

# **EGERIA DENSA CONTROL PROGRAM**

## **2012 ANNUAL REPORT**

**SUBMITTED Pursuant to:**

**NPDES General Permit CAG 99005**

**40 CFR 122.41 (k) and CFR 122.21**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate information submitted. Based on my inquiry of the persons who manage the program, Terri Ely – Senior Environmental Scientist, or persons directly responsible for gathering information, including Geoff Newman – *Egeria densa* Control Program, Environmental Scientist, the information submitted is, to the best of my knowledge and belief, is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including possibility of fines and imprisonment for knowing violations.

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Lucia C. Becerra, Acting Director

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Date

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## EXECUTIVE SUMMARY

DBW (Department of Boating and Waterways) entered into consultation with the US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) January 18, 2012 to address the issuance of new 5 year Biological Opinion, Section 7 "Take " Permit with a start date of April 1, 2012. A second meeting was held on March 30, 2012. USFWS determined that DBW did not need a consultation for 2012 and the April start date was withdrawn. NMFS its concurrence arrived via phone conversation to the Director of DBW, with formal notification on July 12, 2012. Treatment began on July 9, 2012 after the email was received.

DBW treated 2,463 acres within 15 sites located throughout the Delta. The sites treated included Piper Slough, Taylor Slough, Dutch Slough, Sandmound Slough Rivers End Marina, Whiskey Slough, 14 Mile Slough, Disappointment Slough, Bishop Cut, Honker Cut, White Slough, Sycamore Slough, Steamboat Slough, Discovery Bay and Frank's Tract.

Again this year, due to the numerous agricultural intakes located within the treatment sites numerous FasTest Samples (immune-assay testing for chemical residues) were taken. The total number of samples taken were 408 and all residue levels were well within acceptable herbicide label limits during the time of treatment.

All parameters set forth in the USFWS and NOAA Fisheries Biological Opinions were met during the 2012 treatment season. NPDES parameters were met with the exception of several pH readings during the post treatment being below the Basin Plan limits. This was caused due the equipment calibration being out of tolerance and occurred during only two sampling events.

The *Egeria densa* plants are actively growing during the springtime when the water temperature is higher and there is more sunlight. This is when the plant is recovering from overwintering and is taking in as many nutrients as possible. This is the optimum time to apply herbicide to control *Egeria densa*. With later start dates, the Egeria Densa Control Program did not see as much reduction in both bio-mass and bio-coverage as in previous years. Using both visual and sonar readings; it is estimated that the treatments resulted in an average reduction of 20% of the *Egeria densa*. Even though the reduction was only 20% of bio-mass and bio-coverage, boats could freely navigate throughout the Delta with ease.

# 1 - INTRODUCTION

## 1.1 *Egeria densa* Impact on the Delta

*Egeria densa* (Brazilian Elodea) is a fast growing, submerged aquatic plant having a significant impact on the shallow water habitat in the Sacramento and San Joaquin River Delta (Delta) ecosystem. Since first introduced into the Delta approximately 50 years ago, *Egeria densa* has grown to infest approximately 12,300 surface acres or 20% of the 61,619 surface acres of the Delta. *E. densa* influences the Delta's biological diversity, recreation, and agriculture. *Egeria densa* crowds out native vegetation, slows water flows, entraps sediments, obstructs waterways, impedes anadromous fish migration patterns and clogs agriculture and municipal water intakes.

## 1.2 Setting

The *Egeria densa* Control Program area of operation includes portions of six counties that encompass much of the Delta and its upland tributaries. These six counties include Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo. The general boundaries of the treatment areas are:

- West to and including Sherman Island, at the confluence of the Sacramento and San Joaquin Rivers,
- North to the confluence of the Sacramento River and the Sacramento Deep Water Channel,
- East along the San Joaquin River to the City of Stockton, and
- South from Clifton Court along Old River to Mossdale.

## 1.3 Summary of Statutory Authority and Required Permits

In 1997, AB 2193 amended the California Harbors and Navigation Code to designate the California Department of Boating and Waterways as lead agency for controlling *Egeria densa* in the Sacramento and San Joaquin Delta, its tributaries, and the Suisun Marsh. The United States Department of Agriculture-Agriculture Research Service (USDA-ARS) acts as the federal nexus agency for all federal regulatory processes. The USDA-ARS also provides research, technical expertise, and decision making input for the *Egeria densa* Control Program (EDCP) planning process. The DBW and the USDA-ARS implemented the EDCP in 2001.

### **1.3.1 EDCP NPDES PERMIT (No. CAG 990005)**

The EDCP National Pollution Discharge Elimination System General Permit for Aquatic Pesticide Use (NPDES requires the DBW to submit an annual report March 1 following the EDCP treatment season. Reporting guidelines must include an executive summary discussing general permit compliance or violations of permit terms and conditions to waters of the U.S., the effectiveness of the EDCP Aquatic Pest Application Plan (APAP), the discharge of pollutants associated with aquatic pesticide application, summarize monitoring data, including any changes in water quality, and violations of compliance with water quality as outlined in the Central Valley Basin Plan. The Annual Report also includes a discussion of any violations and the actions taken, maps showing application areas, acreage and sampling locations, type and amounts of aquatic pesticides used during each application event, information on surface area, volume and rate of application, and sampling results for all monitoring as outlined in the General Permit Monitoring and Reporting Program.

#### **Terms and Conditions**

##### **Herbicide Residue Limits**

The maximum residue limits in receiving waters for fluridone, the main ingredient of Sonar®, is 560 parts per billion (ppb) and for diquat, the main ingredient in Reward®, the maximum is 20 ppb. DBW did not use any diquat during the 2012 treatment season. Maximum residue limits are based on EPA and municipal drinking water standards.

There are clear distinctions in the NPDES Permit about the application area and receiving waters. An application area is defined as the area in which the aquatic herbicides are applied. The treatment area is the zone that is treated by the aquatic herbicides to aquatic weeds. Receiving waters are defined as: 1) waters directly down flow of the treatment area and 2) water within the treatment when herbicide levels fall below the minimum effective concentrations. In the EDCP, the herbicide can have an impact on the target species as long as residues are present in the water column. Residues found inside the treatment area are not usually considered receiving waters until seven days after an application event.

Herbicides applied to aquatic plants are not considered a pollutant until residues reach the receiving waters. This is because herbicides designed to treat aquatic plants and approved by the EPA cannot also be considered a pollutant under the Clean Water Act. This applies to chemicals approved under federal and state pesticide use regulations.

Herbicide label restrictions dictate maximum rates of application and maximum concentrations

allowed in the water column. The application rate can be greater than the maximum water column concentration due to binding properties and dispersion rates in flowing waters. Fluridone has no maximum application rate in flowing waters. The applicator is allowed to apply at an appropriate rate such that the target concentration in the water column does not exceed 40 ppb. However, most applications have target applications of 50 ppb or less with a residue of 10 ppb or less in the water column.

### **Water Quality Parameters**

The EDCP is required to monitor specific water quality parameters to ensure there are no significant impacts to beneficial waters of the United States (NOAA Fisheries Biological Opinion and NPDES Permit). The physical and chemical water quality parameters monitored consist of temperature, salinity, electrical conductivity, turbidity, pH, and dissolved oxygen. DBW also conducts visual inspections before, during and after applications have been made. DBW annotates any changes in water color, odor, and vegetation health.

### **Selection and Monitoring Frequency**

The NPDES Permit requires representative monitoring for each water type found in the EDCP area of operation. The only water type for the EDCP is tidal. Per monitoring frequency requirements outlined in the NPDES and EDCP Aquatic Pesticide Application Plan, a minimum of two monitoring sites per water type per herbicides used if the total number of applications is below twenty. DBW records water quality parameters no earlier than twenty four hours prior to the first treatment and a minimum of two follow-up visits following the end of the treatment event or until there are no detectable residues in the water column.

### **1.3.2 EDCP USFWS and NMFS Biological Opinion Section 7 Take Permit**

#### **Reporting Requirements**

THE USFWS Biological Opinion Section 7 Permit requires DBW to submit an Annual Report no later than January 31 following the EDCP application season. Annual Reports must summarize compliance with terms and conditions listed to include species and habitat protection, water quality monitoring, and any additional monitoring and studies that may have been conducted as part of the regulatory requirements from other participating state and federal agencies. Additional reporting requirements are on a case-by-case basis in the event that a “take” should occur with any of the species discussed in the permit. Take reports begin with immediate notification of the USFWS Biologist in charge of administering the permit and require documentation of information as such where the “take” occurred, number of species involved,

water quality conditions, chain of custody, and prescriptive action taken for preventing future occurrences.

### **Mitigation Requirements**

The EDCP USFWS BO Section 7 Take Permit imposes several measures to avoid impacts to protected species in the Delta. Primarily DBW has been directed to implement species avoidance and habitat loss minimization. There are three main components to avoidance and habitat minimization mitigation. Components are seasonal timing of applications, species specific toxicity evaluations, and applicator education. All applicators received Worker Environmental Awareness Training before treatments began in July 2012. Personnel were informed AS TO THE PRESENCE OF THE Valley Longhorn Elderberry Beetle and the habitat associated with this species, other species mitigation for the Giant Garter Snake and the Delta Smelt. The briefing also included the contents of the USFWS and NMFS Biological Opinion Section 7 Permits.

### **Delta Smelt (*Hypomesus transpacificus*)**



- Using the Interagency Ecological Program (IEP Real Time Monitoring Program 20mm Survey) determine the presence or absence of the Delta Smelt within or near the boundaries of the herbicide application areas
- There are no restrictions for the use of fluridone, however, if diquat is used in may only be applied between June 1 and July 31
- DBW used no diquat during this reporting period.

**Valley Longhorn Elderberry Beetle (*Desmoecerus californicus dimorphus*)**



- Avoidance is the term USFWS has included in their Biological Opinion
- The area of operation for the EDCP has been surveyed as to the location of Elderberry plants (*Sambucus ssp*) and the locations have been identified and briefed to all crews.

**Giant Garter Snake (*Thamnophis gigas*)**



*Photo credits: Sutter Basin Conservation Bank, Westervelt Geological Services*

- Avoidance of Giant Garter Snake habitat

The only restrictions to the Giant Garter Snake apply to mechanical harvesting and land based operations occurring on unimproved Delta banks. The EDCP currently is not implementing mechanical harvesting nor is it operating near any unimproved areas. However, mitigation beyond the requirements if the USFWS permit have been implemented to avoid any impact. The entire EDCP project area has had a Giant Garter Snake habitat evaluation. Each application crew has been provided with a set of maps outlining potential Giant Garter Snake habitat. This is to ensure that our crews avoid areas where Giant Garter Snakes are likely to be found.

**Chinook Salmon (*Onorhynchus tshawytscha*) Sacramento River winter run and Central Valley Spring run) and Central Valley Steelhead Trout (*Onocorhynchus mykiss*)**



**Chinook Salmon**

- NOAA Fisheries has specified start and stop dates for DBW operations. DBW can start treatments on April 1<sup>st</sup> and must end treatments no later than October 15<sup>th</sup>.
- NOAA Fisheries has also set specific sites that may be treated early. This is to preclude both in and out migrating salmonids from passing through treated areas.
- In order to avoid impacts to aquatic species, particularly salmonids, which are reliant on dissolved oxygen levels (DO), crews monitor DO levels and water temperature prior to and after treatments. Crews are only permitted to make applications when DO levels are above 5 mg/l or below 3 mg/l. During the 2012 season, all DO levels were within the specified parameters<sup>1</sup>.

<sup>1</sup>The Central Valley Regional Water Quality Control Board (CVRWQCB), USFWS, and NOAA Fisheries have slightly different dissolved oxygen limits. The CVRWQCB Basin Plan states the DO shall not be reduced below 5.0 mg/l in all Delta waters except the Sacramento River below the I Street Bridge and the waters west of the Antioch Bridge (7.0 mg/l) and in the San Joaquin River between Turner Cut and Stockton (6.0 mg/l). All EDCP sites are by Basin Plan definition waters of the Delta. The USFWS BO/Take Permit directs no treatment in high flow areas where DO levels are below 5.0 mg/l. It also directs treatments be delayed in low flow areas if DO levels between 4-6 mg/l. The Central Delta is all tidal and with no real distinction between high flow and low flow waters. During the 2012 treatment season, DBW recorded all readings above 5.0 mg/l.

## 2 -PERSONNEL, METHODS AND MATERIALS

### 2.1 EDCP Personnel, Accreditation, and Training

Each application crew consists of a specialist and a technician of which at least one is a certified applicator possessing a Qualified Applicator Certificate "F" (aquatics). This certification is administered by the California Department of Pesticide Regulation (CDPR). All DBW crews have been trained on EDCP herbicide use and environmental awareness.

#### Endangered Species Training

DBW perceives training as a major component necessary to ensure avoidance and minimization measures are met for both the NOAA Fisheries and USFWS BO Section 7 Permits. Application crews not only received refresher training on herbicide use and restrictions before the season began, they also received an annual environmental awareness refresher on threatened, endangered species, and species of concern known to be located within our area of operation. State and federal listed species covered included: Delta Smelt, Giant Garter Snake, Valley Longhorn Elderberry Beetle and its habitat, Central Valley Steelhead Trout, and Chinook Salmon including buffer zones, required surveys, fish passage protocol and DO limits. Also included was a discussion of the legal implications of the Endangered Species Act (ESA) and the California Environmental Quality Act (CEQA).

#### Monitoring Crews

Monitoring crews consisted of a lead Environmental Scientist and one additional person to assist the scientist. The scientist trained, planned and scheduled field sampling events. A digital camera is used to obtain visual records of sampling locations to denote noticeable changes in vegetation or the condition of the surrounding area. Additional responsibilities included quality control (QA/QC) of field monitoring and lab analysis and reporting the findings in an Annual Report as outlined in the EDCP NPDES, USFWS and NMFS Biological Opinions.

### 2.2 Materials

#### Herbicides

Herbicides used during the 2012 treatment season include:

Fluridone: 1-methyl-3-phenyl-5{trifluoromethyl-phenyl}-4(1H)-pyridinone; under the commercial trade names of:

- Sonar A.S® - EPA Registration No. 67690-4 (liquid)
- Sonar PR Precision Release® - EPA Registration No. 67690-12 (Pellet)

- Sonar Q Quick Release® - EPA Registration No. 67690-3 (Pellet)

Fluridone (Sonar®) is a selective systemic herbicide that inhibits the formation of carotene, an action that results in the degradation of sunlight expose chlorophyll. Formation of carotene occurs primarily in new growth, thus fluridone is most effective in maximum growth periods of *E. densa*. Fluridone not absorbed by plants is broken down into naturally occurring elements mostly through exposure to sunlight.

### Summary of Pesticide Use in 2012

Herbicide Formulations	PR Pellets (lbs)	PR Pellets (acres)	Q Pellets (lbs)	Q Pellets (acres)	AS Liquid (gals)	AS Liquid (acres)
<b>July</b>						
Alameda	60	158	80	79	0	0
Contra Costa	12120	5201.1	14060	4040.2	53	1665
Sacramento	480	336	800	504	0	0
San Joaquin	4320	2542	8680	3249	0	0
Solano	645	504	960	672	0	0
<b>August</b>						
Alameda	120	44	120	44	0	0
Contra Costa	18390	7223.9	1452.0	5111.9	0	0
Sacramento	645	510	480	510	0	0
San Joaquin	8030	3088	3760	1569	0	0
Solano	810	672	640	672	0	0
<b>September</b>						
Alameda						
Contra Costa	22020	7963.5	15520	4449.5	0	0
Sacramento	630	336	160	168	0	0
San Joaquin	13440	3491.0	2440	942	0	0
Solano	530	336	160	168	0	0
<b>Totals</b>						

NOTE: Acreages in table are gross acreages. Net acreage treated was 2663.2

### Application Equipment

Crews use either a 19-21 foot aluminum boat powered by either air or outboard. At the start of each treatment the application crew takes a dissolved oxygen and water temperature reading using a HACH™ Dissolved Oxygen Meter within the treatment site. These readings must be within the parameters outlined in the Biological Opinions and NPDES Permit before an application may begin. At the start of the application, the crew uses an Explore™ iX-104C

Tablet PC with GPS unit installed to record beginning and ending spray lines, coordinates of spray area and the time of treatment.

All boats are maintained regularly, washed to rid them of chemical residues, and all application pumps, hoses and nozzles are inspected and if defective replaced on an as-needed basis. Boat records are available upon written request.

### **2.3 Environmental Monitoring**

A 22 foot fiberglass Angler™ fiberglass boat powered by a 225 horsepower outboard motor is used to conduct monitoring activities. DBW uses a Hydrolab MS-5® water quality multi-probe Datatsonde™ to collect water quality readings. The MS-5 reads water temperature, electrical conductivity, salinity, dissolved oxygen, pH, and turbidity. The data is stored together with GPS coordinates with I-xplore 104C PC Tablet. A digital camera is used to obtain visual records of sampling locations to denote noticeable changes in vegetation or the condition of the surrounding area.

#### **Monitoring Activities**

##### **Protocols**

The DBW EDCP follows a water quality monitoring protocol as outlined in the 2004 EDCP Aquatic Pest Control Application Plan (APAP). The monitoring team plans each sampling event in coordination with the field supervisor and application teams. During the 2012 season the DBW sampled three sites, Taylor Slough Site 110, Sandmound Slough 109, and Piper Slough Site 107.

##### **Residue Sampling**

For each application, event DBW takes a pre-sample and as many post samples as necessary until a non-detection of the herbicide residue is obtained. These samples are identified as sample location A, B, and C. Sample location A is inside of application area approximately 1/4 to 1/3 the distance in from the downstream edge of the application polygon, sample location B is located on the downstream outside edge of the application polygon, and sample location C is located in an adjacent non-impacted area with similar hydrological conditions as the application site or receiving waters.

DBW also takes FasTest™ (immune assays) samples throughout the duration of the treatment. These samples are sent to the herbicide manufacturer for analysis. Sample results are used to monitor herbicide residues in the treatment area as well as areas outside the treatment area. DBW can the monitor and adjust the rate of application to keep residue levels within the treatment site at optimum levels.

## **Water Quality Parameters**

Water quality sampling is done concurrent with residue sampling. Water quality monitoring samples are taken at a depth of 3 feet. Water quality measurements taken are temperature, salinity, DO, electric conductivity, pH, and turbidity. DBW also conducts visual inspections of the treated and surrounding areas to identify changes in water color and odor along with changes in the vegetation health.

## **2.4 Laboratory Analytical Methods and Data Validation**

### **Analytical Methods**

The analytical methods used by the contract laboratories, California Department of Food and Agriculture (CDFA) are published in the U.S. EPA Test Methods for Evaluating Solid Waste Physical/Chemical SW 846 or U.S. EPA Method for Chemical Analysis for Water and Waste. The primary method used for the EDCP is Method 4000, immune assay testing (ELISA method).

### **Analytical Testing Validation**

DBW uses several methods to validate results found by the contracting laboratories. These methods include split samples, field spikes, field blanks and equipment blanks. DBW took 18 Equipment Blanks, 5 Split Samples, 5 Field Blanks, and 1 Split Sample. All validation samples were within acceptable ranges.

## 3 - COMPLIANCE

### 3.1 Herbicide Application Data and Permit Compliance

The 2012 EDCP application season began July 9 2012 and ended on September 26 2012. DBW treated in Discovery Bay, Franks Tract, Steamboat Slough, Sycamore Slough, White Slough, Honker Cut, Bishop Cut, Disappointment Slough, 14 Mile Slough, Whiskey Slough, Rivers End Marina, Sand Mound Slough, Taylor Slough, and Piper Slough. Total acreage treated was 2,663.3 acres.

#### Compliance

DBW EDCP treatment operations were in compliance with the USFWS and NOAA Fisheries Biological Opinions. There were no known take or harassment of federally endangered or threatened species. There were several violations to the NPDES Permit. These involved exceeding the water quality parameters for pH and are noted below.

#### Basin Plan Compliance (NPDES)

DBW is required to adhere to all limitations set forth in the Regional Water Quality Control Boards Basin Plan. It specifies limitations for dissolved oxygen, turbidity, pH, salinity, and temperatures. During the 2012 season, all parameters were met except for several low pH readings as discussed below.

All pH readings that were low occurred on October 11 and Nov 07, 2012. These readings ranged from 4.01 to 6.46 all below the parameters of 6.5 to 8.5. After the first low readings the Datasonde™ was recalibrated. The Datasonde™ was again used on October 25, 2012 and all readings were within acceptable parameters. However, when used again on November 7, 2012 readings were again low. The Datasondes™ are being sent back to the manufacturer for recalibration and overhaul.

## 4 – CONCLUSIONS

### 4.1 Discussion

DBW continued treating areas of the Delta during the 2012 treatment season. The areas treated were Rivers End, Discovery Bay, Sand Mound Slough, Taylor Slough, Piper Slough, Franks Tract, Disappointment Slough, Bishop Cut, Honker Cut, White Slough, 14 Mile Slough, Sycamore Slough, Steamboat Slough, and Whiskey Slough. The total acreage treated was 2663.3 acres.

Again this year due to the numerous agricultural intakes located within the treatment sites numerous FasTest Samples (immune-assay testing for chemical residues) were taken the total number of samples taken was 408 and all residue levels were well within acceptable herbicide label limits during the time of treatment.

All parameters set forth in the USFWS and NOAA Fisheries Biological Opinions were met during the 2012 treatment season. The NPDES parameters were met with the exception of several pH readings during the post treatment being below the Basin Plan limits. This was caused due the equipment calibration being out of tolerance. This occurred during two sampling events.

The plants are actively growing during the springtime when the water temperature is higher and there is more sunlight. This is when the plant is recovering from overwintering and taking in as many nutrients as possible. This is also the optimum time to apply the herbicide for the control of *Egeria densa*. With the later start dates, the Egeria Densa Control Program did not see as much reduction in both bio-mass and bio-coverage as in previous years. Using both visual and sonar readings, it is estimated that the treatments resulted in an average reduction of 20% of the *Egeria densa*. Even though the reduction was only 20% of bio-mass and bio-coverage boats could navigate throughout the Delta with ease.

## **APPENDIX A**

### **1 – Site Maps, Water Quality Data, and Residue Levels for:**

- **Sandmound Slough**
- **Taylor Slough**
- **Piper Slough**

### Sand Mound Slough Site 109



### Sandmound Slough Site 109 Water Quality

Sample Location	Sample Number	UTM Coordinates	Date	Time	Temp	Conductivity Ms/cm	Salinity (ppt)	DO Mg/l	Depth	pH	Turbidity
A	E109-062512-011	E620936 N4205046	6/25	1030	22.11	.308	0.15	9.34	3	8.41	0.6
B	E109-062512-013	E621288 N4207766	6/25	1055	21.23	.349	0.17	8.03	3	8.03	4.1
C	E109-062512-014	E621739 N4208144	6/25	1110	21.17	.338	0.17	8.43	3	7.95	2.6
A	E109-070912-031	E620936 N4205046	7/9	0910	23.61	.372	0.18	7.46	3	7.94	4.7
B	E109070912-032	E621288 N4207766	7/9	0820	23.27	.377	0.19	7.66	3	7.91	6.7
C	E109-070912-033	E621739 N4208144	7/9	0810	23.26	.356	0.18	7.91	3	8.20	13.8
A	E109-100412-036	E620936 N4205046	10/4	1050	21.65	.983	0.51	7.61	3	7.84	0.0
B	E109-100412-037	E621288 N4207766	10/4	1115	20.97	.985	0.53	7.03	3	7.82	0.0
C	E109100412-038	E621739 N4208144	10/4	0800	20.94	.972	0.51	7.0	3	7.75	0.0
A	E109-101112-054	E620936 N4205046	10/11	0930	19.31	.741	0.35	8.16	3	5.75	15.0
B	E109-101112-055	E621288 N4207766	10/11	0915	18.63	.756	0.46	9.64	3	5.67	14.7
C	E109101112-056	E621739 N4208144	10/11	0905	16.61	.682	0.35	9.57	3	5.54	3.2
A	E109-102512-079	E620936 N4205046	10/25	0940	17.04	.822	0.43	8.12	3	7.77	0.0
B	E109102512-080	E621288 N4207766	10/25	1000	16.92	.698	0.36	8.75	3	7.80	0.0
C	E109-102512-081	E621739 N4208144	10/25	1010	17.02	.543	0.33	8.67	3	7.76	0.0
A	E109-110712-096	E620936 N4205046	11/07	1015	17.7	.581	0.33	8.49	3	6.98	5.2
B	E109-110712-097	E621288 N4207766	11/07	1000	17.4	.602	0.39	8.34	3	6.71	6.0
C	E109110712-098	E621739 N4208144	11/07	0950	17.7	.592	0.37	8.57	3	6.46	3.2
A	E109-111512-113	E620936 N4205046	11/15	0840	13.44	.359	0.35	10.31	3	5.79	8.3
B	E109-111512-114	E621288 N4207766	11/15	0830	13.99	.360	0.33	9.69	3	5.60	9.2
C	E109-111512-115	E621739 N4208144	11/15	0815	13.88	.475	0.28	10.03	3	5.06	6.1

### Piper Slough Sampling Locations



### Piper Slough Site 107 Water Quality

Sample Location	Sample Number	UTM Coordinates	Date	Time	Temp	Conductivity Ms/cm	Salinity (ppt)	DO Mg/l	Depth	pH
A	E107-062512-001	E622012 N4209239	6/25	1115	20.99	.325	0.16	8.79	3	8.13
A	E107-062512-002	E621557 N4210081	6/25	1125	20.85	.316	0.15	9.78	3	8.41
A	E107-062512-003	E620804 N4210663	6/25	1135	20.83	.310	0.15	10.33	3	8.36
B	E107-062512-004	E619410 N4211910	6/25	1155	21.31	.348	0.17	11.16	3	8.35
C	E107-062512-005	E618594 4211430	6/25	0900	20.63	.368	0.18	9.23	3	7.98
A	E107-070912-025	E622012 N4209239	7/9	0840	22.82	.336	0.16	8.37	3	8.14
A	E107-070912-026	E621557 N4210081	7/9	1045	22.42	.356	0.18	8.82	3	8.04
A	E107-070912-027	E620804 N4210663	7/9	1030	22.16	.401	0.20	8.93	3	8.03
B	E107-070912-028	E619410 N4211910	7/9	1015	22.17	.437	0.22	9.21	3	8.08
C	E107-070912-029	E618594 4211430	7/9	1010	22.13	.407	0.20	10.47	3	8.27
A	E107-100412-041	E622012 N4209239	10/4	0815	20.83	.819	0.42	6.88	3	7.99
A	E107-100412-042	E621557 N4210081	10/4	0830	20.63	.815	0.42	6.56	3	7.95
A	E107-100412-043	E620804 N4210663	10/4	0900	20.36	.791	0.41	6.48	3	7.94
B	E107-100412-044	E619410 N4211910	10/4	0915	20.37	.899	0.42	6.50	3	8.07
C	E107-100412-045	E618594 4211430	10/4	0930	20.32	.904	0.47	6.51	3	8.03
A	E107-101112-065	E622012 N4209239	10/11	0850	18.50	.396	0.17	9.43	3	5.56
A	E107-101112-066	E621557 N4210081	10/11	0840	18.46	.478	0.26	9.63	3	4.77
A	E107-101112-067	E620804 N4210663	10/11	0835	18.37	.848	0.41	9.23	3	4.01
B	E107-101112-068	E619410 N4211910	10/11	0830	18.57	.450	0.24	9.51	3	5.45
C	E107-101112-069	E618594 4211430	10/11	0820	18.20	.649	0.32	9.74	3	5.17
A	E107-102512-071	E622012 N4209239	10/25	1020	16.95	.670	0.35	8.91	3	7.78
A	E107-102512-072	E621557 N4210081	10/25	1035	16.56	.751	0.39	8.63	3	7.75
A	E107-102512-073	E620804 N4210663	10/25	1100	16.95	.744	0.38	8.82	3	7.87
B	E107-102512-074	E619410 N4211910	10/25	1115	17.21	.731	0.38	8.78	3	7.92
C	E107-102512-075	E618594 4211430	10/25	1125	17.38	.664	0.34	8.75	3	7.85
A	E107-110712-090	E622012 N4209239	11/07	0940	17.8	.308	0.29	10.9	3	6.46

A	E107-110712-091	E621557 N4210081	11/07	0925	17.8	.558	0.38	9.89	3	5.36
A	E107-110712-092	E620804 N4210663	11/07	0850	17.8	.304	0.13	9.45	3	5.05
B	E107-110712-093	E619410 N4211910	11/07	0830	17.7	.002	0.01	8.90	3	6.32
C	E107-110712-094	E618594 4211430	11/07	0815	17.1	.003	0.01	8.92	3	5.81

### Taylor Slough Sampling Locations



## Taylor Slough Site 110 Water Quality

Sample Location	Sample Number	UTM Coordinates	Date	Time	Temp	Conductivity Ms/cm	Salinity (ppt)	DO Mg/l	Depth	pH	Turbidity
A	E110-062512-006	E618776 N4208520	6/25	0845	20.63	.381	0.19	8.05	3	8.03	5.4
A	E110-062512-007	E617292 N4209700	6/25	0915	21.05	.359	0.18	10.49	3	8.25	1.9
A	E110-062512-008	E616431 N4210719	6/25	0920	20.70	.324	0.16	9.05	3	7.95	2.5
B	E110-062512-009	E616165 N4211326	6/25	0935	20.57	.308	0.15	8.82	3	8.04	4.1
C	E110-062512-010	E618084 N4211999	6/25	0955	20.59	.341	0.17	9.23	3	8.35	15.8
A	E110-070912-019	E618776 N4208520	7/9	0935	23.13	.421	0.21	7.78	3	7.97	4.9
A	E110-070912-020	E617292 N4209700	7/9	0945	23.31	.386	0.19	10.57	3	8.70	1.3
A	E110-070912-021	E616431 N4210719	7/9	1000	22.55	.370	0.18	8.75	3	8.29	0.0
B	E110-070912-022	E616165 N4211326	7/9	1005	22.39	358	0.18	8.65	3	8.10	0.0
C	E110-070912-023	E618084 N4211999	7/9	1015	22.12	.408	0.20	10.45	3	8.21	7.3
A	E110-100412-047	E618776 N4208520	10/4	1110	20.51	.410	0.55	6.62	3	7.82	0.7
A	E110-100412-048	E617292 N4209700	10/4	0955	20.71	.118	0.59	6.78	3	8.03	0.8
A	E110-100412-049	E616431 N4210719	10/4	0935	20.40	.290	0.59	6.52	3	8.05	0.3
B	E110-100412-050	E616165 N4211326	10/4	0920	20.57	.190	0.56	6.60	3	7.96	1.3
C	E110-100412-051	E618084 N4211999	10/4	0930	20.60	.510	0.55	6.68	3	7.99	0.0
A	E110-101112-058	E618776 N4208520	10/11	1015	18.94	.340	0.56	9.29	3	4.78	26.4
A	E110-101112-059	E617292 N4209700	10/11	1045	18.64	.640	0.33	9.20	3	4.55	10.5
A	E110-101112-060	E616431 N4210719	10/11	1055	17.27	.719	0.27	9.34	3	5.41	0.0
B	E110-101112-061	E616165 N4211326	10/11	1010	18.98	.346	0.22	8.87	3	5.30	13.8
C	E110-101112-062	E618084 N4211999	10/11	1005	18.86	.347	0.41	8.43	3	5.62	1.1
A	E110-102512-084	E618776 N4208520	10/25	0905	17.35	.869	0.45	8.41	3	7.73	0.0
A	E110-102512-085	E617292 N4209700	10/25	0845	17.27	1.004	0.53	7.86	3	7.68	0.0
A	E110-102512-086	E616431 N4210719	10/25	0815	17.46	1.048	0.55	8.70	3	7.82	3.39
B	E110-102512-087	E616165 N4211326	10/25	0915	17.32	.835	0.43	8.36	3	7.71	0.0
C	E110-102512-088	E618084 N4211999	10/25	0920	17.18	.826	0.43	8.05	3	7.69	0.0

Sample Location	Sample Number	UTM Coordinates	Date	Time	Temp	Conductivity Ms/cm	Salinity (ppt)	DO Mg/l	Depth	Ph	Turbidity
A	E110-110712-100	E618776 N4208520	11/07	1050	18.0	.556	0.51	8.15	3	5.66	0.0
A	E110-110712-101	E617292 N4209700	11/07	1110	18.1	.551	0.49	10.4	3	6.59	0.0
A	E110-110712-102	E616431 N4210719	11/07	1130	18.0	.521	0.48	9.29	3	5.46	0.0
B	E110-110712-103	E616165 N4211326	11/07	1140	17.9	.510	0.45	9.13	3	5.49	0.0
C	E110-110712-105	E618084 N4211999	11/07	1145	18.8	.511	0.47	8.68	3	6.01	0.0
A	E110-111512-107	E618776 N4208520	11/15	1320	14.5	NA	NA	9.49	3	NA	NA
A	E110-111512-108	E617292 N4209700	11/15	1345	14.5	NA	NA	9.91	3	NA	NA
A	E110-111512-109	E616431 N4210719	11/15	1355	14.8	NA	NA	9.63	3	NA	NA
B	E110111512-110	E616165 N4211326	11/15	1400	14.9	NA	NA	9.91	3	NA	NA
C	E110-111512-111	E618084 N4211999	11/15	1405	15.1	NA	NA	9.35	3	NA	NA
A	E110-112712-116	E618776 N4208520	11/27	0930	13.6	NA	NA	9.73	3	NA	NA
B	E110-112712-117	E617292 N4209700	11/27	0940	13.9	NA	NA	9.72	3	NA	NA
C	E110-112712-118	E616431 N4210719	11/27	0950	13.7	NA	NA	9.78	3	NA	NA
A	E110-120512-120	E616165 N4211326	12/05	0930	13.6	NA	NA	8.96	3	NA	NA
B	E110120512-121	E618084 N4211999	12/05	1000	13.9	NA	NA	9.23	3	NA	NA
C	E110-120512-122	E618776 N4208520	12/05	1015	13.7	NA	NA	9.28	3	NA	NA

## **Appendix B**

### **1 Pesticide Use Recommendation**

### **2 Fastest Results**