Progress Report
Tembladero Slough Pesticide and Toxicity Reduction Project

Agreement Number DPR 16-C0102
October 2017 – June 2018
UC Davis – Granite Canyon Lab

The project will assess treatment practice effectiveness monitoring of the Molera Experimental Treatment Wetland. Monitoring will include evaluations of contaminant reductions at four stations as Tembladero Slough water progresses through the treatment channel and wetland. Monitoring will include evaluation of the treatment processes through chemical analysis of pesticides, nutrients, suspended particles (as turbidity) and associated toxicity.

Task 1) Project Management (March 2017 – June 2019)

UC Davis faculty researchers, along with the Project Manager from the Department of Pesticide Regulation and scientists from the Central Coast Wetlands Group (CCWG) at Moss Landing have coordinated all aspects of the project. USGS is conducting the chemical analyses.

Level of Completion – We are 18 months into the 27-month project. Modifications have be made to the carbon installation based on the results of the first sampling event. Because of extreme tides and lack of freshwater input from upstream, the Tembladero Slough has had a higher salinity that predicted. Elevated salinity during the winter months caused the transplanted pennywort to die and decay. The freshwater lens in the slough is very shallow, so modifications were made to the pump intake to capture the uppermost layer of water. New pennywort in the wetland appears to be healthy, and the pumping cycles have been tightly controlled to capture the freshest water possible.

Task 2) Management Practice Implementation (July 2017 – August 2017)

The Molera Experimental Treatment Wetland consists of a 285 meter long, 6.5 meter wide, and 0.3 meter deep sinuous channel that drains onto a non-channelized wetland shelf before flows are returned to Tembladero Slough. The treatment system receives water from a pump intake in Tembladero Slough. The existing system has been modified to optimize treatment of current-use pesticides, nutrients and turbidity. Modifications include the addition of pennywort to approximately 20% of the distal end of the treatment channel, and a treatment installation containing granulated activated carbon (GAC) at the outflow of the channel. The GAC installation consists of a flow-through trough containing approximately 400 liters of GAC (Phillips et al., 2017).

Level of Completion – Pennywort transplanting was repeated and is now complete as described above. The pennywort has the desired coverage on the surface of the wetland, but because we had to transplant a second batch, the plants have not completely rooted out on the bottom of the channel. GAC treatment installation is complete.

Task 3) Monitoring Performance (September 2017 – June 2019)

During sampling events, Tembladero Slough water is pumped through the wetland at a rate of approximately 360 L/m for 12 hours per day and 4 hours per day during maintenance periods. The composite samplers are installed at the inflow, upstream and downstream of the vegetation, and at the outflow of the GAC installation for sampling events. Samplers collect 24-hour composites in a staggered fashion to account for wetland residence time. One set of samples was collected in the fall of 2017, and the remaining four will be collected starting in the spring of 2018. All samples are tested for toxicity with *Ceriodaphnia dubia* (96 hour acute test), *Chironomus dilutus* (10 day chronic test), and *Hyalella azteca* (96 hour acute test), as well as analyzed for a suite of neonicotinoid, organophosphate, and pyrethroid pesticides. Water samples are also analyzed for nitrate, phosphate and turbidity.

Level of Completion – The first sampling event took place in the fall of 2017. That event was viewed as a trial run to test the structure of the carbon installation and to measure baseline concentrations of pesticides. Preliminary results show significant input toxicity to Hyalella and Ceriodaphnia, although daphnid toxicity was likely partially caused by elevated conductivity. Toxicity to Hyalella was reduced by the wetland and pennywort, but residual toxicity was observed in the sample from Station D, indicating that the carbon installation was not functioning properly and contributing artifactual toxicity (Table 1). Analytical samples have been processed and a complete set of detections is presented in Table 2. The remaining monitoring events are scheduled for late June, July, August and September.

Table 1. Toxicity results from first monitoring event. Shaded cells indicate significant toxicity.

	H. azteca % Survival	*C. dubia* % Survival	*C. dilutus* % Survival	*C. dilutus* Growth (mg)
Station A	34	60	100	3.67
Station B	100	92	100	1.56
Station C	100	64	100	3.32
Station D	72	36	98	3.73
Conductivity Control		64		
Control	100	100	100	2.45

Table 2. Analytical results in ng/L.

Chemical	Type	Class	Station A	Station B	Station C	Station D
Azoxystrobin	Fungicide	Strobilurin	98.0	98.1	110	104
Boscalid	Fungicide	Pyridine	399	403	384	344
Cyprodinil	Fungicide	Pyrimidine	26.5	16.6	15.7	13.1
Dimethomorph	Fungicide	Morpholine	208	197	210	191
Fenamidone	Fungicide	Imidazole	62.8	63.1	63.1	57.4
Fludioxinil	Fungicide	Pyrrole	68.2	46.4	47.8	44.7
Fluopicolide	Fungicide	Pyrimidine	170	215	211	204
Fluxapyroxad	Fungicide	Anilide	144	155	163	150
Metalaxyl	Fungicide	Phenylamide	157	144	142	132
Myclobutanil	Fungicide	Triazole	191	184	179	168
Paclobutrazol	Fungicide	Triazole	78.4	69.6	49.8	52.0
Pyrimethanil	Fungicide	Pyrmidine	43.7	32.6	29.0	25.3
Tetraconazole	Fungicide	Azole	23.7	19.6	18.6	16.0
Fluopyram	Fungicide		275	280	269	257
Penthiopyrad	Fungicide		36.5	28.9	25.3	15.7
Mandipropamid	Fungicide	Mandelamide	21.2	14.7	14.3	8.6
Carbendazim	Fungicide/Degradate	Benzimidazole	2196	1891	9564	1002
Cycloate	Herbicide	Thiocarbamate	94.7	82.5	81.0	45.3
Oxyfluorfen	Herbicide	Nitrophenyl ether	8.1			
Prometryn	Herbicide	Triazine	119	166	153	145
Propyzamide	Herbicide	Benzamide	101	128	121	116
Diuron	Herbicide	Urea	20.2	27.1	26.5	12.7
Flupyradifurone	Herbicide	Unclassified	292	455	429	334
Bifenthrin	Insecticide	Pyrethroid	16.5	2.0	2.0	1.8
Fipronil	Insecticide	Phenylpyrazole	8.2	8.8	8.6	7.5
Fipronil desulfinyl	Insecticide/Degradate	Phenylpyrazole	5.1	4.9	5.3	4.3
Fipronil sulfide	Insecticide/Degradate	Phenylpyrazole			4.5	
Fipronil sulfone	Insecticide/Degradate	Phenylpyrazole	5.0	5.1	6.1	4.6
Acetamiprid	Insecticide	Neonicotinoid	11.6	17.2	18.1	10.4
Chlorantraniliprole	Insecticide	Anthranilic diamide	174	282	301	197
Clothianidin	Insecticide	Neonicotinoid	51.5	75.0	64.2	44.0
Cyantraniliprole	Insecticide	Anthranilic diamide	16.4	14.0	15.5	11.4
Dinotefuran	Insecticide	Neonicotinoid	28.1	48.3	42.7	31.1
Flonicamid	Insecticide	Unclassified	94.4	151	141	116
Imidacloprid	Insecticide	Neonicotinoid	103	135	119	90.4
Imidacloprid Urea	Insecticide/Degradate		11.1	24.0	20.5	16.5
Methoxyfenozide	Insecticide	Diacylhydrazine	181	267	266	163
Thiamethoxam	Insecticide	Neonicotinoid	143	159	145	103
Thiamethoxam (CGA-355190)	Degradate		20.4	24.6	23.9	15.6
Thiamethoxam (NOA-407475)	Degradate		14.3	10.1	20.1	7.8
p,p'-DDD	Insecticide/Degradate	Organochlorine	7.7			
p,p'-DDE	Insecticide/Degradate	Organochlorine	31.8			
3,4-DCA	Insecticide/Degradate	Urea	6.2	3.4		
Sulfoxaflor	Insecticide			6.3	5.6	

Task 4) Education and Outreach (January 2019 – June 2019).

Conduct project demonstrations and outreach to educate growers, landowners, and other stakeholders on project outcomes through field tours or other communications.

Level of Completion – None at this time.

Table 3. Project Timeline and Percent Completion

Task	Start Date	End Date	Percent Completed
Task 1: Project Management	3/1/17	6/30/19	60
Task 2: Management Practice Implementation	7/1/17	8/31/17	80
Task 3: Monitoring Performance	9/1/17	9/30/19	20
Task 4: Education and Outreach	1/1/19	6/30/19	0

Reference

Phillips, B.M., Anderson, B.A., Cahn, M., Rego, J.L., Voorhees, J.P., Siegler, C., Zhang, X., Budd, R., Goh, K., Tjeerdema, R.S., 2017. An Integrated Vegetated Ditch System Reduces Chlorpyrifos Loading in Agricultural Runoff Integrated Environmental Assessment and Management 13, 423-430.