Letter Health Consultation

Evaluation of Chemical Contaminant Data from Eastern Softshell Clams

Warm Beach, Snohomish County, Washington

December 3, 2014

Prepared by

The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

DOH 334-363 December 2014

Foreword

The Washington State Department of Health (DOH) prepared this health consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services. ATSDR is responsible for health issues related to hazardous substances.

The purpose of a health consultation is to assess the health threat posed by hazardous substances in the environment. If needed, a health consultation will also recommend steps or actions to protect public health. Health consultations are initiated in response to health concerns raised by residents or agencies about exposure to hazardous substances.

This health consultation was prepared in accordance with ATSDR methodologies and guidelines. However, the report has not been reviewed and cleared by ATSDR. The findings in this report are relevant to conditions at the site during the time the report was written. It should not be relied upon if site conditions or land use changes in the future.

Use of trade names is for identification only and does not imply endorsement by state or federal health agencies.

For additional information, please contact us at 1-877-485-7316 or visit our web site at www.doh.wa.gov/consults.

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December 3, 2014

Sean Edwards
Snohomish County Public Works
Surface Water Management Division
3000 Rockefeller Avenue, MS-607
Everett, Washington 98201-4046

Re: Evaluation of Chemical Contaminant Data from Eastern Softshell Clams collected from Warm Beach, Snohomish County

Dear Mr. Edwards:

At the request of the Snohomish County Public Works Department, the Washington State Department of Health (DOH) has evaluated chemical contaminant data from eastern softshell clam (*Mya arenaria*) tissue. The clams were collected on September 8, 2014 from Warm Beach, Snohomish County. DOH received the sampling results on October 1, 2014 and reviewed the chemical contaminant data to determine if there is a potential human health risk from consuming these clams.

Based on the evaluation of the October 1, 2014 clam contaminant data, consuming clams is not expected to result in harmful human health effects. The DOH Site Assessments Program recommends that DOH Office of Shellfish and Water Protection (OSWP) and Snohomish County use this letter health consultation to guide decisions related to recreational shellfish harvesting in unclassified and prohibited harvesting areas of the Warm Beach area. This letter health consultation is limited to the evaluation of chemical contamination in one species of clam; no microbial contaminants were evaluated. A summary of the findings is included in this letter. DOH conducts health consultations in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR).

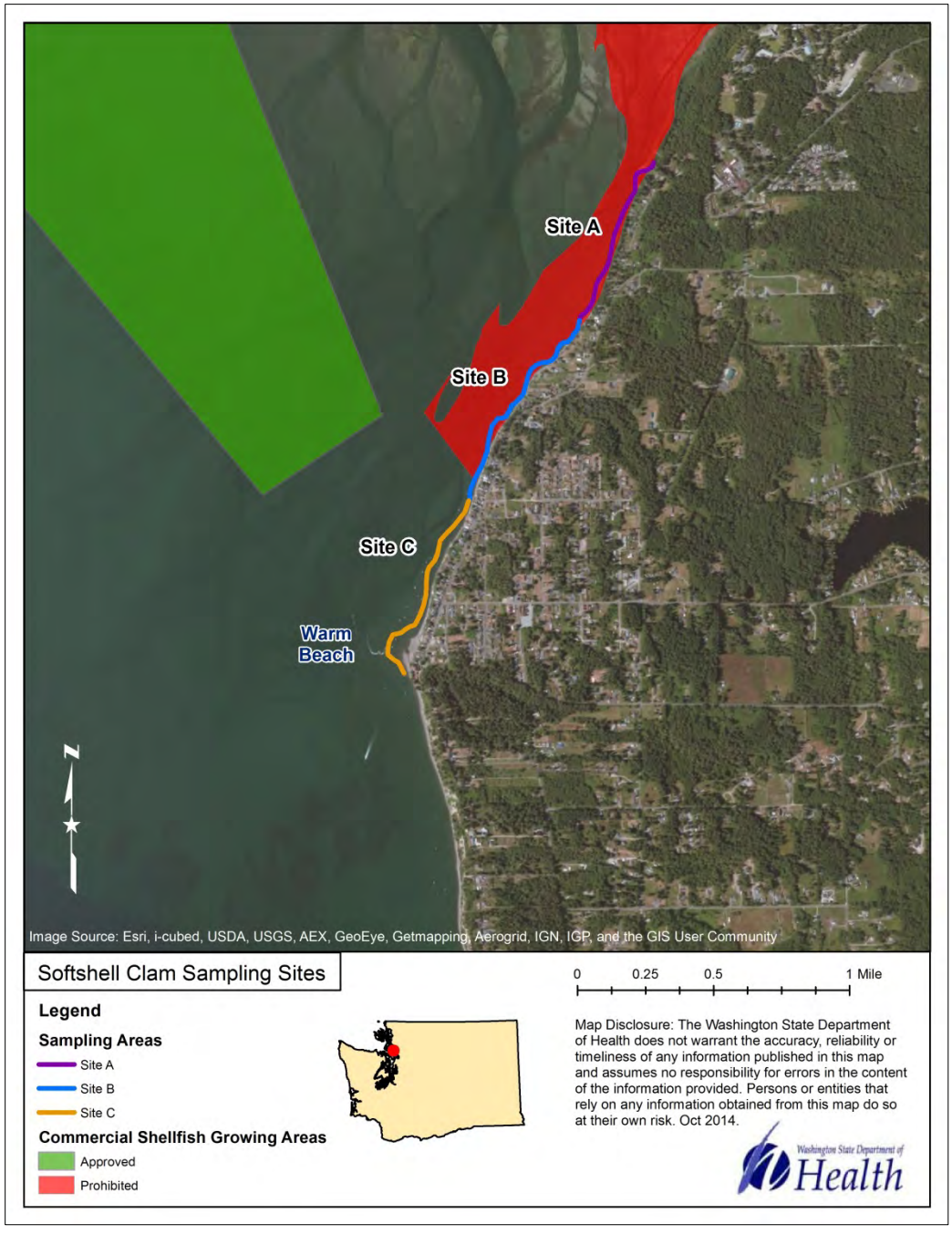
Background and Statement of Issues

This letter health consultation was conducted as a follow-up to one completed in March 2014 that examined environmental monitoring data from mussels collected from Warm Beach. No health concerns were identified with mussels from the Warm Beach Mussel Watch Pilot Expansion Project [1]. However, a site visit indicated that area residents and recreational

shellfish harvesters may be more interested in the sampling and analysis of clams in comparison to mussels. To make a conclusion about the potential health risk from eating other shellfish from the area, sampling of other species, primarily eastern softshell clams, was recommended.

Warm Beach is located along the shores of Port Susan in Snohomish County. This beach supports private, non-tribal recreational shellfish harvesting; there are approximately 230 private tideland owners in the vicinity [2]. Figure 1, below, outlines the areas where clams were sampled.

Figure 1: Softshell Clam Sampling Areas, Warm Beach, Snohomish County, Washington



The OSWP is responsible for classifying commercial and recreational shellfish growing areas. Commercial shellfish growing areas are classified as Approved, Conditionally Approved, Restricted, and Prohibited. Recreational beaches are classified as Open, Conditionally Open, Emergency Closure, Closed, and Unclassified. Currently, a part of the Warm Beach area is classified as "Approved". Close by, another area is classified as "Prohibited" due to proximity to a wastewater treatment plant outfall. The remaining area is "Unclassified" (no formal assessment has been conducted). Figure C1 (see Attachment C – Prohibited Shellfish Harvesting) shows a map of Port Susan area and its current classifications for shellfish growing and harvesting.

Snohomish County Public Works collaborates with local partners and stakeholders to raise public awareness about water quality and the need for shellfish protection in Port Susan and South Skagit Bay. One of the objectives of their shellfish program is to reconnect the local community to local shellfish resources through various outreach and education activities, such as shellfish gardening workshops and shellfish dinner events [2]. By interpreting the clam data, DOH aims to help Snohomish County and the Warm Beach community understand any potential human health risks from chemical contaminants in locally harvested shellfish.

Discussion

Clam Study Dataset and Limitations

Five composite samples were collected along Warm Beach: two from Site A, two from Site B, and one from Site C (see Figure 1). Each composite was comprised of about 30 clams of legal harvest size. These clams were sent to AmTest Inc., where they were shucked and the tissues homogenized for chemical analysis. The lab report provided by AmTest Inc. analyzed each of these samples for various metals, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). Concentrations were reported as dry weight clam tissue data [3]. DOH converted these concentrations to wet weight concentrations (see Attachment A – Concentration and Screening Value Calculations) to use in the health screening process in order to reflect typical seafood consistency consumed. Sample results only examine chemical contaminants and do not address potential health concerns regarding microbial contamination in shellfish.

Exposure Pathways

In order for any contaminant to be a health concern, the contaminant must be present at a high enough concentration to cause potential harm, and there must be a completed route of exposure to people. Tideland owners report eating clams from Warm Beach. Therefore, the potentially exposed population consists of private tideland owners who harvest shellfish recreationally.

Health Screening Evaluation

DOH generated screening values for each contaminant using the Environmental Protection Agency (EPA) guidance method for fish advisories [4]. These risk-based screening values are a basis for assessing whether chemical contaminant concentrations present in clam tissue are a concern to human health when consumed. Based on Warm Beach community demographics, DOH used a consumption rate based on general population shellfish consumers. EPA has developed national recommended human health criteria (HHC) based on a general population

consumption rate of 17.5 grams per day (g/day) of fish and/or shellfish for the average adult weighing 70 kg [4]. This is approximately 8 ounces of uncooked clam meat once every two weeks. For details, see Attachment A – Concentration and Screening Value Calculations.

For the initial screening, DOH conservatively assumed that all shellfish consumed are clams with the highest levels of contaminants from Warm Beach. The highest level of each chemical was then compared to its screening value to see if it would pose a potential health problem. Both non-cancer and cancer health effects (when applicable to a chemical) were part of the screening process. If the highest concentration of a chemical exceeds its calculated screening value, DOH analyzes the chemical further and categorizes it as a "chemical of concern." ATSDR Minimal Risk Levels (MRLs) for oral exposure were referenced for each chemical and used in the screening value calculations. For chemicals that did not have MRLs, EPA Oral Reference Doses (RfDs) were used instead. For details, see Attachment B – Screening of Chemicals.

Based on the health screening evaluation of this clam sampling data, no chemicals were found to be contaminants of concern at Warm Beach.

Conclusions

DOH concludes that the concentrations of chemicals found in clams collected from the Warm Beach are not expected to harm human health. The maximum levels of chemical contaminants are below concentrations where we would expect to see non-cancer or cancer health effects.

Recommendations

OSWP should use this letter health consultation to guide decisions related to recreational shellfish harvesting at Warm Beach.

DOH recommends that Snohomish County continue activities that encourage local residents and other Warm Beach stakeholders to harvest clams recreationally and reconnect to local shellfish resources.

Note that a portion of Warm Beach is classified as prohibited for shellfish harvesting. This is primarily due to possible microbial contamination concerns with effluent from the Warm Beach Christian Camp Water Reclamation Facility. For a detailed map of the Warm Beach area, see Attachment C. To protect yourself against bacteria, viruses, and biological toxins, follow the Department of Health's shellfish advisories. Check the shellfish safety map (http://www.doh.wa.gov/shellfishsafety.htm) before harvesting. With current chemical contaminant data, DOH recommends that normal fish consumption guidelines be followed for this region of Puget Sound. See the DOH fish advisory website for details: http://www.doh.wa.gov/CommunityandEnvironment/Food/Fish/Advisories.aspx.

DOH appreciates the opportunity to review and assist in the evaluation of the Snohomish County clam sampling data from Warm Beach. A copy of this letter will be placed on the DOH Site Assessments webpage: http://www.doh.wa.gov/consults. If you have any questions regarding this letter please contact me at 360-236-3357 or by email at Amy.Leang@doh.wa.gov.

Sincerely,

Amy Leang
Health Assessor, Toxicologist
Site Assessments and Toxicology Section

cc: Joanne Snarski, Department of Health

References

1. Washington State Department of Health. 2014. Letter Health Consultation, Evaluation of Environmental Data from Mussels from Warm Beach, Snohomish County. <www.doh.wa.gov/consults>. Olympia, WA.

2. Snohomish County. 2011. Stillaguamish Shellfish Protection Program. Snohomish County Public Works, Surface Water Management. Everett, WA.

3. AmTest Laboratories. 2014. Analytical Data AMTEST ID 14-A014241 – 14-A014245. Prepared by Aaron Young. Kirkland, WA.

4. U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories - Volume 1, Fish Sampling and Analysis, Third Edition. EPA-823-B-00-007.

5. Washington State Department of Ecology, Environmental Assessment Program: 2002. Inorganic arsenic levels in Puget Sound fish and shellfish from 303(d) listed water bodies and other areas, Prepared by Art Johnson and Morgan Roose: Publication No. 02-03-057. Olympia, WA.

Attachment A – Concentration and Screening Value Calculations

Calculations are based on Environmental Protection Agency (EPA) methodology [4]

Screening Value (SV) Formulas

Non-cancer Health Effects	Cancer Health Effects
$SV = [(MRL\ or\ RfD) \times BW]/CR$	$SV = [(RL/CSF) \times BW]/CR$

SV = Screening value (mg/kg or ppm)
MRL = Minimal risk level (mg/kg/day)
RfD = Reference dose (mg/kg/day)
BW = Mean body weight (kg) = 70 kg, average adult
RL = Risk level (life time cancer risk) = $1x10^{-5}$
CSF = Oral cancer slope factor (mg/kg/day), contaminant-specific
CR = consumption rate (kg/day)

- General population fish and shellfish CR = 17.5 g/day = 0.0175 kg/day (used in SV1)
- General population average shellfish CR = 1.70 g/day = 0.0017 kg/day (used in SV2)

Note: Preliminary screening with Screening Value 1 (SV1) uses the general population *shellfish and fish* consumption rate based on EPA methodology. All chemicals are screened first using SV1. Additional screening with a Screening Value 2 (SV2) is used when the maximum concentration of a chemical exceeds SV1. Since the scope of this consultation is limited to the consumption of softshell clams, DOH uses a more specific average *shellfish* consumption rate in calculating SV2. Any chemical concentration that exceeds SV2 would then require further health risk assessment.

Conversion from Dry Weight to Wet Weight Concentrations

Wet Weight = Dry Weight × [100 - % Water Content] /100
= Dry Weight × [% Total Solids*] /100

*Total Solids in each sample ranged from 10.3% - 14.0%.

Attachment B – Screening of Chemicals

The arsenic concentration was given as total arsenic in the data set, although only inorganic arsenic is known to be harmful. To account for this, the arsenic concentration was multiplied by 1% as studies have shown that this is the estimated proportion of inorganic arsenic in shellfish [5].

Table B1. Non-Cancer Health Effects Screening of Metal Concentrations in Clams from Warm Beach, Snohomish County, WA

Metal	EPA Cancer Class	Maximum Concentration (ppm)	MRL (mg/kg/day)	Screening Value (ppm)	Reference for Screening Values	Contaminant of Concern
Arsenic (inorganic)	A	0.07	0.0003	1.2	MRL, Chronic-Oral	No
Cadmium	B1	0.39	0.0001	0.4	MRL, Chronic-Oral	No
Copper	D	18.7	0.01	40	MRL, Intermediate-Oral	No
Lead	B2	1.40	NA	NA	EPA exposure model	[see Table B2]
Mercury	C	0.10	0.0003	1.2	MRL, Chronic-Oral	No
Zinc	IN	13.1	0.3	1200	MRL, Chronic-Oral	No

MRL: Minimal Risk Level from Agency for Toxic Substances & Disease Registry
mg/kg: milligrams per kilogram; mg/kg/day: milligrams per kilogram per day
EPA (Environmental Protection Agency) Cancer Class -
A: Human Carcinogen
B1: Probable Human carcinogen based on limited evidence in humans and sufficient evidence in animals
B2: Probable human carcinogen based on sufficient evidence in animals
C: Possible human carcinogen
D: Not classifiable as to its carcinogenicity to humans
IN: Inadequate information to assess carcinogenic potential

Table B2: Screening of Lead Concentration in Clams from Warm Beach, Snohomish County, WA using Integrated Exposure Uptake Biokinetic (IEUBK) Model

Maximum Lead Concentration (ppm)	Proportion of Meat Intake as Fish (%)	Children with Blood Lead Levels ≥ 5 µg/dL (%)	Public Health Concern
1.4	7.5	0.432	No

Results are based on the IEUBK Model Version 1.1 Build 11; input parameters from Environmental Protection Agency.
ppm: parts per million, µg/dL:micrograms per deciliter of blood; % : percent, ≥: greater than or equal to

Table B3. Non-Cancer Health Effects Screening of Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations in Clams from Warm Beach, Snohomish County, WA

PAHs	EPA Cancer Class	Concentration (ppb)	MRL or RfD (mg/kg/day)	Screening Value (ppb)	Reference for Screening Values	Contaminant of Concern
2-Methylnaphthalene		<3.33	0.6	2400000	Naphthalene, MRL Int-Oral	No
acenapthylene		<3.33	0.03	120000	Pyrene RfD surrogate	No
acenaphthene		<3.33	0.6	2400000	MRL, Intermediate-Oral	No
fluorene	D	<3.33	0.04	160000	RfD, Chronic Oral	No
phenanthrene	D	<3.33	0.3	1200000	Anthracene RfD surrogate	No
anthracene	D	<3.33	0.3	1200000	RfD, Chronic Oral	No
fluoranthene	D	<3.33	0.04	160000	RfD, Chronic Oral	No
pyrene	D	<3.33	0.03	120000	RfD, Chronic Oral	No
benz(a)anthracene	B2	<3.33	0.03	120000	Pyrene RfD surrogate	No
chrysene	B2	<3.33	0.03	120000	Pyrene RfD surrogate	No
benzo(b)fluoranthene	B2	<3.33	0.04	160000	Fluoranthene RfD surrogate	No
benzo(j,k)fluoranthene	B2	<3.33	0.04	160000	Fluoranthene RfD surrogate	No
benzo(a)pyrene	B2	<3.33	0.03	120000	Pyrene RfD surrogate	No
indeno(1,2,3-c,d)pyrene	B2	<3.33	0.04	160000	Fluoranthene RfD surrogate	No
dibenz(a,h)anthracene	B2	<3.33	0.03	120000	Pyrene RfD surrogate	No
benzo(g,h,i)perylene	D	<3.33	0.03	120000	Pyrene RfD surrogate	No

MRL: Minimal Risk Level from Agency for Toxic Substances & Disease Registry
RfD: Reference Dose from EPA
ppb: parts per billion
mg/kg/day: milligrams per kilogram per day
EPA (Environmental Protection Agency) Cancer Class -
B2: Probable human carcinogen based on sufficient evidence in animals
D: Not classifiable as to its carcinogenicity to humans

Table B4. Non-Cancer Health Effects Screening of Polychlorinated Biphenyls (PCBs) Concentrations in Clams from Warm Beach, Snohomish County, WA

PCBs	EPA Cancer Class	Concentration (ppb)	MRL or RfD (mg/kg/day)	Screening Value (ppb)	Reference for Screening Values	Contaminant of Concern
PCB (Aroclor 1254)	B2	<17	0.00002	80	MRL, Chronic-Oral	No
PCB (Aroclor 1016)	B2	<17	0.00007	280	Oral RfD	No

Note: No PCBs were detected; reported concentrations are the highest Practical Quantitation Limits (PQLs). No MRLs or RfDs have been established for other PCB aroclors.
EPA: Environmental Protection Agency
MRL: Minimal Risk Level from Agency for Toxic Substances & Disease Registry
RfD: Reference Dose from EPA
B2: Probable human carcinogen based on sufficient evidence in animals
ppb: parts per billion ; mg/kg/day: milligrams per kilogram per day

Table B4 ends the non-cancer health effects screening. No contaminants of concern (COCs) were identified. For screening cancer health effects, analytes with probable or likely cancer class categorization were analyzed further. Cadmium is known to be carcinogenic, but only when inhaled. Therefore, arsenic was the only metal to be screened for cancer.

Preliminary cancer screening resulted in chemicals identified as COCs; however, preliminary screening values (SV1) assume a total *fish and shellfish* consumption rate of 17.5 g/day. If the concentration of a chemical exceeds its screening value, DOH analyzes the chemical further. Further screening was completed using a more specific screening value (SV2), which assumes a general population average *shellfish* consumption of 1.70 g/day. This further screening indicated that none of the chemicals are a health concern for consuming eastern softshell clams.

Table B5: Cancer Health Effects Screening of Metal Concentration in Clams from Warm Beach, Snohomish County, WA

Metal	Concentration (ppm)	SV1 (ppm)	SV2 (ppm)	EPA Cancer Class	Cancer Slope Factor $(mg/kg/day)^{-1}$	COC for SV1	COC for SV2, Final
Arsenic (Inorganic)	**0.068**	0.007	**0.072**	A	5.7	Yes**	**No**

**Secondary screening with SV2 is required to determine whether further evaluation is necessary.
COC: Contaminant of Concern
EPA (Environmental Protection Agency) Cancer Class A: Human Carcinogen
SV1: Screening Value 1, preliminary screening using general population seafood consumption rate of 17.5 g/day.
SV2: Screening Value 2, secondary screening using general population average shellfish consumption rate of 1.70 g/day.
ppm: parts per million; $mg/kg/day^{-1}$: milligrams per kilograms body weight-day

Table B6: Cancer Health Effects Screening of Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) Concentrations in Clams from Warm Beach, Snohomish County, WA

cPAHs	Concentration* (ppb)	TEF	Concentration × TEF (ppb)	SV1 (ppb)	SV2 (ppb)	EPA Cancer Class	Cancer Slope Factor $(mg/kg/day)^{-1}$	COC for SV1	COC for SV2, Final
benz(a)anthracene	<3.33	0.1	0.333						
chrysene	<3.33	0.001	0.00333						
benzo(b)fluoranthene	<3.33	0.1	0.333						
benzo(j,k)fluoranthene	<3.33	0.01	0.0333	5	**56**	B2	7.3	Yes**	**No**
benzo(a)pyrene*	<3.33	1	3.33						
indeno(1,2,3-c,d)pyrene*	<3.33	0.1	0.333						
dibenz(a,h)anthracene*	<3.33	1	3.33						
Total cPAH TEQ			**8**						

Method: Environmental Protection Agency (EPA). Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EAP/600/R-93/089. 1993.
*No PAHs were detected; reported concentrations are the highest Practical Quantitation Limits (PQLs).
**Secondary screening with SV2 is required to determine whether further evaluation is necessary.
COC: Contaminant of Concern
TEF: Toxicity Equivalency Factors for cPAHs
EPA (Environmental Protection Agency) Cancer Class B2: Probable human carcinogen based on sufficient evidence in animals
SV1: Screening Value 1, preliminary screening using general population seafood consumption rate of 17.5 g/day.
SV2: Screening Value 2, secondary screening using general population average shellfish consumption rate of 1.70 g/day.
ppb: parts per billion

Table B7: Cancer Health Effects Screening of Polychlorinated Biphenyls (PCBs) Concentrations in Clams from Warm Beach, Snohomish County, WA

PCBs	Concentration* (ppm)	SV1 (ppm)	SV2 (ppm)	EPA Cancer Class	Cancer Slope Factor $(mg/kg/day)^{-1}$	COC for SV1	COC for SV2, Final
Total PCBs	**<0.12**	0.02	**0.21**	B2	2	Yes**	**No**

*No PCBs were detected; reported concentrations are the sum of the highest Practical Quantitation Limits (PQLs) for all seven PCB aroclors analyzed.
**Secondary screening with SV2 is required to determine whether further evaluation is necessary.
COC: Contaminant of Concern
EPA (Environmental Protection Agency) Cancer Class B2: Probable human carcinogen based on sufficient evidence in animals
SV1: Screening Value 1, preliminary screening using general population seafood consumption rate of 17.5 g/day.
SV2: Screening Value 2, secondary screening using general population average shellfish consumption rate of 1.70 g/day.
ppm: parts per million ; mg/kg/day: milligrams per kilogram per day

Attachment C – Prohibited Shellfish Harvesting

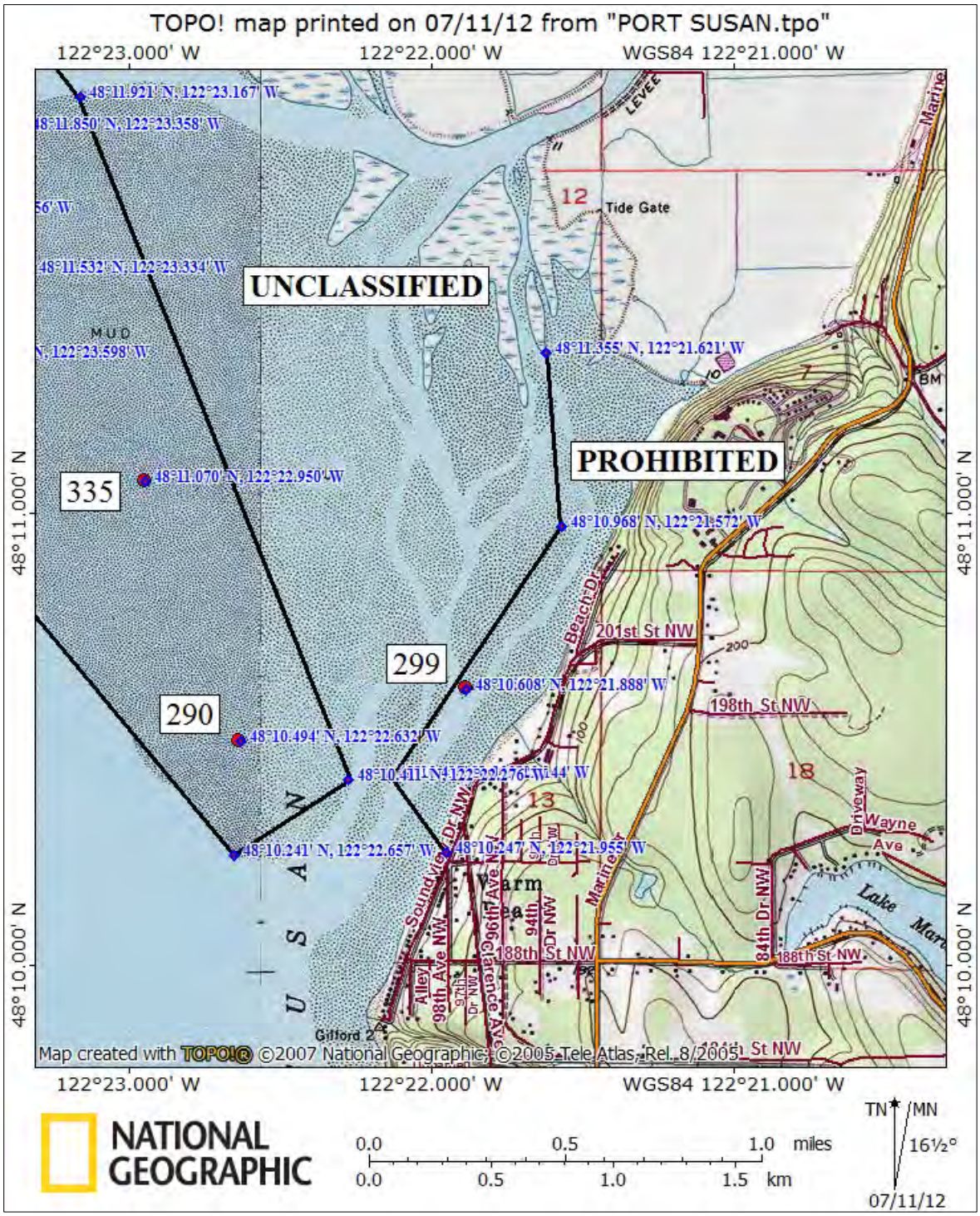


Figure C1: Topographic Map of Prohibited Shellfish Harvesting Area in Port Susan from Washington State Department of Health Office of Shellfish and Water Protection, URL: http://www.doh.wa.gov/Portals/1/Documents/4400/portsusan.pdf