

# PESTICIDE SURFACE WATER QUALITY REPORT

SEPTEMBER 2010 SAMPLING EVENT



*Richard J. Pfeuffer*  
South Florida Water Management District  
MSC 7281  
3301 Gun Club Road  
West Palm Beach, FL 33406

## **Pesticide Monitoring Project Report September 2010 Sampling Event**

### ***Summary***

As part of the South Florida Water Management District's (SFWMD) quarterly ambient monitoring program, unfiltered water samples from 33 of the 34 network sites were collected September 20 to September 23, 2010, and analyzed for over 70 pesticides and/or products of their degradation.

The herbicides ametryn, atrazine, bromacil, hexazinone, metolachlor, metribuzin, norflurazon, prometryn, and simazine, along with the insecticide/degradate atrazine desethyl, were detected in one or more of these surface water samples. No harmful impacts are expected from the detected pesticides.

The compounds and concentrations found are typical of those expected from an area of intensive historical and contemporary agricultural activity.

### ***Background and Methods***

The SFWMD pesticide monitoring network includes stations designated in the Everglades Settlement Agreement, the Lake Okeechobee Protection Act Permit, and the non-Everglades Construction Project (non-ECP) permit. The canals and marshes depicted in Figure 1 are protected as Florida Administrative Code (F.A.C.) 62-302 Class III (fishable and swimmable) waters, while Lake Okeechobee and a segment of the Caloosahatchee River are protected as a Class I drinking water supply. Water Conservation Area 1 (WCA-1) and the Everglades National Park are also designated as Outstanding Florida Waters, to which anti-degradation standards apply. Surface water and sediment are sampled quarterly and semiannually, respectively, upstream at each structure identified in the permit or agreement.

Seventy-one pesticides and degradation products were analyzed in samples from 33 of the 34 network sites (Figure 1). The analytes, their respective method detection limits (MDLs), and practical quantitation limits (PQLs) are listed in Table 1. All the analytical work is performed by the Florida Department of Environmental Protection (FDEP) Central Laboratory in Tallahassee, Florida. Analytical method details can be found at the following location:

<http://www.dep.state.fl.us/labs/cgi-bin/sop/chemsop.asp>.

To evaluate the potential impacts on aquatic life, the observed concentration is compared to the appropriate criterion outlined in F.A.C. 62-302.530. If a pesticide compound is not specifically listed, acute and chronic toxicity criterion are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50% of the test organisms in 96 hours, using the lowest technical grade effective concentration 50 (EC<sub>50</sub>) or lethal concentration 50 (LC<sub>50</sub>) reported in the summarized literature for the species significant to the indigenous aquatic community (F.A.C. 62-302.200). Each pesticide's description and possible uses and sites of application described herein are taken from Hartley and Kidd (1987). This summary covers surface water samples collected from September 20 to September 23, 2010.

## ***Results***

At least one pesticide was detected in surface water at 22 of the 33 sites. Modifications to the non-ECP permit changed the requirement for sampling at S142 to only during discharge or flow events. For this sampling event, no sample was obtained due to no discharge at the time of sample collection. The concentrations of the pesticides detected at each of the sites are summarized for the surface water in Table 2. All of these compounds have previously been detected in this monitoring program. No harmful impacts are expected from the detected pesticides.

The above findings must be considered with the caveat that pesticide concentrations in surface water and sediment may vary significantly in relation to the timing and magnitude of pesticide application, rainfall events, pumping and other factors, and that this was only one sampling event. The possible long-term or chronic toxicity impacts are also reported based on the single sampling event and do not take into account previous monitoring data.

### ***Usage and Water Quality Impacts***

**Ametryn:** Ametryn is a selective terrestrial herbicide registered for use on sugarcane, bananas, pineapple, citrus, corn, and non-crop areas. Most algal effects occur at concentrations > 10 micrograms per liter ( $\mu\text{g/L}$ ) (Verschueren, 1983). Environmental fate and toxicity data in Tables 3 and 4 indicate that ametryn (1) is lost from soil relatively easily by leaching, surface adsorption, and in surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96-hour  $\text{LC}_{50}$  of 14.1 milligrams per liter ( $\text{mg/L}$ ) for goldfish (Hartley and Kidd, 1987). The ametryn surface water concentrations found in this sampling event ranged from 0.011 to 0.057  $\mu\text{g/L}$  (Table 2). Using these criteria, these observed surface water concentrations should not have an acute, detrimental impact on fish or aquatic invertebrates.

**Atrazine:** Atrazine is a selective systemic herbicide registered for use on pineapple, sugarcane, corn, rangelands, ornamental turf and lawn grasses, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that atrazine (1) is easily lost from soil by leaching and in surface solution, with moderate loss from surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96-hour  $\text{LC}_{50}$  of 76  $\text{mg/L}$  for carp, 16  $\text{mg/L}$  for perch and 4.3  $\text{mg/L}$  for guppies (Hartley and Kidd, 1987). Also, in a flow-through bioassay, the maximum acceptable toxicant concentration (MATC) of atrazine was 90 and 210  $\mu\text{g/L}$  for bluegill and fathead minnow, respectively (Verschueren, 1983). The draft ambient aquatic life water quality criterion identifies a one-hour average concentration that does not exceed 1,500  $\mu\text{g/L}$  more than once every three years on the average (United States Environmental Protection Agency [U.S. EPA], 2003). The atrazine surface water concentrations found in this sampling event at 11 of the 33 sampling locations, ranged from 0.0099 to 0.12  $\mu\text{g/L}$  (Table 2). Using these criteria, these observed surface water concentrations should not have an acute or chronic detrimental impact on fish or invertebrates.

Atrazine desethyl (DEA) and atrazine desisopropyl (DIA) are biotic degradation products of atrazine. These degradation products are both persistent and mobile in water; however, DEA is

more stable and the dominant initial metabolite. Since DEA and DIA are structurally and toxicologically similar to atrazine, the concentrations of total atrazine residue (atrazine + DEA + DIA) may also be a significant consideration in the surface water environment. The DEA to atrazine ratio (DAR), on a molar basis, has been suggested as an indicator of nonpoint-source pollution of groundwater (Adams and Thurman, 1991) and as a tracer of groundwater discharge into rivers (Thurman et al., 1992). Goolsby et al. (1997) determined that low DAR values, median <0.1, occur in streams during runoff shortly after application of atrazine. Higher DAR values, median about 0.4, occur later in the year after considerable degradation of atrazine to DEA has occurred in the soil. The low median DAR ratio (0.1 to 0.2) at the locations where both atrazine and DEA were detected, suggests minimum degradation of atrazine (Table 5). However, these general guidelines were developed based on observations in Midwest watersheds in northern temperate climates with different soil and water management regimes as well as higher atrazine water concentrations. Applications to the South Florida environment should be made with caution.

Bromacil: Bromacil is a terrestrial herbicide registered for use on pineapple, citrus, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that bromacil (1) is easily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96-hour LC<sub>50</sub> of 164 mg/L for carp (Hartley and Kidd, 1987). The highest concentration of bromacil detected in the surface water during this sampling event was at S191 (0.16 µg/L) (Table 2). Using these criteria, this observed concentration should not have an acute or chronic detrimental impact on fish or aquatic invertebrates.

Hexazinone: Hexazinone is a non-selective contact herbicide that inhibits photosynthesis. Registered uses include sugarcane, pineapple, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that hexazinone (1) is easily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Hexazinone is practically non-toxic to freshwater invertebrates with an EC<sub>50</sub> of 145 mg/L for *Daphnia magna* (U.S. EPA, 1988). The highest surface water concentration detected in this sampling event at S4 (0.058 µg/L) (Table 2) should not have an acute impact on fish or aquatic invertebrates.

Metolachlor: Metolachlor is a selective herbicide used on potatoes, sugarcane, and some vegetables. Environmental fate and toxicity data in Tables 3 and 4 indicate that metolachlor (1) has a large potential for loss due to leaching and a medium potential for loss in surface solution and due to surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Metolachlor is non-toxic to birds (Lyman et al., 1990). The only surface water concentration found in this sampling event (0.16 µg/L at S80; Table 2) is over two orders of magnitude below the calculated chronic toxicity level. Using these criteria, this observed level should not have a harmful effect on fish or aquatic invertebrates.

Metribuzin: Metribuzin is a selective systemic herbicide used on a variety of crops including potatoes, tomatoes, sugarcane, and peas. Environmental fate and toxicity data in Tables 3 and 4 indicate that metribuzin (1) has a large potential for loss due to leaching, a medium potential for

loss in surface solution, and a small potential for loss due to surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioaccumulate significantly. The only concentration of metribuzin detected was 0.024 µg/L (S190). Using these criteria, this surface water concentration should not have an acute impact on fish or aquatic invertebrates.

Norflurazon: Norflurazon is a selective herbicide registered for use on many crops including citrus. Environmental fate and toxicity data in Tables 3 and 4 indicate that norflurazon (1) is easily lost from soil surface solution and a moderate potential for loss due to leaching and surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. The LC<sub>50</sub> for norflurazon is > 200 mg/L for catfish and goldfish (Hartley and Kidd, 1987). The norflurazon surface water concentrations ranged from 0.022 to 0.30 µg/L (Table 2). Even at the highest concentration, this is several orders of magnitude below the calculated chronic action level. Using these criteria, these observed concentrations should not have an acute, detrimental impact on fish or aquatic invertebrates.

Prometryn: Prometryn is a selective systemic herbicide used on a variety of crops including potatoes, tomatoes, beans, and peas. Environmental fate and toxicity data in Tables 3 and 4 indicate that prometryn: (1) is easily lost from soil surface solution and a moderate potential for loss due to leaching and surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioaccumulate significantly. The only concentration of prometryn detected was 0.021 µg/L at structure S2. Using these criteria, this level should not have an acute impact on fish.

Simazine: Simazine is a selective systemic herbicide registered for use on many crops including sugarcane, citrus, corn, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that simazine (1) is easily lost from soil by leaching and has a moderate potential for loss due to surface adsorption and surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96-hour LC<sub>50</sub> of 49 mg/L for guppies (Hartley and Kidd, 1987). Most of the aquatic biological effects occur at concentrations > 500 µg/L (Verschueren, 1983). Aquatic invertebrate LC<sub>50</sub> toxicity ranges from 3.2 mg/L to 100 mg/L for simazine (U.S. EPA, 1984). The highest surface water concentration of simazine detected at S235 (0.055 µg/L; Table 2) was below any level of concern for fish or aquatic invertebrates.

### ***Quality Assurance Evaluation***

Replicate samples were collected at sites S99 and S331. All the analytes detected in the surface water had precision ≤ 30 percent relative percent difference. No pesticide analytes were detected in the field blanks performed at S99, S177, S79, S8, and S7. All collected samples were shipped and all bottles were received.

### ***Glossary***

**Bioconcentration Factor**: The ratio of the concentration of a contaminant in an aquatic organism to the concentration in water, after a specified period of exposure via water only. The duration of exposure should be sufficient to achieve a near steady-state condition.

EC<sub>50</sub>: A concentration necessary for 50 percent of the aquatic species tested to exhibit a toxic effect short of mortality (e.g., swimming on side or upside down, cessation of swimming) within a short (acute) exposure period, usually 24 to 96 hours.

Henry's law constant (H): Relates the concentration of a compound in the gas phase to its concentration in the liquid phase. The constant is calculated from the formula:  $H = P_{vp}/S$  where  $P_{vp}$  is pressure in atmospheres and S is solubility in moles/meter<sup>3</sup> for a compound.

K<sub>oc</sub>: The soil/sediment partition or sorption coefficient normalized to the fraction of organic carbon in the soil. This value provides an indication of the chemical's tendency to partition between soil organic carbon and water.

LC<sub>50</sub>: A concentration which is lethal to 50 percent of the aquatic animals tested within a short (acute) exposure period, usually 24 to 96 hours.

LD<sub>50</sub>: The dosage which is lethal to 50 percent of the terrestrial animals tested within a short (acute) exposure period, usually 24 to 96 hours.

Method Detection Limits (MDLs): The minimum concentration of an analyte that can be detected with 99 percent confidence of its presence in the sample matrix.

Practical Quantitation Limits (PQLs): The lowest level of quantitation that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions. The PQLs are further verified by analyzing spike concentrations whose relative standard deviation in 20 fortified water samples is < 15 percent. In general, PQLs are 2 to 5 times larger than the MDLs.

Soil or water half-life: The time required for one-half the concentration of the compound to be lost from the water or soil under the conditions of the test.

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Figure 1. South Florida Water Management District Pesticide Monitoring Network.

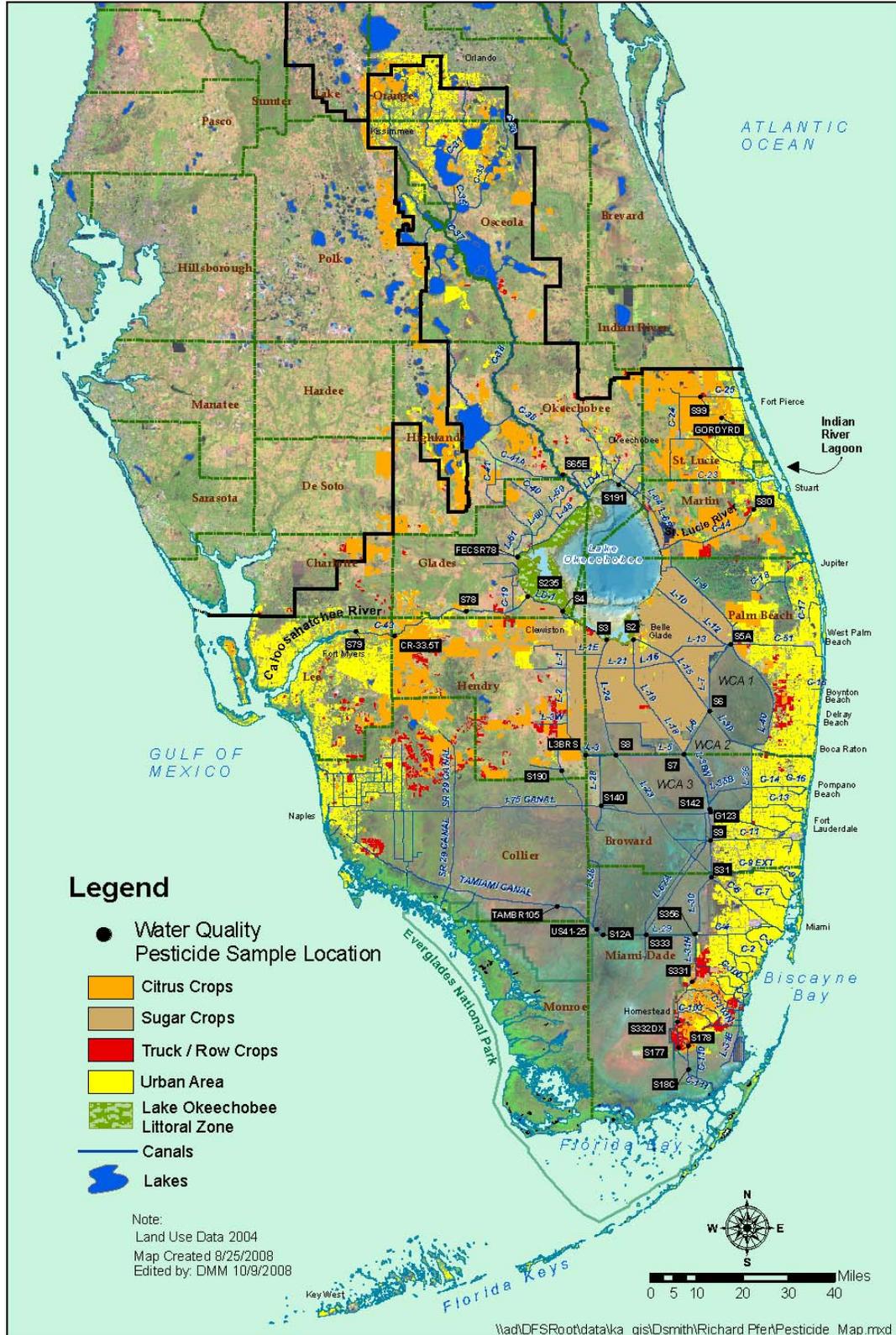


Table 1. Method detection limits (MDLs) and practical quantitation limits (PQLs) for September 2010 sampling event.

Pesticide or metabolite	Water: range of MDLs - PQLs (µg/L)	Pesticide or metabolite	Water: range of MDLs - PQLs (µg/L)
2,4-D	0.2 - 0.62	endrin aldehyde	0.0042 - 0.018
2,4,5-T	0.2 - 0.62	ethion	0.00095 - 0.04
2,4,5-TP (silvex)	0.2 - 0.62	ethoprop	0.00095 - 0.04
acifluorfen	0.2 - 0.62	fenamiphos	0.0038 - 0.16
alachlor	0.0057 - 0.24	fonofos	0.00095 - 0.04
aldrin	0.0019 - 0.008	heptachlor	0.0023 - 0.0096
ametryn	0.00095 - 0.04	heptachlor epoxide	0.0019 - 0.008
atrazine	0.00095 - 0.11	hexazinone	0.0019 - 0.1
atrazine desethyl	0.00095 - 0.04	imidacloprid	0.2 - 0.68
atrazine desisopropyl	0.00095 - 0.04	linuron	0.2 - 0.68
azinphos methyl (guthion)	0.0028 - 0.12	malathion	0.0028 - 0.12
α-BHC (alpha)	0.0021 - 0.0088	metalaxyl	0.0047 - 0.2
β-BHC (beta)	0.0032 - 0.014	methoxychlor	0.0094 - 0.04
δ-BHC (delta)	0.0019 - 0.008	metolachlor	0.0057 - 0.24
γ-BHC (gamma) (lindane)	0.0019 - 0.008	metribuzin	0.0019 - 0.08
bromacil	0.0047 - 0.22	mevinphos	0.0057 - 0.24
butylate	0.0019 - 0.08	mirex	0.011 - 0.048
carbophenothion (trithion)	0.015 - 0.064	naled	0.0076 - 0.32
chlordane	0.019 - 0.08	norflurazon	0.0019 - 0.08
chlorothalonil	0.015 - 0.064	parathion ethyl	0.0019 - 0.08
chlorpyrifos ethyl	0.00095 - 0.04	parathion methyl	0.0019 - 0.08
chlorpyrifos methyl	0.0019 - 0.08	PCB-1016	0.019 - 0.08
cypermethrin	0.019 - 0.08	PCB-1221	0.019 - 0.08
DDD-P,P'	0.0045 - 0.019	PCB-1232	0.019 - 0.08
DDE-P,P'	0.0038 - 0.016	PCB-1242	0.019 - 0.08
DDT-P,P'	0.0057 - 0.024	PCB-1248	0.019 - 0.08
demeton	0.0028 - 0.12	PCB-1254	0.019 - 0.08
diazinon	0.0019 - 0.08	PCB-1260	0.019 - 0.08
dicofol (kelthane)	0.042 - 0.18	permethrin	0.015 - 0.064
dieldrin	0.0019 - 0.008	phorate	0.00095 - 0.04
disulfoton	0.0019 - 0.08	prometryn	0.0019 - 0.08
diuron	0.2 - 0.68	prometon	0.0019 - 0.08
α-endosulfan (alpha)	0.0038 - 0.016	simazine	0.00095 - 0.04
β-endosulfan (beta)	0.0038 - 0.016	toxaphene	0.094 - 0.4
endosulfan sulfate	0.0045 - 0.019	trifluralin	0.0075 - 0.032
endrin	0.0094 - 0.04		

Table 2. Summary of pesticide residues ( $\mu\text{g/L}$ ) above the method detection limit found in surface water samples collected by SFWMD in September 2010.

Date	Location	Flow	ametryn	atrazine	atrazine desethyl	bromacil	hexazinone	metolachlor	metribuzin	norflurazon	prometryn	simazine	Number of compounds detected at location
9/20/2010	S99	Y	-	-	-	-	-	-	-	0.19 *	-	0.038 *	2
	GORDYRD	Y	-	-	-	-	-	-	-	0.21	-	-	1
	S2	N	0.057	0.046	-	-	-	-	-	-	0.021 I	-	3
	S3	N	-	0.12	0.026 I	-	-	-	-	-	-	0.011 I	3
	S4	N	0.030 I	0.038 I	-	-	0.058 I	-	-	-	-	-	3
9/21/2010	S80	Y	-	-	0.012 I	-	-	0.16 I	-	0.30	-	-	3
	CR33.5T	R	-	-	-	0.12 I	-	-	-	0.18	-	0.025 I	3
	FECSR78	Y	-	-	-	-	-	-	-	-	-	-	0
	S12A	Y	-	-	-	-	-	-	-	-	-	-	0
	S177	N	-	-	-	-	-	-	-	-	-	-	0
	S178	Y	-	-	-	-	-	-	-	-	-	-	0
	S18C	Y	-	-	-	-	-	-	-	-	-	-	0
	S191	N	-	-	-	0.16 I	0.036 I	-	-	0.022 I	-	-	3
	S235	R	-	-	-	-	-	-	-	0.052 I	-	0.055	2
	S331	Y	-	-	-	-	-	-	-	-	-	-	0
	S332DX	N	-	0.0099 I	-	-	-	-	-	-	-	-	1
	S333	N	-	0.029 I	-	-	-	-	-	-	-	-	1
	S356-334	N	-	-	-	-	-	-	-	-	-	-	0
	S65E	N	-	-	-	-	-	-	-	-	-	-	0
	S78	N	0.011 I	-	-	0.074 I	-	-	-	0.14	-	0.012 I	4
S79	Y	-	-	0.010 I	0.098 I	-	-	-	0.20	-	0.023 I	4	
TAMBR105	Y	-	-	-	-	-	-	-	-	-	-	0	
US41-25	Y	-	-	-	-	-	-	-	-	-	-	0	
9/22/2010	G123	N	-	-	-	-	-	-	-	-	-	-	0
	L3BRS	Y	-	-	-	-	-	-	-	0.054 I	-	-	1
	S140	Y	-	-	-	-	-	-	-	0.041 I	-	-	1
	S190	Y	-	-	-	-	-	-	0.024 I	-	-	-	1
	S31	Y	0.012 I	0.031 I	-	-	-	-	-	-	-	-	2
	S8	Y	0.022 I	0.021 I	-	-	-	-	-	-	-	-	2
	S9	Y	-	0.12	0.016 I	-	-	-	-	-	-	-	2
9/23/2010	S5A	N	0.046	0.039 I	-	-	-	-	-	-	-	-	2
	S6	N	0.037 I	0.018 I	-	-	-	-	-	-	-	-	2
	S7	Y	0.025 I	0.041	-	-	-	-	-	-	-	-	2
Total number of compound detections			8	11	4	4	2	1	1	10	1	6	48

N - no Y - yes R - reverse; - denotes that the result is below the method detection limit; \* results are the average of replicate samples  
I - value reported is less than the practical quantitation limit, and greater than or equal to the method detection limit

Table 3. Selected properties for pesticides found in September 2010 sampling event.

Common Name	Surface Water Standards F.A.C. 62-302 (µg/L)	Acute Oral LD <sub>50</sub> For Rats (mg/Kg) (1)	U.S. EPA Carcinogenic Potential	Water Solubility (WS) (mg/L) (2, 3)	Koc (mL/g) (2, 3)	Soil Half-life (days) (2, 3)	Soil Conservation Service (SCS) rating (2)			Volatility from Water	Bioconcentration Factor (BCF)
							LE	SA	SS		
ametryn	-	1,110	D	185	300	60	M	M	M	I	33
atrazine	-	3,080	C	33	100	60	L	M	L	I	86
bromacil	-	5,200	C	700	32	60	L	M	M	I	15
hexazinone	-	1,690	D	33,000	54	90	L	M	M	I	2
metolachlor	-	2,780	C	530	200	90	L	M	M	I	18
metribuzin	-	2,200	D	1,220	41	30	L	S	M	I	11
norflurazon	-	9,400	C	28	700	90	M	M	L	I	94
prometryn	-	5,235	-	33	400	60	M	M	L	I	86
simazine	-	>5,000	C	6.2	130	60	L	M	M	I	221

SCS Ratings are pesticide loss due to leaching (LE), surface adsorption (SA) or surface solution (SS) and grouped as large(L), medium (M), small (S) or extra small (XS)  
Volatility from water: R = rapid, I = insignificant, S = significant

Bioconcentration Factor (BCF) calculated as  $BCF = 10^{(2.791 - 0.564 \log WS)}$  (4)

B2: probable human carcinogen; C: possible human carcinogen; D: not classified; E: evidence of non-carcinogen for humans (5)

FDEP F.A.C. 62-302 surface water standards (4/2008) for Class III waters except Class I in ( )

(1) Hartley and Kidd (1987)

(2) Goss Wauchope (1992)

(3) Montgomery (1993)

(4) Lyman, et al. (1990)

(5) U.S. EPA (1996a)

Table 4 . Toxicity of pesticides found in the September 2010 sampling event to freshwater aquatic invertebrates and fishes (µg/L).

Common Name	48 hr EC <sub>50</sub> Water flea <i>Daphnia magna</i>			96 hr LC <sub>50</sub> Fathead Minnow (#) <i>Pimephales promelas</i>			96 hr LC <sub>50</sub> Bluegill <i>Lepomis macrochirus</i>			96 hr LC <sub>50</sub> Largemouth Bass <i>Micropterus salmoides</i>			96 hr LC <sub>50</sub> Rainbow Trout (#) <i>Oncorhynchus mykiss</i>			96 hr LC <sub>50</sub> Channel Catfish <i>Ictalurus punctatus</i>		
	Acute Toxicity (*)	Chronic Toxicity (*)		Acute Toxicity	Chronic Toxicity		Acute Toxicity	Chronic Toxicity		Acute Toxicity	Chronic Toxicity		Acute Toxicity	Chronic Toxicity		Acute Toxicity	Chronic Toxicity	
ametryn	28,000 (3)	9,333	1,400	16,000 (4)	5,333	800	4,100 (1)	1,367	205	-	-	-	8,800 (1)	2,933	440	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	3,600 (4)	1,200	180	-	-	-
atrazine	6900 (3)	2,300	345	15,000 (3)	5,000	750	16,000 (1)	5,333	800	-	-	-	8,800 (1)	2,933	440	7,600 (1)	2,533	380
	-	-	-	-	-	-	-	-	-	-	-	-	5,300 (5)	1,767	265	-	-	-
bromacil	-	-	-	-	-	-	127,000 (3)	42,333	6,350	-	-	-	36,000 (3)	12,000	1,800	-	-	-
	121,000 (10)	40,333	6,050	-	-	-	127,000 (10)	42,333	6,350	-	-	-	36,000 (10)	12,000	1,800	-	-	-
hexazinone	151,600 (3)	50,533	7,580	274,000 (1)	91,333	13,700	100,000 (3)	33,333	5,000	-	-	-	180,000 (3)	60,000	9,000	-	-	-
	151,600 (6)	50,533	7,580	274,000 (6)	91,333	13,700	505,000 (6)	168,333	25,250	-	-	-	>320,000 (6)	>106,667	>16,000	-	-	-
metolachlor	23,500 (3)	7,833	1,175	-	-	-	15,000 (1)	5,000	750	-	-	-	2,000 (1)	667	100	4,900 (2)	1,633	245
metribuzin	4,200 (3)	1,400	210	-	-	-	80,000 (1)	26,667	4,000	-	-	-	64,000 (1)	21,333	3,200	100,000 (3)	33,333	5,000
	4,200 (7)	1,400	210	-	-	-	75,900 (7)	25,300	3,795	-	-	-	76,770 (7)	25,590	3,839	-	-	-
norflurazon	15,000 (3)	5,000	750	-	-	-	16,300 (3)	5,433	815	-	-	-	8,100 (3)	2,700	405	>200,000 (1)	>67,000	>10,000
	>15000 (9)	>5,000	>750	-	-	-	16,300 (9)	5,433	815	-	-	-	8,100 (9)	2,700	405	-	-	-
prometryn	18,590 (3)	6,197	930	-	-	-	10,000 (1)	3,333	500	-	-	-	2,500 (1)	833	125	-	-	-
	18,590 (8)	6,197	930	1,390 (8)	463	70	10,000 (8)	3,333	500	-	-	-	2,900 (8)	967	145	-	-	-
simazine	1,100 (3)	367	55	100,000 (3)	33,333	5,000	90,000 (1)	30,000	4,500	-	-	-	100,000 (3)	33,333	5,000	-	-	-

(\*) Florida Administrative Code (F.A.C.) 62-302.200, for compounds not specifically listed, acute and chronic toxicity standards are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50% of the test organisms in 96 hours, where the 96 hour LC<sub>50</sub> is the lowest value which has been determined for a species significant to the indigenous aquatic community.

(#) Species is not indigenous. Information is given for comparison purposes only.

(1) Hartley and Kidd (1987)

(2) Montgomery (1993)

(3) U.S. EPA (1991)

(4) U.S. EPA (2005)

(5) U.S. EPA (2006)

(6) U.S. EPA (1994)

(7) U.S. EPA (1998)

(8) U.S. EPA (1996d)

(9) U.S. EPA (1996b)

(10) U.S. EPA (1996c)

Table 5. Atrazine Desethyl/Atrazine ratio (DAR) data for September 2010 sampling event.

Date	Location	Flow*	atrazine		atrazine desethyl		DAR
			µg/L	moles/l	µg/L	moles/l	
9/20/2010	S3	N	0.12	5.56367E-10	0.026	1.38569E-10	0.2
9/22/2010	S9	Y	0.12	5.56367E-10	0.016	8.52735E-11	0.2
			DAR		All sites	Flow only sites	No flow sites
			average		0.2	0.2	0.2
			median		0.2	0.2	0.2
			minimum		0.2	0.2	0.2
			maximum		0.2	0.2	0.2

\* No - no; Y - yes; R- reserve