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Irondale Beach Park Shellfish Sample Plan

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Purpose

Irondale Beach Park is located along the sheltered Port Townsend Bay on the northeastern corner of the Olympic Peninsula in Irondale, Jefferson County, Washington State (See Figure 1). In order to fill a data gap base on a single composite sample from Jefferson County Public Health (JCPH), the Washington State Department of Health (DOH) recommended the sampling and analysis of shellfish grown and harvested in the area for possible inorganic contaminants. The purpose of this sampling effort is to quantify chemical concentrations in shellfish so that their acceptability for human consumption can be determined. The following discussion outlines recommendations for the sampling of shellfish from inter-tidal beach areas of Irondale Beach Park.

Background

The city of Irondale was platted in 1909 with a population of 1500 and plans were made for a booming city of 20,000 in three years [1]. The community was named for iron smelting plant. Irondale Furnace, Puget Sound Iron Company (Irondale Furnace) was built in 1880-1881 and operated a hot blast, open top furnace that produce # 1 foundry pig iron with an annual capacity of 10,000 tons [2]. Irondale Furnace operated through 1889 then closed. The smelting plant later reopened as Western Steel Company and smelting continued intermittently into the early 1900's.

Today, Irondale is an unincorporated community and is part of the "Tri-Area" of Irondale, Chimacum and Port Hadlock in central-east Jefferson County. In 2001, Jefferson County purchased the 13-acre former industrial site and shoreline area (Irondale Beach Park). In 2005, a citizen complained of oil on the beach and the Washington State Department of Ecology (Ecology) investigated and took three samples. These samples revealed the presence of severely weathered fuel oil that exceeded the state's Model Toxic Control Act (MTCA) cleanup level. In March 2006, Ecology placed the site on the suspected contaminated site list. Irondale Beach Park has been identified as a high-priority cleanup area as part of Governor Christine Gregoire led Puget Sound Initiative, to protect and restore the Puget Sound and Hood Canal to good ecosystem health by 2020.

In December 2006, Irondale Beach Park was closed pending concerns about potential human health risk. Jefferson County Public Health (JCPH) conducted additional tests including a single multi-species composite shellfish sample. The shellfish tissue was analyzed for polycyclic aromatic hydrocarbons (PAHs) and metals. The sample results indicated that lead may be of concern to human health especially for young children, but the nature in which the sample was taken did not follow standard protocols, and so DOH recommended additional shellfish sampling at the site. In April 2007, Irondale Beach Park was reopened to the public. However, JCPH and Jefferson County posted signs warning of possible risk to human health from consumption of intertidal shellfish harvested in the area. Currently, DOH Office of Shellfish and Water Protection has a marine biotoxin closure for butter clams in the Chimacum Creek Tidelands and Irondale Beach Park area.

The Washington State Department of Fish and Wildlife (WDFW) indicated that there are sufficient numbers of native littleneck clams (*Protothaca staminea*) at Irondale Beach Park. The WDFW also indicated the adjoining Chimacum Creek Tidelands has native littleneck clams, butter clams

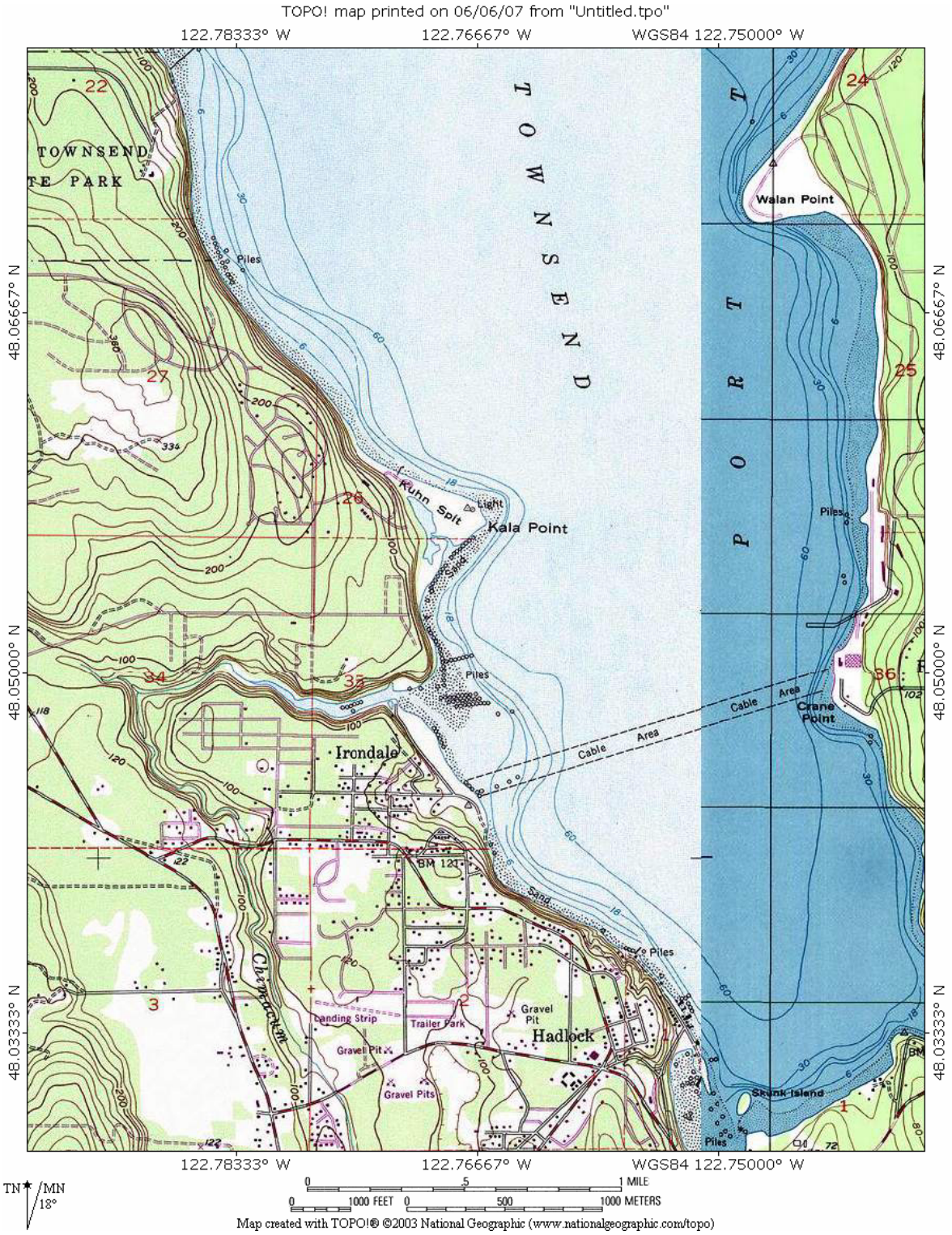
(*Saxidomus giganteus*), horse clams (*Tresus nuttalli* and *Tresus capax*) and eastern softshell clams (*Mya arenaria*). According to WDFW beach surveys (flyovers??) about 1,334 recreational harvesters collected shellfish from the Irondale Beach Park growing area in 2005.

Shellfish Sampling

The goal of shellfish sampling at Irondale beach park is to measure the mean or median concentrations of selected chemical (metals) in specific shellfish species targeted for human consumption and determine whether or not they are safe for people to eat. In preparing this discussion, the following issues were considered:

- which species to sample and test,
- sample handling procedures that maintain sample integrity and security, and
- the number and formulation of samples, as well as sample collection locations.

Figure 1. Port Townsend Bay, Irondale Beach Park Shellfish Growing area, Jefferson County Washington State



Species Selection

Selection of shellfish specie to sample for this study was driven by availability and anticipated consumption. WDFW indicated Irondale Beach Park has good numbers of native littleneck clams. Focusing on native littleneck clams as the primary target species for this study is recommended, unless other species are found to be in greater abundance within the area of concern.

Sample Handling

Underlying the quality of all environmental data are the procedures used to collect and handle samples prior to analysis. Specific recommendations regarding the collection, handling, documentation, and analysis of shellfish tissue samples are documented in various guidance documents prepared for the U.S. Environmental Protection Agency, Region 10, and the Puget Sound Water Quality Action Team. These guidance documents are available on the world wide web at: http://www.psat.wa.gov/Publications/protocols/protocol.html [3]. These protocols were developed in an effort to standardize data gathering and hence increase the comparability of Puget Sound data. Because of their length, these documents and the recommendations contained in them are included herein by reference. Updated analytical methods resulting in lower detection and quantitation limits should be used when available in place of those specified in these referenced guidance documents.

Sampling Design

Consideration of the number and formulation of samples is essential to achieve study goals. Numerous discussions have been written on the topic of composite sampling verses the use of individual grab samples [4,5,6,7]. While there are advantages associated with the analysis of individual shellfish, the greatest benefit being the determination of chemical concentration variance, the analysis of composite shellfish samples is recommended. Use of composite shellfish samples is justified based on: analytical need for greater tissue mass than is available from an individual shellfish, cost considerations, a typical exposure metric involving the consumption of numerous shellfish during a meal, and the desire to be consistent with past Puget Sound Ambient Monitoring Program (PSAMP) studies of contaminants in shellfish [8]. Additionally, EPA demonstrated using power analysis calculations that composite sampling results in a much more precise estimate of the mean and a considerable increase in statistical power, over the analysis of individual samples [9]. The following recommendations are provided for the formation of native littleneck clam composite samples.

- Composite samples should be comprised of a single species and not contain a mixture of species,
- Shellfish should not be depurated prior to shucking,
- The entire soft tissue parts of the clam should be included in the composite,
- Shellfish comprising the composite sample should be of legal harvest size, and
- Each composite sample should contain 30 individuals, representing the distribution of sizes at the sample location, (i.e. 10 small, 10 medium, and 10 large shellfish).

Secondary Species

Collection of a limited number of secondary species (e.g., butter clams or eastern softshell clams) samples is recommended to verify that contaminant concentrations are similar to or below concentrations reported for native littleneck clams. Butter clams composite samples should consist of 15 individual shellfish each of random sizes within the legal size limits. However, if the concentration of butter clams is limited in the areas, no sampling of the species should occur. As mentioned above, composite samples should only be comprised of a single specie.

Sample Size Estimation

Sample size calculations were performed for primary COCs to estimate the minimum number of samples required based on a significance of 10%, a power of 90%, and a minimum detectable difference of observed values from levels that would result in a shellfish consumers' dose equal to a non-cancer reference dose (RfD), a 10^{-4} cancer risk level (from inorganic arsenic exposure), or a lead exposure protective of both adults and children. DOH recommends a minimum of 3 composite samples o obtain mean contaminant concentrations at Irondale Beach and Chimacum Creek tidelands. Composite samples will be analyzed to provide a measure of average concentrations of chemicals of typical exposures. Composite samples are a cost-effective way to estimate average tissue concentrations compare to analyses of individual. Each sample consisted of the pooled entire soft parts from approximately 30 individual organisms for the primary species (native littleneck clams) and 15 individual organisms for the secondary species (butter clams or eastern softshell clams). All clams taken for analysis should be of legal size and all specimens should be unbroken. Table 1 shows the species and number of composite samples that will be analyzed from each sampling location.
Different species should never be combined in composites but should be analyzed separately. A minimum of three composites per location is also necessary to compare sites if one wants to test for site differences.

Recommended Sample Locations

Two different regions should be sampled representing Irondale Beach Park and a part of Chimacum Creek Tidelands. The proposed sample collection areas are as follows, Figure 2: (A) Irondale Beach Park beach, (B) a part of Chimacum Creek Tidelands. All shellfish samples should be collected during a low tidal cycle, preferably when the tide is at a height of 0.0 feet or lower, and as close to the water as practical.

Figure 2. Irondale Beach Park and adjacent Chimacum Creek Tidelands shellfish collection area, Jefferson County Washington State

Quality Assurance

Quality assurance includes aspects of sample collection, handling, documentation, analysis, and reporting. A complete discussion of quality assurance measures is included in the previously referenced sampling guidance documents and is beyond the scope of this document [10]. One aspect worth mentioning is the need for the analysis of a duplicate sample of the primary species (i.e., native littleneck clams). Analysis of a duplicate sample provides a useful measure of the precision associated with the analysis of particular chemicals in a particular matrix.

Summary

The following table summarizes the total number of field samples and analyses recommended for characterizing chemical contamination in native littleneck, and butter clams from Irondale Beach Park and adjacent Chimacum Creek Tidelands.

Table1. Sample Summary

Species	Irondale Beach Park	Chimacum Creek Tidelands	Duplicate Sample	Matrix Spike	N=
	A	B			
Native littleneck clams	3	3	1	1	9
Butter or Eastern softshell clams	1	1	0	0	2
				Total number of analyses = 10	

Metals – All samples: Arsenic, Cadmium, Chromium, Copper, Lead, and Zinc.

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