



DEPARTMENT OF  
**ECOLOGY**  
State of Washington

Date: September 13, 2018

To: Rich Doenges, SWRO Section Manager, Water Quality Program

From: Barry Rogowski, HQ Cleanup Section Manager, Toxics Cleanup Program  
*Barry Rogowski*

Subject: Recommendation to deny Sediment Impact Zone applications as impacts of the discharge prohibit Sediment Impact Zone authorization and cannot be addressed via permit conditions

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### **Background and Scope**

This memorandum has been prepared by the Washington State Department of Ecology Toxics Cleanup Program (Ecology) and is a review of the proposed discharge under the application for a National Pollutant Discharge Elimination System (NPDES) permit and Sediment Impact Zone (SIZ) applications submitted by the Willapa-Grays Harbor Oyster Growers Association (WGHOGA) to discharge imidacloprid in Willapa Bay and Grays Harbor for the control of burrowing shrimp. This memorandum focuses solely on the SIZ applications. This memorandum has been updated in response to public comments received during the public comment period for Ecology's Notice of Intent to Deny National Pollutant Discharge Elimination System Permit. Ecology's Toxic Cleanup Program provided a response to comments pertaining to the Sediment Management Standards contained in a memo sent to the project file from Barry Rogowski on September 11, 2018.

### **1. Introduction**

In 2016, the WGHOGA on behalf of a group of growers requested an Individual NPDES permit to authorize chemical applications of imidacloprid on up to 485 acres per year of commercial clam and oyster beds within Willapa Bay, and up to 15 acres per year within Grays Harbor. WGHOGA completed and submitted an application for the required NPDES permit, and applications for two SIZ authorizations for areas in Willapa Bay and Grays Harbor in April 2017.

The WGHOGA's application proposes a discharge of imidacloprid to kill native burrowing shrimp. Burrowing shrimp mortality would occur through indirect mortality or through paralysis and eventual suffocation after the shrimp can no longer maintain their burrows (Final Supplemental Environmental Impact Statement 2018 (FSEIS)). Imidacloprid is a neonicotinoid pesticide. It is a broad spectrum pesticide that targets a wide-range of invertebrates, with a lesser toxicity to vertebrates (FSEIS). As such, in an open water environment, it will affect non-target invertebrates concurrently with the target invertebrate (i.e., burrowing shrimp).

The toxicity of imidacloprid is based on interference of the neurotransmission in the nicotinic cholinergic nervous system. Imidacloprid binds to the nicotinic acetylcholine receptor (nAChR) at the neuronal and neuromuscular junctions in insects and vertebrates. The nAChR is an ion channel, and the endogenous agonist is the excitatory neurotransmitter acetylcholine (ACh). The receptor normally exists in a closed state, however, upon ACh binding, the complex opens a pore and becomes permeable for cations. The channel openings occur in short bursts, which represent the lifetime of the receptor-ligand complex. ACh is then rapidly degraded by the enzyme acetylcholinesterase (AChE). In contrast, imidacloprid bound to the nAChR is inactivated very slowly. Prolonged activation of the nAChR by imidacloprid causes desensitization and blocking of the receptor and leads to paralysis and death of biological organisms (CEPA-DPR, 2006).

The proposed chemical application under the WGHOGA application is described in detail within the 2018 Final Supplemental Environmental Impact Statement (FSEIS). The Literature Review (section 1.6.1) of the FSEIS includes a discussion of the new science and research that was evaluated during this process. This review included more than 100 research papers and the federal Environmental Protection Agency (EPA) Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid. The EPA document established proposed acute and chronic chemical concentration risk endpoints for saltwater invertebrates which are important in evaluating the environmental impacts of the pesticide application proposal submitted by WGHOGA. Numerous comments received by Ecology regarding the draft SEIS included extensive review of new scientific information and research publications and potential environmental impacts. Those comments, including references and citations, are included in both Appendix B and Appendix C of the FSEIS. The FSEIS is available through Ecology at the website: <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Aquatic-pesticide-permits/Burrowing-shrimp-control-Imidacloprid>.

Considering the concern for pollinators and aquatic insects raised by increased, widespread use of neonicotinoid pesticides, the literature regarding imidacloprid aquatic toxicity is rapidly expanding. For example, the Center for Food Safety submitted comments regarding Ecology's Notice of Intent to Deny National Pollutant Discharge Elimination System Permit. These comments included references to twelve additional scientific research papers regarding the environment impacts of imidacloprid which have recently been published. Ecology has continued to collect other relevant publications as well.

## **2. Regulatory Background on the Sediment Management Standards**

The Sediment Management Standards rules (Chapter 173-204 WAC) were developed to reduce and ultimately eliminate adverse effects on biological resources, including those that make up the base of the benthic food web, and reduce significant threats to human health from surface sediment contamination.<sup>1</sup>

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<sup>1</sup> The SMS rule Parts I-VI and Part VI were adopted under the Water Pollution Control Act, RCW 90.48, as well as the Model Toxics Control Act, RCW 70.105D and other authorities. The U.S. Environmental Protection Agency has approved the SMS Rule Parts I-VI and Part VI as federally-approved water quality standards for the State of Washington. In 1991, the EPA approved the initial version of the Sediment Management Standards in its entirety under the CWA. EPA also approved revisions to the Sediment Management Standards on September 18, 2008 and



Part III of the rule establishes sediment quality standards (SQS) – numeric and narrative criteria for marine and freshwater sediment. The SQS correspond to the long-term goals for sediment quality in Washington State. Chemical concentrations in sediments at, or below, the SQS criteria for that chemical are presumed to have no adverse effects on biological resources. Part IV of the rule includes a process for managing sources of sediment contamination, including conditioning an NPDES permit where the discharge has the potential to impact sediment and requiring use of a SIZ.

The NPDES permit applicant is required to apply for a SIZ authorization when Ecology determines that, as a result of a proposed discharge, the permit applicant will violate or create a substantial potential to violate the Sediment Management Standards of WAC 173-204-320 through WAC 173-204-420. A SIZ is an area where the applicable SQS may be temporarily exceeded due to a permitted or otherwise authorized discharge because it is not possible in the near term to reduce contamination resulting from the discharge sufficiently to meet the SQS. However, an upper limit has been placed on the allowable level of sediment contamination and impact to biological resources within a SIZ.

The discharge within a SIZ may not exceed a maximum chemical concentration or level of biological effects (often referred to as a SIZ max criteria). Ecology shall only authorize a SIZ if the discharge limitations, requirements, and compliance time periods can be conditioned sufficient to meet the Sediment Management Standards in Chapter 173-204 WAC. It is the policy of Ecology – as set out in the Sediment Management Standards rule – to only authorize a sediment impact zone in such a way as to “minimize the number, size, and adverse effects of all zones . . . with the intent to eliminate the existence of all such zones whenever practicable.” WAC 173-204-410(1)(b).

### **3. Regulatory Compliance for Sediment Impact Zone Authorization**

Ecology determined that the WGHOGA’s NPDES permit application to discharge imidacloprid<sup>2</sup> into Willapa Bay and Grays Harbor would require Ecology to authorize a Sediment Impact Zone for each bay. The WGHOGA submitted two SIZ applications, one each for Willapa Bay and Grays Harbor. The SIZ authorization can only be approved if a demonstration can be made that the proposed discharge can meet the requirements detailed in WAC 173-204 or if the permit can be conditioned sufficient to meet the requirements of the Sediment Management Standards.

Ecology’s review indicates that the proposed discharge cannot meet two requirements for a sediment impact zone, and that a NPDES permit cannot be sufficiently conditioned to meet those requirements. Authorization of a SIZ requires compliance with several requirements as set out in WAC 173-204-415(1)(a)-(j). The two requirements which the proposed discharge cannot meet are: (1) that the discharge shall not have an adverse effect to biological resources within the sediment impact zone above a minor adverse effects level; and (2) that the discharge shall not result in a violation of the SQS outside of the SIZ. *See* WAC 173-204-415(1)(f) and (i).

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again on December 18, 2015. *See* Water Quality Standards Regulations: Washington, available at <https://www.epa.gov/wqs-tech/water-quality-standards-regulations-washington> (last visited on March 2, 2018).

<sup>2</sup> The NPDES application and SIZ applications propose a discharge of imidacloprid to be applied directly to the sediment at a rate of up to 0.5 pounds of active ingredient per acre for all treatment scenarios.



**A) Requirement: Adverse effects to biological resources within a sediment impact zone shall not exceed a minor adverse effects level as a result of the discharge. WAC 173-204-415(1)(f).**

The impact of the proposed discharge inside the SIZ<sup>3</sup> cannot exceed a minor adverse effects level to biological resources.

The Sediment Management Standards establishes that “minor adverse effects” are the maximum chemical contaminant concentration, maximum health risk to humans, maximum biological effects level, maximum other toxic, radioactive, biological, or deleterious substance level, and maximum nonanthropogenically affected sediment quality level allowed within a SIZ. The process to establish those criteria are set out in WAC 173-204-420<sup>4</sup>.

The criteria at issue with this proposed discharge is the maximum biological effects level and the maximum other toxic, radioactive, biological, or deleterious substance level.

**i) Maximum Biological Effects Level**

The Sediment Management Standards in WAC 173-204-420(3) establishes that the maximum biological effects level allowed within a sediment impact zone is at or below a “minor adverse biological effects level” (in other words, there cannot be more than a minor adverse effect to biological resources within the SIZ).

The minor adverse biological effects level may be set using the acute and chronic effects biological tests of WAC 173-204-315(1) as set out in WAC 173-204-420(3). Ecology reviewed the potential for the proposed discharge to exceed the biological test determination using benthic abundance as detailed in WAC 173-204-420(3)(c)(iii). Using a benthic abundance test, the proposed discharge will be determined to be at the minor adverse biological effect so long as there is no exceedance of the biological test determination. The proposed discharge will have more than a minor adverse biological effect (and thus be in exceedance of the maximum biological effects criteria<sup>5</sup>) if the biological test determination demonstrates the following result: the test sediment (i.e., sediment where the discharge has occurred) has less than 50% of the reference sediment mean abundance of any two of the major taxa (i.e., Class Crustacea, Phylum Mollusca, or Class Polychaeta) and the test sediment abundances must be statistically different from the reference sediment abundances (*t* test,  $p \leq 0.05$ ).

**a) Benthic Abundance Test Determination**

Ecology’s review of the benthic abundance monitoring data indicates that a benthic abundance test within the SIZ would fail, given the significant decline in abundance of crustacean and polychaete invertebrates compared to the control site during the 2011 field trial in Willapa Bay in Cedar River. (Cedar River site 2011; FSEIS 2018).

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<sup>3</sup> The Sediment Impact Zones for the proposed discharge would include the site of the pesticide application (i.e., the plot) and a 25 foot buffer surrounding the plot.

<sup>4</sup> WAC 173-204-420(1)(b) has reserved criteria for Non-Puget Sound marine sediment (“The department shall determine on a case-by-case basis the criteria, methods, and procedures necessary to meet the intent of this chapter.”) Ecology has determined that for Willapa Bay and Grays Harbor, use of the marine criteria is appropriate.

<sup>5</sup> An exceedance of the maximum biological effects level can also be shown if two tests exceed the SQS criteria in WAC 173-204-320(3). See WAC 173-204-420(3)(c).

During the 2011 field trial, mean crustacean abundance in the treatment plot showed an 86% decline after 14 days, while there was little change in the control plot. After 28 days, there was more than a 40% increase in crustaceans at the control plot, while there was a 60% decrease in crustaceans on the treatment plot. After 28 days, six out of nine subgroups showed a more than 60% decrease compared to before treatment numbers. For polychaetes, after 14 days there was a 72% decrease on the treatment plot while there was a 44% increase at the control plot. At 28 days, there was a 55% decrease in polychaetes at the control plot compared to a 75% increase in the control plot.

Benthic abundance monitoring was conducted during 2011, 2012, and 2014, as part of experimental imidacloprid applications. Finding adequate matching reference sites was difficult and did not occur in all cases. During all three years, statistical power was low given high variability exhibited at sites. Pre- and post-spray monitoring could not be compared with enough rigor to meet Sediment Management Standard benthic abundance test criteria<sup>6</sup>. Ecology has determined that results of benthic abundance monitoring as proposed cannot be used to show that the proposed discharge would pass a benthic abundance test. (TerraStat, January 2, 2018; FSEIS 2018).

**ii) Maximum Other Toxic, Radioactive, Biological or Deleterious Substances Level**

The Sediment Management Standards in WAC 173-204-420(5) indicates that a discharge of toxic, radioactive, biological or deleterious substances in or on sediments shall be below levels which cause minor adverse effects in marine biological resources. As defined in WAC 173-204-200(15), "minor adverse effects" means a level of effects that has been determined by rule, that does not result in significant human health risk; and that meets the following criteria: (1) an acute<sup>7</sup> or chronic<sup>8</sup> adverse effect to biological resources; or (2) a statistically and biologically significant response that is significantly elevated relative to reference or control; or (3) biological effects as predicated by exceedance of an appropriate chemical or other deleterious substance standard.

**a) Sediment Porewater and Surface Water is above the EPA Acute/Chronic Levels**

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<sup>6</sup> In order to meet the conditions detailed in WAC 173-204-420(3)(c)(iii), there must be the ability to tell the statistical difference between the major taxa abundance between treatment and reference sediments in order for Ecology to be able to determine whether a SIZ is functioning as authorized. A review of the combined monitoring events showed the submitted monitoring data is inadequate to statistically evaluate the benthic community data (TerraStat, January 2, 2018; FSEIS 2018).

<sup>7</sup> "Acute" effects may include mortality, larval abnormality, or other endpoints as determined by Ecology. WAC 173-204-200(1).

<sup>8</sup> "Chronic" effects may include mortality, reduced growth, impaired reproduction, histopathological abnormalities, adverse effects to birds and mammals, or other endpoints as determined by Ecology. WAC 173-204-200(7).



Ecology has compared the 2014 sediment porewater results against the EPA (2017) acute and chronic marine endpoints for surface water. (FSEIS 2018). EPA recommended an acute marine invertebrate endpoint for imidacloprid of 16.5 ppb<sup>9</sup> and a chronic marine endpoint of 0.16 ppb<sup>10</sup>.

In Willapa Bay, all of the on-plot surface water samples immediately after treatment significantly exceed the EPA acute toxicity endpoint of 16.5 ppb, with averages of 796 ppb (Taylor and Coast plots 2014) and 290 ppb (Nisbet plot 2014), and 800 ppb (Cedar River 2014). Maximum concentrations on-plot were measured up to 1,600 ppb.

One day post treatment, concentrations in porewater ranged from 4.7 ppb to 100 ppb, and three of eight samples exceeded the acute marine endpoint of 16.5 ppb, and all samples exceeded the chronic marine endpoint. Although concentrations (range 0.09 to 3.1 ppb) declined over 14 days, 6 of 8 (75%) samples exceeded the EPA chronic marine endpoint of 0.16 ppb. At 28 days post treatment, concentrations (range 0.11 to 1.2 ppb) continued to exceed the EPA chronic marine endpoint in 5 of 8 (63%) samples. No data were collect after 28 days so it is uncertain as to when sediment porewater declined to below the EPA chronic marine endpoint.

#### **b) Effect to Marine Biological Resources**

Ecology's review of data leads to the conclusion that the proposed discharge of imidacloprid will cause more than a minor adverse effect to marine biological resources within the sediment impact zone. The toxicity of imidacloprid is not limited to burrowing shrimp, and other biota will be present and impacted by the proposed discharge.

Burrowing shrimp live with other species, as described by Chapman et al. (2012) when detailing that “[f]unctional and absolute losses of *Upogebia* species reduce their ecosystem services and dependent symbionts . . . .” For example, soft shell clams can be expected to be co-located in an area that has burrowing shrimp. Griffen et al. (2004) found up to eight soft shell clams (*Cryptomya californica*) per burrowing shrimp burrow in Yaquina Bay, Oregon – this is comparable to what Ecology expects to find in Willapa Bay and Grays Harbor. Ecology expects that if 60-80% of burrowing shrimp are killed during spraying due to burrow collapse, then a significant portion of commensal species such as the soft shell clams would also be killed by either the impact of the imidacloprid or burrow collapse.

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<sup>9</sup> The U.S. Environmental Protection Agency 2017 Risk Assessment (EPA 2017) chose “the lowest acceptable (quantitative) acute toxicity value of 33 µg a.i./L ...for estimating risks to saltwater aquatic invertebrates,” based on toxicity to mysid shrimp. They also identified “qualitative” studies with toxicity values as low as 10 µg a.i./L. EPA notes that this value is “42x less sensitive than that for freshwater invertebrates” due in part to fewer species studied. EPA then applied a Level of Concern (LOC) safety factor of 0.5 to this value, resulting in an acute toxicity standard for marine invertebrates of 16.5 µg a.i./L. (i.e., 33 µg a.i./L x 0.5 LOC = 16.5 µg a.i./L). Inclusion of a factor of safety is a standard practice in risk assessments.

<sup>10</sup> For chronic toxicity of saltwater invertebrates, EPA (2017) again used data on mysid shrimp to develop a 28-day No Observable Adverse Effects Concentration (NOAEC) value of 0.163 µg a.i./L and a Lowest Observable Adverse Effects Concentration (LOAEC) of 0.326 µg a.i./L based on “significant reductions in length and weight.” EPA (2017) includes only two chronic studies of imidacloprid effects on saltwater invertebrates. If a larger database had been available, it seems likely that lower values for chronic toxicity would have been noted for one or more invertebrate types, especially given the consistent pattern of wide variation of imidacloprid toxicity among species. For comparison, the freshwater chronic toxicity endpoint was 0.01 µg a.i./L.



Soft shell clam mortality from imidacloprid spraying was documented in the 2012 monitoring report. During post spray monitoring, off-plot impacts were documented using dead *Cryptomya* shells to estimate the areal “extent of off-target effects...by the presence or absence of these surface shells following imidacloprid treatment,” (Hart Crowser 2014).

Studies also indicate that the proposed discharge of imidacloprid will cause death or paralysis to more than 50% of Dungeness crab (a species found in Willapa Bay and Grays Harbor) within a SIZ. Crab studies by Patten and Norelius (2017) and Osterberg et al. (2012), reviewed in the FSEIS 2018, confirm that Dungeness crab juveniles and planktonic forms will be affected on- and off-plot and outside of the SIZ by the proposed discharge of imidacloprid on shellfish beds. In 2014, commercial scale application of imidacloprid to a 90 acre plot in central Willapa Bay showed high Dungeness crab mortality. After imidacloprid application 137 affected crabs and 4 live crabs were counted. (FSEIS 2018). The rate of affected juvenile Dungeness crabs was 97%. It was shown in the study that paralysis was effectively a measure of mortality since those crabs were preyed upon resulting in death.

The 2014 monitoring data confirms EPA’s (2013) conclusions that “direct effects on the individual organisms, including crab species, can also be expected” from spraying imidacloprid in the environment. (FSEIS Section 3.3.5 Animals, Affected Environment, pg. 3-34)

**B) Requirement: The permitted discharge shall not result in a violation of the applicable SQS outside the area limits of the established Sediment Impact Zone. WAC 173-204-415(1)(i).**

The impact of the proposed discharge outside the SIZ cannot exceed the SQS, which corresponds to a sediment quality that will result in no adverse effects, including no acute or chronic adverse effects on biological resources and no significant health risk to humans. WAC 173-204-320(1)(a). Ecology’s review indicates that the proposed discharge will result in concentrations of imidacloprid, at a level which will result in acute or chronic impact to marine invertebrates, being carried by surface water up to ¼ mile outside the SIZ.

In several trials (2012) where imidacloprid was applied to sediment in Willapa Bay, high surface water concentrations of imidacloprid were measured up to ¼ mile off-plot in a location which would be considered outside of a SIZ. The concentration of the off-plot imidacloprid was at levels 4 to 250 times that of the EPA acute (mortality) endpoint. This indicates that the proposed discharge of imidacloprid will result in concentrations in surface water (and subsequently in the sediments) that will exceed the EPA acute and chronic marine endpoint in areas outside the SIZ. These levels of imidacloprid will result in mortality, and/or reduced survival, reproduction or growth to invertebrates that come into contact with imidacloprid concentrations in these waters.

During the imidacloprid application trials, imidacloprid was frequently detected in surface water samples in the leading edge of the incoming tide in off-plot areas and would be further concentrated in drainage channels and adjacent areas covered by the rising tide.



These measured surface water concentrations would result in acute or chronic adverse effects on marine benthic invertebrates. The EPA Risk Assessment<sup>11</sup> (2017) recommended for marine aquatic invertebrates an acute toxicity endpoint of 16.5 ppb. The EPA marine aquatic invertebrate chronic toxicity endpoint is 0.16 ppb<sup>12</sup>. Of the 60 total surface water samples collected off-plot (i.e., outside the proposed SIZ boundary) in Willapa Bay (2012), imidacloprid was detected in 50 samples (83%) with the concentration ranging from 0.043 ppb to 4,200 ppb. The proposed SIZ would cover the treatment plot and a 25 foot buffer zone. These trials documented detectable concentrations of imidacloprid up to 1,575 feet from the border of the sprayed plots. The same trial in 2012 showed off-plot concentrations reached as high as 1300 ppb and included nine detections above 100 ppb, with concentrations as high as 200 ppb at a distance of 480 meters or 1,575 feet from the treated area. Two others trials showed concentrations reached 130 ppb at a distance of 60 meters (or 196 feet) and 260 ppb at 100 meters (or 328 feet) from the treated plot.

Results from the 2012 imidacloprid application trials monitoring illustrate that nearly half (29/60 samples) of off-plot surface water samples showed exceedances of the EPA Risk Assessment acute toxicity endpoint. More than half of these (16) exceeded the EPA acute criteria by more than 10 times. While it is expected that dilution would be the dominant fate mechanism, a number of plots, such as the 2012 monitoring trials indicated, showed a broad spatial extent above the EPA acute marine endpoint. (FSEIS Section 3.3.3 Surface Water, Affected Environment, pg. 3-12 to 3-16).

The 2012 imidacloprid application trials monitoring results also indicate that of the 60 total samples, 47 showed exceedances of the EPA Risk Assessment chronic toxicity endpoint. Using EPA Risk Assessment (2017) acute toxicity endpoint of 16.5 ppb, Ecology modeled potential impacts of imidacloprid on marine invertebrates as it is carried off-plot by rising tidal waters<sup>13</sup>. Ecology calculated the off-plot area that could be exposed to acutely toxic levels of imidacloprid as it was carried by the rising tide.

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<sup>11</sup> The EPA Risk Assessment (2017) evaluated available toxicity data for marine species and recommended acute and chronic marine biologic endpoints. Ecology views the EPA's recommended endpoints as the current best available science.

<sup>12</sup> Exposure to chronic or sub lethal levels of imidacloprid may be compounded by repeated exposures because imidacloprid has irreversible binding to neurological receptors so that each subsequent exposure reduces the organism's neurological capacity. Rondeau et al. (2014) showed that terrestrial insects exposed to imidacloprid have delayed mortality which may not be detected in studies with less than 10 days duration. It is not known what duration of exposure is needed to create an additive acute effect and whether a short "pulse" of high concentrations is less likely to create an effect than a sustained exposure of hours.

<sup>13</sup> While Ecology's modeling indicates that imidacloprid will travel off-plot, the travel has been documented during the 2012 imidacloprid application trials. Imidacloprid was detected at the Leadbetter control plot (0.97 ppb) on the day imidacloprid was applied on treatment plots in the 2012 monitoring trials. While it is problematic that a control plot would test positive for imidacloprid when monitoring protocol dictates no measurable quantity should be present, it is important to note that the control site is over 600 meters (approximately 0.4 miles) away from the closest treated trial plot. This is a further indication of the areal extent imidacloprid can be transported off a treated plot.



Based upon modeling of the 2012 surface water monitoring results, an area approximately double the size of the modeled treated plot would experience imidacloprid levels at least five times above the acute toxicity criterion of 16.5 ppb (FSEIS 2018). In addition, the area exposed to levels exceeding the EPA acute marine biological endpoint for imidacloprid off plot is greater than five times the size of the spray plot location. For example, for every one acre treated approximately five acres will be affected above 16.5 ppb.

Monitoring trials conducted in 2012<sup>14</sup> confirm that imidacloprid dissolves in surface water and persists in the water column during the first tidal cycle at a minimum off-plot through surface water conveyance. The highest concentrations of imidacloprid would occur during the first rising tide after application, and would dilute and flow off-plot during consecutive tidal cycles (Hart Crowser 2016). Modelling provides more clarity of the areal extent and magnitude of toxicity that surface water levels of imidacloprid pose off-plot to biological resources. *See* FSEIS Surface Water Chapter, pages 3-15 and 3-16, for a discussion of Ecology surface water modelling conducted using WGHOGA supplied data and comparing to the EPA Risk Assessment endpoints. WGHOGA comments (Paradox, May 12, 2018) acknowledge that discharge of imidacloprid would result in a percentage of sediment porewater samples outside the SIZ exceeding the applicable SQS. The SMS requires that a permitting discharge cannot result in any exceedance of the SQS outside of the SIZ. WAC 173-204-415(1)(i).

#### **4. Sediment Impact Zone Conditions and NPDES Permit Terms and/or Conditions Evaluated to Meet Compliance Standards**

Ecology has determined that the proposed discharge would exceed SQS standards and requires a SIZ. As detailed above, the proposed discharge would not meet some of the general requirements which must be complied with for authorization of a SIZ. The two requirements which the proposed discharge cannot meet are: (1) that the discharge shall not have an adverse effect to biological resources within the SIZ above a minor adverse effects level; and (2) that the discharge shall not result in a violation of the SQS outside of the SIZ. *See* WAC 173-204-415(1)(f) and (i). Ecology then reviewed whether the NPDES permit's effluent limitations, requirements, or compliance time period could be conditioned sufficient to meet the standards for authorization of a SIZ and concluded that it was not possible to condition the permit in a manner sufficient to address the issues without compromising the purpose for the discharge. The primary options reviewed by Ecology for conditioning were to:

- Decrease size of treatment plot and subsequently the SIZ;
- Decrease amount of imidacloprid applied to a treatment plot; or
- Limiting application of imidacloprid to low total organic carbon areas.

Ecology found that each potential condition (either by itself or bundled with other conditions) either (1) did not address the issues enough to bring the proposed discharge into compliance; or (2) compromised the purpose for the discharge.

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<sup>14</sup> Off-plot impacts were also seen in 2014 but spatial extent could not be determined based on lack of monitoring.



**A) Addressing the issue that the proposed discharge will exceed a minor adverse effects level**

Reductions in treatment plot size will not address the issue that application of imidacloprid has a more than minor adverse impact. The area being addressed may be smaller, but the impact of imidacloprid within that space will remain just as lethal.

The rate of 0.5 pounds of active ingredient per acre of imidacloprid was used to treat shellfish beds throughout the 2012 and 2014 imidacloprid application trials. Any reductions in the amount of imidacloprid applied would have a corresponding negative affect on the efficiency of that pesticide in completing its purpose (i.e., to kill burrowing shrimp).

Another potential condition is to limit the application of imidacloprid to only areas of low total organic carbon. However, this would not eliminate all of the adverse biological effects, since negative adverse biological effects have been documented in a range of sediment containing low total organic carbon in the central bay, and high total organic carbon in the north of Willapa Bay. Further, Ecology does not have any data indicating the total organic carbon throughout Willapa Bay and Grays Harbor, and would be unable to make such a condition without this information.

**B) Addressing the issue that the proposed discharge will result in an exceedance of the applicable SQS outside the area limits of the Sediment Impact Zone**

Imidacloprid is highly soluble with the surface water of the incoming tide and the proposed discharge will result in acute and chronic impacts outside the SIZ. It is not physically possible to prevent imidacloprid from entering the water column or, once it dissolves in the water column, being transported throughout the estuary at acute and chronic toxicity levels.

Decreasing the size of a treatment plot would result in a corresponding decrease in the size of the sediment impact zone. The area boundaries of the SIZ must include the minimal practicable surface area. WAC 173-204-415(1)(e). Therefore, this would not address the issue of a toxic concentration of imidacloprid being transported outside of the SIZ through the water column.

Decreasing the amount of imidacloprid applied may result in transportation at a level below the chronic endpoint because there will be less of the imidacloprid to dissolve into water column. However, to decrease the amount of imidacloprid applied per acre will decrease the effectiveness of the pesticide at its intended purpose of killing burrowing shrimp. Additionally, Ecology has received no data to assist it in determining the maximum amount of imidacloprid that could be applied before it results in the water column moving an amount outside of the SIZ that will result in chronic adverse effects on biological resources.

Another potential condition is to limit the application of imidacloprid to only areas of low total organic carbon. However, no data indicates that this approach would eliminate the movement of imidacloprid outside of the SIZ.



### **C) Additional Conditions Reviewed**

Ecology looked at the addition of harrowing as a condition of the permit. This is a promising non-chemical method of controlling burrowing shrimp, however harrowing can be done by the WGHOGA without gaining approval from Ecology. There is no indication that harrowing could address the issues noted above.

Another suggested condition was additional monitoring or different types of monitoring of the proposed discharge. Monitoring would not address the issues noted above but will only give greater documentation of the impacts of use of imidacloprid in a marine environment.

### **5. Conclusions**

It is my determination that the proposed discharge is required to obtain a SIZ. The requirements necessary to authorize a SIZ cannot be met by the proposed discharge<sup>15</sup>. It is not possible to condition a permit to meet the requirements of the SIZ. I recommend that Ecology deny the SIZ authorization applications.

Ecology's review indicates that the proposed discharge cannot meet two requirements for a SIZ, and that a NPDES permit cannot be sufficiently conditioned to meet those requirements. Authorization of a SIZ requires compliance with several requirements as set out in WAC 173-204-415(1)(a)-(j). The two requirements which the proposed discharge cannot meet are: (1) that the discharge shall not have an adverse effect to biological resources within the SIZ above a minor adverse effects level; and (2) that the discharge shall not result in a violation of the SQS outside of the SIZ. *See* WAC 173-204-415(1)(f) and (i).

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<sup>15</sup> In each year of the imidacloprid experimental trials conducted by WGHOGA, at least one significant negative environmental effect was measured which did not meet SMS SIZ requirements; e.g. in 2011, the Cedar River site experienced significant benthic invertebrate mortality; in 2012, significant surface water quality contamination was measured on and off site exceeding EPA criteria; and, in 2014 significant Dungeness Crab mortality was discovered on and adjacent to a 90-acre treatment plot.



## 6. References and Additional Information Sources

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