.^{44, 54, 55}

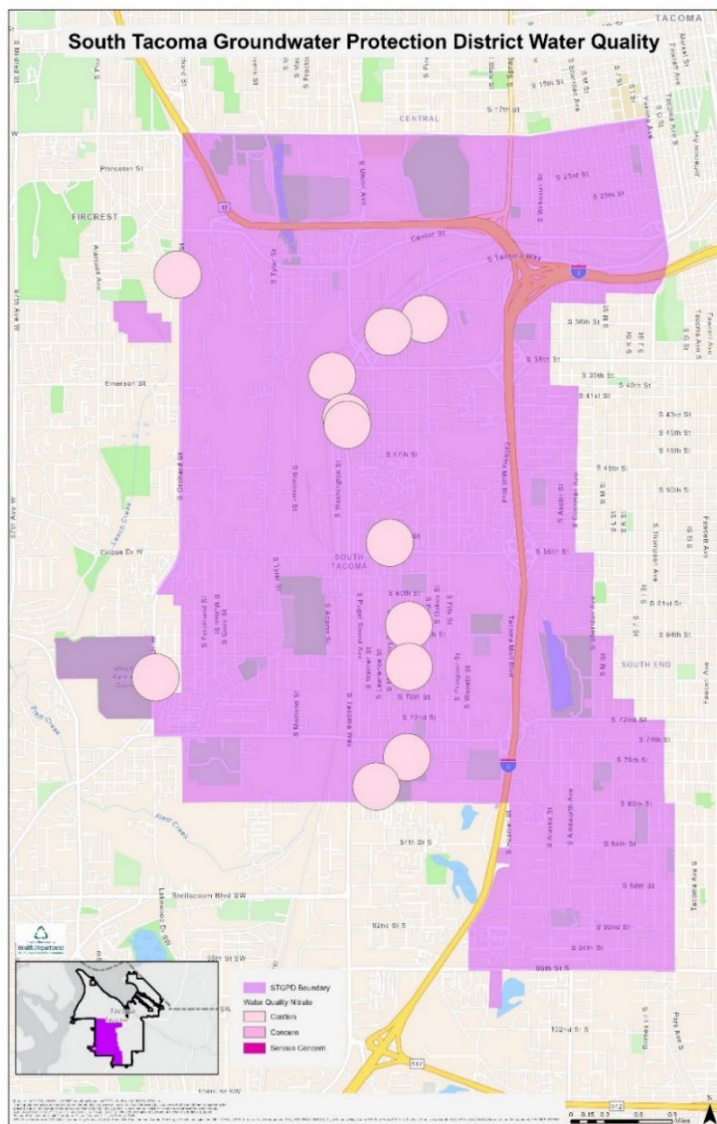


Figure 8. Point-in-time detections of nitrates in groundwater (below regulatory standards).

Tacoma Water tests for nitrate at most points along its distribution system once a year. Their most recent water quality testing results show that while nitrate was detected in groundwater (4.06 parts per million [ppm]), the detection was below the highest regulatory level allowed (10 ppm).⁵⁶ There have been several nitrate groundwater detections below the regulatory level between 2012 and 2023. Many of these detections follow the interior of the South Tacoma MIC (Figure 7). There are no known septic tanks and no wastewater treatment facilities in this area, and the Health Department cannot make conclusions on the source of the nitrate.

PFAS (per- and polyfluoroalkyl substances) are an emerging contaminant of concern in drinking water. Many PFAS are highly soluble in water and many standard wastewater treatment processes do not remove PFAS.^{57, 58} PFAS exposure in humans is associated with kidney and testicular cancer. PFAS substances can transfer from mother to child both pre- and post-natally.^{54, 57, 59, 60}

In 2018, the EPA and Ecology learned of PFAS contamination in Fort Lewis and McChord field water systems at Joint-Base Lewis McChord and off-base water systems in Dupont, Lakewood, Tacoma, and Parkland.⁶¹

and were subsequently taken out of service.^{62, 63} Tacoma Water's most recent water quality testing results from 2023 detected PFAS in all wells except for those that pull from the deepest part of the Central Pierce County SSA. PFAS levels in all of these wells were below Washington State's 2021. Going forward, all public water systems -on and off base- will need to comply with the EPA's drinking water standard for PFAS set in 2024.⁶²

In 2018, some of Tacoma Water's groundwater wells in South Tacoma tested positively for PFAS

PFAS and Biosolids

Biosolids containing PFAS are an emerging source of concern for public health. TAGRO products, produced by the City contain some biosolids along with other soils and mulch. Some biosolids are known to be contaminated with PFAS from the use of PFAS in commercial and household products, which can then leach into soil and groundwater when applied to the ground, or contaminate food grown in soils containing PFAS.

TAGRO products are available for small-scale residential use and larger scale commercial use. When used in smaller amounts, the risk of contamination of the aquifer is lower than compared to use at a larger scale (e.g., multi-acre agricultural use).

Washington is considering passing a law to require comprehensive PFAS testing in biosolids and biosolids products. Some states have implemented similar laws for testing biosolids and have limits for PFAS in biosolids that are applied to land,

While it is unlikely that new septic tanks or wastewater treatment facilities would be proposed for the STGPD area, the Health Department recommends adopting a prohibition on new septic tanks and wastewater treatment facilities within the STGPD.

Dry Cleaning and Industrial Laundry Facilities

Dry cleaners can generate hazardous waste that can contaminate soil and groundwater. Perchloroethylene (PERC) is one VOC in solvents that dry cleaners commonly use.⁶⁵

There is one industrial laundry facility permitted by the Health Department in the STGPD.²⁵ There are dry cleaners located in the STGPD, but none are currently permitted by the Health Department, likely because they do not handle enough hazardous wastes to necessitate a STGPD permit.

In 2021, Ecology studied chemicals of emerging concern (CEC) in pretreated industrial wastewater in the Puget Sound region. Industrial laundry facilities showed the highest concentration of VOCs, PCBs, and polybrominated diphenyl ethers (PBDEs) in their pretreated industrial wastewater, followed by landfills.⁶⁶

Exposure to VOCs through ingestion is associated with liver, kidney, spleen, circulatory system and immune system damage, increased cancer risk, changes in adrenal glands, anemia, decrease in blood platelets.⁴⁴ Tacoma Water tests for seven types of PCBs through a general pesticide panel at most their wells, generally once every 3 to 9 years, dependent on the susceptibility assessment.

Though most PCB exposure occurs from ingesting contaminated fish and breathing contaminated air, PCB exposure can also occur via water, soil, and house dust.^{26, 28, 29, 101} In addition to cancer, exposure to PCBs is associated with several health impacts, including skin lesions, reproductive and developmental impacts, endocrine disruption, and impacts on the health of thyroid, liver and teeth.^{26, 30} Tacoma Water tests for seven types of PCBs through a general pesticide panel at most their wells, generally once every 3 to 9 years, dependent on the susceptibility assessment.

Though most PBDE exposure occurs from ingesting contaminated fish, and can be a major exposure pathway to infants through breastmilk, PBDE exposure can also occur via air, water, soil, and house dust.¹⁰⁰ Exposure to high concentrations of PBDEs is associated with cancer and damage to the nervous, reproductive, and immune systems, and damage to the liver, pancreas, and thyroid.⁶⁷ Tacoma Water does not currently test for PBDEs, however, drinking water is not expected to be a major exposure route to PBDEs.¹⁰⁰

While there are few dry cleaners and industrial laundry facilities in the STGPD, the hazardous waste they generate has the potential to severely contaminate groundwater sources, especially if handled improperly.

To be most protective of human health, the Health Department recommends prohibiting new dry cleaners and industrial laundry facilities within the STGPD. A less protective measure would be to permit dry cleaners and industrial laundry facilities that do not utilize PERC in their processing.

Historic Contamination from Dry Cleaners

The former Plaza Cleaners in Lakewood was identified as a Superfund site in the 1980s because its operations contaminated groundwater and soil.⁶⁸ The cleaner dumped waste into bottomless septic tanks and directly on the ground, leading to groundwater and soil contamination.

Cleanup involved moving and disposing of contaminated soils, installing air strippers in 2 Lakewood Water District wells, and prohibiting installation of new wells. Soil cleanup was completed in 1992. Ecology continues to oversee drinking water treatment and monitoring.

Decades later, groundwater contamination remains from the cleaner's historical operation. As part of its most recent 5-year review of the site in 2022, Ecology sampled groundwater from 5 monitoring wells and Lakewood Water District's municipal well and found levels of PERC that exceeded cleanup levels in 2 of the monitoring wells and the municipal well.

Groundwater treatment remains required to protect human health. Ecology recommended further hydraulic study to better understand flow of contaminated groundwater throughout the year.⁶⁹

Landfills

While no longer active, there is one landfill within the STGPD, which was constructed prior to laws that require the installation of a bottom liner (WAC 173-351). Now active as a transfer station, the site houses a household hazardous waste drop off, yard waste drop off, and recycling center.

The Tacoma Landfill was identified as a Superfund site in 1983 after it was found that landfill gas had migrated to adjoining properties, and soil and groundwater contamination was confirmed.⁷⁰ In 1991, Ecology

and the City entered a consent decree to monitor the cleanup of the site and monitor groundwater and surface water contamination.

The Health Department, EPA, and Ecology have a shared agreement to monitor landfill gas and groundwater, and the Health Department regulates the entire site under a solid waste permit. While most of the landfill site has been cleaned up, PERC substances are still found in concentrations above performance standards in 2 groundwater monitoring wells.⁷

Leachate from landfills, particularly unlined or inadequately lined landfills, can be a source of several contaminants: pharmaceuticals and personal care products, PFAS, PCBs, PBDEs, and non-aqueous phase liquids (like heavy crude oil, chlorinated solvents).^{28, 54, 66, 71} According to Ecology in their study of chemicals of emerging concern, landfills contained the second highest load of these chemicals.⁶⁶

PFAS exposure in humans is associated with kidney and testicular cancer. PFAS substances can transfer from mother to child both pre- and postnatally.^{54, 57, 59, 60} Though most PCB exposure occurs from ingesting contaminated fish and breathing contaminated air, PCB exposure can also occur via water, soil, and house dust.^{26, 28, 29, 101} In addition to cancer, exposure to PCBs is associated with several health impacts, including skin lesions, reproductive and developmental impacts, endocrine disruption, and impacts on the health of thyroid, liver and teeth.^{26, 30} Exposure to high concentrations of PBDEs is associated with cancer and damage to the nervous, reproductive, and immune systems, and damage to the liver, pancreas, and thyroid.⁶⁷ Tacoma Water tests for 7 types of PCBs through a general pesticide panel at most their wells. This occurs about once every 3-9 years, depending on the susceptibility assessment.

While it is unlikely that a new landfill would be proposed for the STGPD area, the Health Department recommends the City adopt a prohibition on new landfills within the STGPD and prohibit expansions of the existing landfill for solid waste disposal.

Other Regulations or Standards

Should other policies or standards be implemented or updated?

Stormwater Infiltration Policy

It is beyond the scope of this HIA to provide technically-specific recommendations on the City's Stormwater Infiltration Policy for the STGPD (City Policy ESD17-1). The Health Department's Waste Management Program and the representatives from DOH, Ecology, EPA, and the United State Geological Survey may be able to provide more technical expertise in this area. However, the Infiltration Policy could be beneficial for protecting human health, if consistently followed and applied.

For example, the Infiltration Policy currently states "*Infiltration within the area of influence of underground contamination or contaminated sites regulated by EPA or another agency will not be allowed.*" This prohibition is in place to ensure that contaminated sediments don't infiltrate directly into the ground yet is not consistently applied and was not followed during recent land use permitting decisions.⁷²

The Health Department recommends requiring soil contaminant testing for any on-site infiltration and recommends that the existing policy of not infiltrating through contaminated soils be upheld.

Tree Canopy and Impervious Surface Standards

It is beyond the scope of this HIA to provide technically-specific recommendations for tree canopy and impervious surface standards within the STGPD. Representatives from DOH, Ecology, EPA, and the United States Geological Survey may be able to provide more technical expertise in these areas. However, because tree canopy and impervious surfaces both have the potential to impact health, the HIA Team determined it was appropriate to address the question at a basic level.⁷³

Many studies show a direct association between decreasing tree canopy and increasing respiratory disease, excess morbidity, and mortality.⁷⁴ The presence of a healthy urban forest reduces the risk of respiratory illnesses and cardiovascular diseases because trees mitigate air pollution by absorbing harmful pollutants known to cause these health conditions, including carbon dioxide, nitrogen oxides, sulfur dioxide, and particulate matter.^{75, 76} Further, trees promote infiltration and control stormwater flow, both of which can protect and enhance aquifer recharge.⁷⁷

Impervious surfaces like roads, parking lots, and buildings, etc. absorb and retain heat from the sun to create a heat island. Because of the way we have built infrastructure, many urban areas experience higher temperatures compared to their less urbanized surroundings. This difference in temperature is what defines an urban heat island. Urban areas experience higher temperatures due to the urban heat island effect (UHI), which can exacerbate heat-related illnesses and heat stress.^{75, 78}

Planting trees and vegetation helps reduce UHI effects. Trees provide natural shade and evaporative cooling, helping to lower ambient temperatures and create more comfortable microclimates. By lowering temperatures, trees and vegetation help mitigate the health impacts of extreme heat. Mature trees provide these benefits on the largest scale.⁷⁹⁻⁸¹

Tree canopy and impervious surface cover is not distributed evenly nor equitably in the City. Tree canopy ranges from 3% in some census block groups to more than 60% in others. Tree canopy coverage is also not distributed equitably across Tacoma. Based on the Equity Index map, the average canopy cover in areas classified as very low opportunity (like much of South Tacoma) is approximately 15%, while the average canopy cover in areas classified as very high opportunity is more than 26%.⁸²

Impervious surface cover is also not distributed evenly nor equitably in the City. Lower opportunity neighborhoods have 19% more impervious surface than higher opportunity neighborhoods.⁸² Some areas in North Tacoma saw temperatures that were up to 14 degrees cooler than Central, South, and Eastside Tacoma. Tacoma's historically redlined areas have about 15% less tree cover than areas that were not subject to redlining. Further, in Tacoma, a strong correlation between household income and severe urban heat islands exists.^{83, 84}

Again, it is beyond the scope of this HIA to make specific, technical recommendations to the City on what its tree canopy standard or impervious surface standard should be. However, the Health Department supports the adoption of an equitable tree canopy standard and impervious surface standard within the STGPD. These types of standards could reduce disparities in heat-related illness and negative health outcomes associated with air pollution, while maintaining or enhancing aquifer recharge.

Addressing Air Quality

While the STGPD code doesn't regulate air pollution, it is a concern of community members across Tacoma and is influenced by many of the types of businesses that are regulated by the STGPD code. Additionally, when looking at health impacts for a community, we must analyze all factors that impact individual and community. For example, the health impacts from contaminated water could be exacerbated because a population has negative health impacts from poor air quality.

Washington Department of Ecology determined that South Tacoma is a community overburdened by air pollution. This means that the people that live in this area are at greater risk of adverse health impacts from air pollution because of their environmental surroundings and socioeconomic vulnerabilities.

Compared to the statewide population, communities identified as "overburdened by air pollution" tend to have higher rates of chronic conditions and cardiovascular mortality, with the average life expectancy being 2.4 years shorter in these communities.⁴¹ In general, older adults, children, pregnant people, and those with pre-existing health conditions are most at risk from exposure to air pollutants, especially fine particulate matter (PM_{2.5}).⁸⁵ Particulate matter contains microscopic debris that are so small they can be inhaled, and in some cases enter the bloodstream.⁸⁶

Those living near heavily trafficked roadways exhibit the greatest cancer risk from air pollution, primarily driven by their exposure to Diesel Particulate Matter (DPM). An equity analysis performed by PSCAA in 2023 shows that these communities near heavily trafficked roadways often also have a higher percentage of residents who are people of color and and/or of lower income.³⁶ This finding has been replicated in studies assessing the effect of air pollution on health outcomes in other populations in other geographies.^{87,88} Compared to Pierce County, the STGPD Study Area has a higher percentage of people of color and people living in poverty.

Air pollutants can be characterized in 2 ways: Toxic Air Pollutants (TAP) or Criteria Air Pollutants (CAP). Air pollution in Tacoma is monitored by the Puget Sound Clean Air Agency and Ecology at 3 monitoring stations, including one in STGP on South 36th Street near the junction of Interstate 5 and Highway 16.

Criteria Air Pollutants in Tacoma

Criteria Air Pollutants (CAPs) are pollutants that are limited by the Clean Air Act and regulated by the EPA's National Ambient Air Quality Standards. The CAPs are ozone, lead, carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and PM.⁸⁹

The primary source of CO, SO₂, and NO₂ emissions in Tacoma is from motor vehicles, but these pollutants are also emitted from asphalt and concrete manufacturers.^{90, 91} There are 5 registered asphalt/concrete manufacturers within the STGPD, but the STGPD code no longer allows new asphalt and concrete manufacturers to locate there.⁹²

When CO levels are high, people with cardiovascular disease or respiratory problems may experience worsened symptoms, including chest pain, especially while exercising. High CO levels are also associated with decreased alertness and vision, even in healthy people,³⁶ and admission to hospital or mortality from stroke.⁹³

Inhalation of SO₂ can be especially harmful for people with asthma who are active outdoors, people with lung disease, seniors, and children. This type of exposure can cause bronchial constriction which can lead to wheezing, shortness of breath, and tightening of the chest.³⁶ Skin irritation and redness, damage to mucous membranes, and worsening of pre-existing cardiovascular disease has also been observed.⁸⁸ Increases in SO₂ in the air has been associated with hospital admissions for stroke or stroke mortality.⁹³

Inhalation of nitrogen dioxide NO₂ can be especially harmful for people with asthma and other respiratory diseases, and can cause coughing, wheezing, and shortness of breath in the short-term,³⁶ as well as eye, nose, and throat irritation. Long-term exposure to NO₂ has been associated with an impaired sense of smell, chronic lung disease, and stroke.⁸⁸

Studies of Traffic Related Air Pollution (TRAP) that focused on NO₂ showed an association between long-term exposure to NO₂ and asthma onset in children and adults, acute lower respiratory infections in children, adverse circulatory outcomes, ischemic heart disease, and lung cancer mortality, with a high to moderate-to-high level of confidence.⁹⁴⁻⁹⁵

The primary sources of PM in the STGPD and surrounding areas are wildfire smoke and fireworks in the summer months, and woodburning stoves in the winter months.^{41, 85} Motor vehicles and construction equipment also emit PM.⁸⁵ Inhalation of PM is associated with a variety of adverse health outcomes, including heart attacks, premature death, and increased hospital admissions and emergency room visits for respiratory and cardiovascular problems.^{36, 41, 42} Fine PM is easily inhaled and can penetrate deep into the lungs and even

Lead and Ozone

Exposure to ozone in the Tacoma area is not a significant health risk, as the required environmental and chemical conditions needed to form ozone are not present, so this report will not include an assessment of the health outcomes related to ozone.⁹⁰

Lead-based paint in homes and other buildings constructed before 1980 is the main health concern in the Tacoma area, as the lead can become airborne during repainting, remodeling, and demolition.

Lead can also still be found in gasoline used by small aircrafts, which is then emitted in the exhaust of the aircraft.³⁶

Because the STGPD code does not regulate the demolition or remodeling of buildings, and there are no major sources of airborne lead within the STGPD, we did not include an assessment of health outcomes related to lead in this report.

enter the bloodstream.⁴¹ Long-term exposure to PM is also associated with type 2 diabetes mellitus and damage of the immune system.^{88, 96}

Levels of CO, SO₂, NO₂, and PM_{2.5} in Tacoma are below health-based air quality standards as of the time of this writing. However, as noted above, motor vehicles are the primary sources of these pollutants in our region, and while there are promising advancements in new technologies such as electric vehicles, widespread adoption of these less polluting technologies has been limited due to lack of electric charging infrastructure, slower fleet turnover, pace and cost of developing battery technology, and required decarbonization of electricity sources.⁹⁷

Toxic Air Pollutants in Tacoma

Toxic Air Pollutants are pollutants known or suspected to cause cancer or other serious health effects.⁸ From 2021 to 2022, PSCAA monitored VOCs and heavy metal PM emissions from the 3 Tacoma monitoring stations.

In many cases, PSCAA can determine the source of the pollutant, like PM from diesel exhaust or woodsmoke, for example. Further, the risk of developing cancer from exposure to air pollution can be quantified.⁸⁵ Of the risk one has of developing cancer due to air pollution:

- 85% of that risk comes from exposure to Diesel Particulate Matter (DPM).
- 6% of that risk comes from exposure to Hexavalent Chromium.
- 4% of that risk comes from exposure to the Benzene found in woodsmoke.^{36, 85, 90}

In the STGPD the main sources of DPM are the diesel vehicles that use the heavily trafficked roadways that envelop the area. The DOH Environmental Health Disparities map shows that the communities living in the census tracts within and surrounding the STGPD experience a disproportionate exposure to DPM from heavily trafficked roadways compared to communities in the rest of the State.⁹⁸

Further, a large warehouse facility is currently being constructed in the STGPD which is estimated to add an additional 4,980 new weekday daily vehicle trips. 1,411 of those daily trips will be from heavy-duty diesel trucks, of which 80% will travel through the residential area between the project site and Highway 16.⁹⁹

Hexavalent Chromium can be emitted from various industrial processes such as metal fabrication and chrome electroplating, as well as from the combustion of gasoline and diesel fuels, green glass production, and from some funeral home operations.³⁶ There are 2 funeral homes, 1 steel foundry, and approximately 6 metal fabrication facilities registered with PSCAA currently located in the STGPD.

The primary health outcome associated with inhalation of hexavalent chromium is lung cancer, followed by adverse respiratory, liver, and kidney effects.³⁶ Adverse immune, hematological, and male reproductive toxicity has also been associated with exposure to hexavalent chromium.³⁷

Traffic Related Air Pollution

Traffic Related Air Pollution (TRAP) is a mixture of both TAPs and CAPs and is a significant health concern for populations living near heavily-trafficked roadways. TRAP consists of both tailpipe and non-tailpipe

emissions. Tailpipe emissions include NO₂, elemental carbon, black carbon, hydrocarbons, CO, nitrogen oxides, and PM_{2.5}, as well as the VOC group called BTEX (benzene, toluene, ethylbenzene, and xylene).

Non-tailpipe emissions also present human health risks largely due to the resuspension of road dust that can include PM_{2.5} and heavy metals left behind from the wear and tear of tires, brakes, and roadway surfaces.^{94, 95}
⁹⁷ Many negative health outcomes are associated with long term exposure to TRAP including lung cancer, respiratory disease, asthma onset in children and adults, low birth weight, and heart disease.^{94, 95}

As mentioned above, air pollution is not regulated by the STGPD code but has been identified as a major concern for community members across Tacoma, and this assessment has identified multiple health conditions this community lives with are known to be associated with air pollution (Table 3).

In the next section, we propose multiple recommendations to address these health concerns, directed at decision-makers outside of the authority of the STGPD code.

Recommendations

The HIA process began in June 2024, and at that time a draft of the updated code was not available. Our recommendations reflect the basic structure of the existing code which applies to the entirety of the STGPD, and does not delineate between wellhead protection areas, as the draft code that was proposed in March 2025 does.

For ease of access, below is a list of our recommendations proposed in the Assessment section. Recommendations to alleviate other health concerns that cannot be addressed by the STGPD code follow.

An icon or multiple icons accompany each recommendation to indicate what health outcomes could be improved by the implementation of the recommendation.



Respiratory Health



Incidence of Cancer



Digestive Health



Cardiovascular Health



Neurological Health



Endocrine Health



Immune Health



Reproductive and Birth Outcomes

Recommendations for STGPD Code Update

Should the City's temporary ban on new metal recycling and auto wrecking facilities in the STGPD be permanent?

The City should make the temporary moratorium on metal recycling and auto-wrecking facilities permanent and it should include a prohibition on the expansion of existing metal recycling and auto wrecking facilities. The Health Department also recommends a prohibition on the establishment of new—and expansion of existing—metal fabrication facilities and steel foundries.



Should the City's temporary ban on new underground storage tanks within the STGPD be permanent?

The City should make the temporary moratorium on new—and the expansion of existing—underground storage tanks permanent, no matter the volume capacity of the tank. Expansions for the express purpose of repair should be permitted. This recommendation only applies to businesses that meet the criteria for regulation under the STGPD code.



ⁱ Metal manufacturing facilities refers to primary and secondary metal industries that manufacture, produce, smelt, or refine ferrous and nonferrous metal from molten materials and machine shops, fabricating, metal processing with etchers and chemicals.

Are there other use types that should be further regulated or prohibited from locating within the STGPD?

There should be a prohibition on new:

Vehicle maintenance facilities. Existing vehicle maintenance facilities regulated by the STGPD Code that wish to relocate in the STGPD should be exempt from this prohibition.



Septic tanks and wastewater treatment facilities.



Dry cleaning and industrial laundry facilities. A less protective approach would be to only permit facilities that do not use PERC substances.



Landfills. Prohibit expansion of existing landfill for purposes of solid waste disposal.



Should other standards or policies be updated or implemented?

- Require soil contaminant testing for any on-site infiltration.
- Uphold the existing policy of not infiltrating through contaminated soils.
- Specific, technical recommendations for a tree canopy standard or impervious surface standard cannot be made, but the Health Department supports adoption of such standards.



Recommendations Outside of Code Scope

Air Quality

As addressed in the Assessment section, South Tacoma has been identified as a “community overburdened by air pollution.” Residents of South Tacoma experience higher rates of health outcomes associated with Traffic Related Air Pollution (TRAP), like asthma, cancer, poor birth outcomes, and mortality from heart disease, respiratory disease, and diabetes. Below are recommendations to address these health outcomes through TRAP mitigation.

The City and Health Department should collaborate to begin conversations with the Puget Sound Clean Air Agency on best next steps for adopting an Indirect Source Rule.

Indirect Source Rules regulate facilities that produce extensive freight traffic. An Indirect Source Rule could require businesses that generate large volumes of TRAP through their indirect operations (i.e., freight traffic coming to and from a business) to reduce emissions of air pollutants from their ground operations.

Development and implementation of an Indirect Source Rule will require extensive community engagement and collaboration among agencies.



The Health Department should prioritize clean air interventions for residents in South Tacoma that may be at risk for poor birth outcomes or asthma-onset in children.

The Health Department will prioritize interventions like air purifiers to families and people in the STGPD Study Area that either have young children, pregnant people, or people planning to become pregnant soon.



The Health Department should support tree planting initiatives in areas of South Tacoma that experience poor air quality.



The Health Department and City of Tacoma should collaborate on the development and adoption of a residential habitability standard and improvements to the Building and Development code.

City of Tacoma should partner with the Health Department to identify appropriate elements of a residential habitability standard and building code improvements, that include mechanical cooling, such as air conditioners, or passive cooling features like green rooftops, and ventilation/filtration to reduce exposure to airborne contaminants.



Increased Collaboration

The City, Health Department, and Tacoma Water should create a more formal mechanism between the agencies responsible for the implementation of the Stormwater Infiltration Policy, like a Memorandum of Understanding (MOU), to ensure consistent application and implementation.

The City should collaborate with the Health Department to ensure new businesses, businesses that change use, or businesses that expand their capacity to handle hazardous substances in the STGPD are properly vetted to determine if they should be regulated by the STGPD Code. This measure could be formalized in the recommended MOU.

All the jurisdictions encompassed by the Central Pierce County Aquifer SSA should collaborate to adopt a consistent set of regulations.

- The Central Pierce County SSA is a resource that is impacted by activities across all of Pierce County, not just in Tacoma. This collaboration could begin with discussions amongst municipal and county planners at the Pierce County Regional Council Growth Management Coordinating Committee. The Health Department should be present during these conversations to ensure any new standards being considered are evaluated with a public health lens.

The Health Department should use this HIA as a resource when it updates its *General Guidance and Performance Standards for the South Tacoma Groundwater Protection District* manual.

Monitoring and Evaluation

Monitoring and Evaluation planning constitute the final phase of HIAs. This section shall serve as a plan for ongoing monitoring, as well as process and impact evaluation of the STGPD HIA. The Health Department will seek funding and staffing opportunities to support ongoing monitoring and evaluation of this HIA to:

1. Track adoption, feasibility, and effectiveness of recommendations.
2. Assess the ability of this HIA to improve equity and community empowerment.
3. Monitor for trends in health disparities.
4. Conduct quality improvement on our internal process for conducting health impact assessments.

The proposed evaluation plans include process and impact evaluation. Specific outcomes evaluation is difficult due to the complexity, time, and resource commitment needed. However, the Health Department will monitor a subset of their standard health indicators for the STGPD Study Area to watch for trends in identified health disparities and inequities.

Monitoring

Monitoring includes the development of a strategy to sustain the relevance of HIA recommendations and relationships over time. It also includes a process to track the potential impacts on policy, health determinants and outcomes over time.

The STGPD HIA monitoring strategy includes an approach to sustain community engagement in the decision-making system and build upon successes and lessons learned through the process. Monitoring also creates an opportunity for the City and Health Department to demonstrate accountability to community members impacted by the STGPD code.

Indicators

We selected health indicators for monitoring based on identified health disparities for the community living within the STGPD Study Area and on potential impact of the updated code. HIA recommendations, if adopted, align with other efforts happening in this community, and may collectively work to decrease health disparities.

The Health Department is in the process of building a data dashboard for many population and health indicators across the county. We will monitor a subset of these indicators annually for the STGPD Study Area. This subset includes:

- Population demographics.
- Persons living with a disability.
- Households with limited English proficiency.
- Households below the poverty line.
- Median household income.
- Unemployment rate.
- Households without a vehicle.
- Hypertension prevalence.
- Cardiovascular disease.
- Diabetes incidence.
- Cancer incidence.
- Heat related ED visits.
- Asthma related ED visits.
- Infant mortality.
- Low birth weight.

Additionally, the Health Department will monitor environmental conditions in the project area. We selected environmental indicators based on feasibility of monitoring, as well as potential impact from updated code. These environmental indicators include:

- Air quality—Via annual monitoring reports from the Puget Sound Clean Air Agency and Department of Ecology.
- Changes to tree canopy—Via City of Tacoma Equity Index.
- Water quality—Via Tacoma Water annual reporting.

Evaluation

Process Evaluation

The Health Department will conduct a process evaluation to assess this HIA's fidelity to minimum elements and practice standards, as well as to identify opportunities for quality improvement. This evaluation will include an opportunity for advisory group and contributing agency feedback on the process and may include a report of the findings that can be shared broadly with other HIA practitioners.

Impact Evaluation

Impact evaluation seeks to understand if, and how, the HIA affected the STGPD code update process, and the decision-making climate in general. Health Department staff will conduct an initial impact evaluation simultaneously with the process evaluation. This initial impact evaluation may be followed up on periodically, to capture ongoing or later stage impacts. Impact evaluation considerations include:

- How final STGPD code update decisions made or implemented relate to those considered in the HIA.
- How HIA findings and recommendations were considered and included in policy and planning efforts—either by the City or other affected agencies.
- If Advisory Group members and impacted communities were given opportunities to develop skills or form new partnerships.
- How awareness and consideration of health changed the decision-making climate.

Outcome Evaluation

Outcome evaluation can track effects of the STGPD code revision and adopted HIA recommendations over time on health determinants and disparities and other outcomes detailed in the assessment phase of the HIA. Health outcomes are difficult to quantify because they are affected by many factors including residents moving into and out of the STGPD Study Area—thereby making it inappropriate to make comparisons of that community's health over time. Outcome evaluation efforts will use the health and environmental indicators listed in the monitoring plan. The HIA used best available evidence to identify recommendations that could result in direct and indirect long-term and short-term impacts on health and specifically, health inequities in the South Tacoma community. However, there is considerable difficulty in attributing specific indicator changes to this HIA and policy alone.

The Health Department may seek funding to collaborate with the City and conduct an outcome evaluation 2-3 years after the code revision process is complete.

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