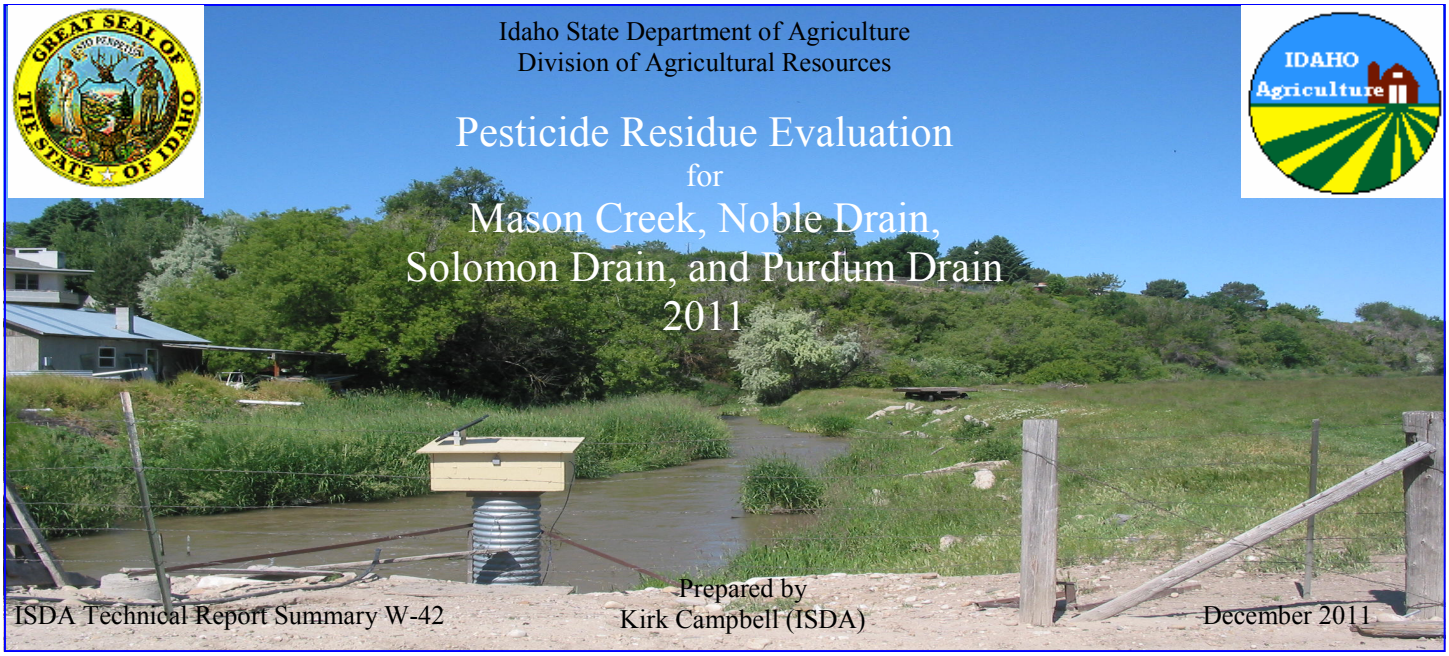

Idaho State Department of Agriculture
Division of Agricultural Resources

Pesticide Residue Evaluation
for
Mason Creek, Noble Drain, Solomon Drain, and Purdum Drain
2011

ISDA Technical Report Summary W-42

Prepared by
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Introduction

The Idaho State Department of Agriculture (ISDA) conducted follow-up pesticide residue monitoring in 2011 on Mason Creek and three tributaries to Mason Creek; Noble Drain, Solomon Drain, and Purdum Drain (Figure1).

Monitoring conducted by ISDA in 2010 indicated that Mason Creek is a contributor of pesticide residues into the Lower Boise River. In 2010 there were 20 different pesticide compounds identified in Mason Creek including 13 herbicides and 7 insecticides. Of these 20 different pesticides there were a total of 89 detections (72 herbicides and 17 insecticides).

The 2011 monitoring focused again on Mason Creek which is a major tributary to the Lower Boise River along with Noble Drain, Solomon Drain and Purdum Drain which are major tributaries to Mason Creek. Mason Creek, Noble Drain, Solomon Drain, and Purdum Drain consist of approximately 53,786 total acres with agricultural acreage comprising approximately 43,092 acres or 80% of the drainage area (USGS StreamStat). Mason Creek drainage consists of approximately 38,451 acres followed by Purdum Drain (10,477 acres), Nobel Drain (2,285 acres) and Solomon Drain (2,573 acres). Partial funding for this project was provided by the U.S. Environmental Agency (EPA) Region 10.

Monitoring for this project was conducted on a bi-weekly schedule starting from April 5, 2011 through September 28, 2011. A total of 12 pesticide samples were collected from each monitoring site.

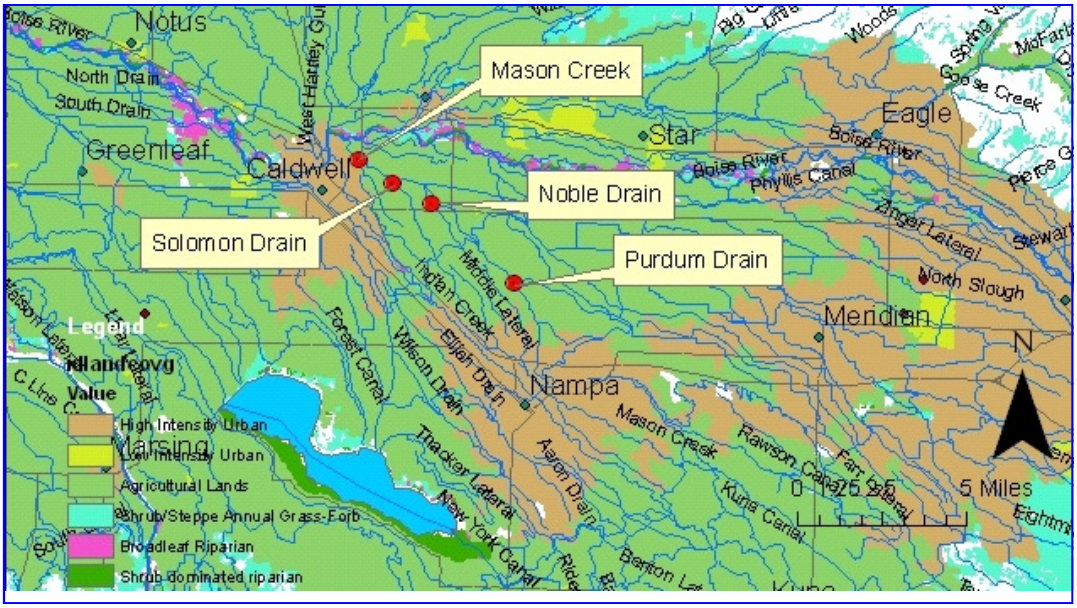

Figure 1. Mason Creek, Solomon Drain, Noble Drain, and Purdum Drain sampling sites.

Analytical Quality Assurance

During this study, all analyte spikes and surrogate standard recoveries were within acceptable ranges (70-130%) indicating that pesticide residues were accurately recovered. All bottle blanks and equipment blanks submitted during this study resulted in non-detectable results indicating both field and laboratory activities were free from contamination. Relative percent difference (RPD) calculated on field duplicate samples, submitted to UIASL, had a range of 0-27% an overall mean of 10% and a median of 8.0%.

It should be noted that holding times between extraction and instrumental analysis were exceeded (samples collected on 8/19, 8/23, 9/6, and 9/20/2011) for the carbamate and phenylurea pesticide screens due to instrument failure following an electrical storm. Extraction solutions were frozen while the instrument was being replaced. All standard recoveries (spikes and surrogates) for the frozen extracts fell within an acceptable range.

Overall Results

During the 2011 assessment there were a total of 25 pesticide compounds identified with 19 herbicides, 5 insecticides and 1 degradate of atrazine (Table 1).

Table 1. Pesticides detected and trade names for 2011.

Detected Pesticides	Pesticide Type	Trade Name
2,4-D	Herbicide	Curtail
Acephate	Insecticide	Orthene
Alachlor	Herbicide	Lasso
Atrazine	Herbicide	Aatrex
Bentazon	Herbicide	Basagran
Bromacil	Herbicide	Krovar
Bromoxynil	Herbicide	Buctril
Chlorpyrifos	Insecticide	Dursban/Lorsban
DCPA	Herbicide	Dacthal
Desethyl Atrazine	[1] Degradate	—
Dicamba	Herbicide	Brushmaster
Diuron	Herbicide	Karmex
EPTC	Herbicide	Eptam
Ethalfluralin	Herbicide	Sonalan
Ethoprop	Insecticide	Mocap
Hexazinone	Herbicide	Velpar
Linuron	Herbicide	Lorox DF
Malathion	Insecticide	Fyfanon
MCPA	Herbicide	Banlene
Methomyl	Insecticide	Lannate
Metolachlor	Herbicide	Dual
Metribuzin	Herbicide	Sencore
Oxyfluorfen	Herbicide	Goal
Pendimethalin	Herbicide	Prowl
Terbacil	Herbicide	Sinbar
[1] Degradate of Atrazine		

For 2011 there were a total of 314 pesticide detections which were 62 less detections than in 2010. Also for 2011 there were seven less compounds identified as in 2010. In 2011 the highest number of herbicides were diuron (41), terbacil (39), atrazine desethyl (38), and Bromacil (32). The highest number of insecticide detections were chlorpyrifos (17), methomyl (14), and ethoprop (9) (Figure 2).

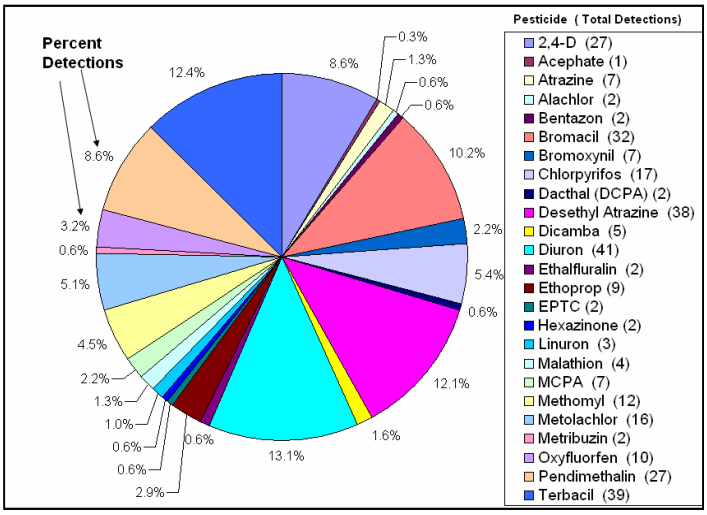

Figure 2. Total pesticide detections in 2011.

Monitoring Results

ISDA defines a pesticide of concern (POC) as any pesticide that is detected at a concentration that is greater than or equal to fifty percent (≥50 %) of an established Environmental Protection Agency (EPA) Aquatic Life Benchmark. These aquatic benchmarks are established for pesticide effects on fish and aquatic invertebrates at acute and chronic levels and non-vascular and vascular plants at acute levels. Acute toxicity refers to how poisonous a pesticide is to a human, animal, or plant after a single short-term exposure (promptly or within 24 hours). A pesticide with a high acute toxicity is deadly even when a very small amount is absorbed. Chronic toxicity is the delayed poisonous effect from longer term exposure to a substance.

The Aquatic Life Benchmarks (for freshwater species) are based on toxicity values reviewed by EPA and used in the EPA's most recent risk assessments developed as part of the decision making process for pesticide registration. The Office of Pesticide Programs (OPP) in EPA relies on studies required under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as well as a wide range of environmental laboratory and field studies available in the public scientific literature to assess environmental risk. Each Aquatic Benchmark is based on the most sensitive, scientifically acceptable toxicity endpoint available to EPA for a given taxon (EPA, OPP, 2011).

Mason Creek

There were a total of 22 pesticide compounds detected at Mason Creek with 17 herbicides, four insecticides, and one degradate of atrazine (desethyl atrazine). In all, there were a total of 95 pesticide detections with 72 herbicide detections, 13 insecticide detections, and 10 desethyl atrazine detections. (Table 2).

The pesticides of concern within Mason Creek that were ≥50% of an EPA benchmark are as follows: the insecticides chlorpyrifos (four detections) for acute and chronic invertebrates, ethoprop (one detection) for chronic invertebrate, and malathion (two detections) for chronic invertebrate. There was one detection of the herbicide linuron that was ≥50% of the chronic invertebrate concentration (Table 2).

Table 2. Mason Creek pesticide detections, POC in red.

Mason Creek				EPA Aquatic Life Benchmarks (ug/L)					
Pesticides	Pesticide	Number of	Highest	Fish	Fish	Inverts	Inverts	NonVascular	Vascular
Detected	Type	Detections	Detection	Acute	Chronic	Acute	Chronic	Acute	Acute
2,4-D	H	8	3.3	1,000	—	7,500	—	932	—
Acephate	I	1	0.54	416,000	5,760	550	150	—	—
Alachlor	H	2	0.099	900	187	1,250	110	1.64	2.3
Atrazine	H	3	0.031	2,650	65	360	60	1	37
Bentazon	H	1	0.28	>50,000	—	>50,000	—	>4,500	5,350
Bromacil	H	11	0.093	18,000	3,000	60,500	8,200	6.8	45
Bromoxynil	H	2	0.25	26.5	18	48	2.5	51	—
Chlorpyrifos	I	4	0.043	0.9	0.57	0.05	0.04	140	140
			0.035	0.9	0.57	0.05	0.04	140	140
			0.031	0.9	0.57	0.05	0.04	140	140
			0.03	0.9	0.57	0.05	0.04	140	140
Desethyl Atrazine	D	10	0.059	2,650	65	360	60	1	37
Dicamba	H	1	0.12	14,000	—	17,300	—	60	—
Diuron	H	11	0.59	200	26	80	200	2.4	15
Ethoprop	I	3	1.6	150	24	22	0.8	8,400	—
EPTC	H	1	0.057	7,000	—	3,245	810	1,400	5,600
Linuron	H	1	0.088	1,500	5.58	60	0.09	13.7	2.5
Malathion	I	2	0.52	16.4	8.6	0.3	0.035	2,400	—
			0.15	16.4	8.6	0.3	0.035	2,400	—
MCPA	H	2	0.61	380	—	90	—	170	20
Methomyl	I	4	0.26	160	12	2.5	0.7	—	—
Metolachlor	H	5	0.12	1,600	1,000	550	1	8	21
Metribuzin	H	1	0.052	21,000	3,000	2,100	1,290	9	130
Oxyfluorfen	H	3	0.083	102	1.3	40	13	0.29	0.35
Pendimethalin	H	7	0.26	69	6.3	140	14.5	5.2	12.5
Terbacil	H	12	0.35	23,100	1,200	32,500	640	11	140

Solomon Drain

Solomon Drain had a total of 20 pesticide compounds identified with 15 herbicides, four insecticides, and one degradate of atrazine (desethyl atrazine). Overall there were a total of 79 total pesticide detections for Solomon Drain with 59 herbicides, 12 insecticides, and eight detections of desethyl atrazine (Table 3).

Solomon Drain had six detections of the insecticide chlorpyrifos that were ≥50% of both the acute and chronic concentrations for invertebrates. Two other insecticides ethoprop and malathion each had one detection that exceeded the chronic concentration for invertebrates. The herbicide diuron had one detection that exceeded the criteria for non-vascular plants and the herbicide linuron had two detections that were ≥50% of the chronic invertebrate level (Table 3).

Table 3. Solomon Drain pesticide detections, POC in red.

Solomon Drain				EPA Aquatic Life Benchmarks (ug/L)					
Pesticides	Pesticide	Number of	Highest	Fish	Fish	Inverts	Inverts	NonVascular	Vascular
Detected	Type	Detections	Detection	Acute	Chronic	Acute	Chronic	Acute	Acute
2,4-D	H	7	4.1	1,000	—	7,500	—	932	—
Atrazine	H	1	0.032	2,650	65	360	60	1	37
Bromacil	H	6	0.09	18,000	3,000	60,500	8,200	6.8	45
Bentazon	H	1	0.24	>50,000	—	>50,000	—	>4,500	5,350
Bromoxynil	H	2	0.56	26.5	18	48	2.5	51	—
Chlorpyrifos	I	6	0.14	0.9	0.57	0.05	0.04	140	140
			0.13	0.9	0.57	0.05	0.04	140	140
			0.08	0.9	0.57	0.05	0.04	140	140
			0.051	0.9	0.57	0.05	0.04	140	140
			0.038	0.9	0.57	0.05	0.04	140	140
			0.033	0.9	0.57	0.05	0.04	140	140
Dacthal (DCPA)	H	2	0.092	15,000	—	13,500	—	>11,000	>11,000
Desethyl Atrazine	D	8	0.067	2,650	65	360	60	1	37
Dicamba	H	1	0.13	14,000	—	17,300	—	60	—
Diuron	H	11	3.0	200	26	80	200	2.4	15
Ethoprop	I	2	1.1	150	24	22	0.8	8,400	—
Linuron	H	2	0.05	1,500	5.58	60	0.09	13.7	2.5
			0.14	1,500	5.58	60	0.09	13.7	2.5
Malathion	I	1	0.13	16.4	8.6	0.3	0.035	2,400	—
MCPA	H	2	0.86	380	—	90	—	170	20
Methomyl	I	3	0.18	160	12	2.5	0.7	—	—
Metolachlor	H	6	0.36	1,600	1,000	550	1	8	21
Metribuzin	H	1	0.13	21,000	3,000	2,100	1,290	9	130
Oxyfluorfen	H	2	0.065	102	1.3	40	13	0.29	0.35
Pendimethalin	H	6	0.61	69	6.3	140	14.5	5.2	12.5
Terbacil	H	9	0.16	23,100	1,200	32,500	640	11	140

Noble Drain

There were a total of 17 pesticide compounds identified for Noble Drain which consisted of 13 herbicides, three insecticides and one degradate of atrazine. The total detections at Noble Drain were 77 with 60 herbicide detections, seven insecticide detections, and 10 desethyl atrazine detections (Table 4).

Noble Drain had three detections of chlorpyrifos that were ≥50% of the acute and chronic concentrations for aquatic invertebrates. There was one detection of diuron that was ≥50% of the non-vascular acute value (Table 4).

Table 4. Noble Drain pesticide detections, POC in red.

Noble Drain				EPA Aquatic Life Benchmarks (ug/L)					
Pesticides	Pesticide	Number of	Highest	Fish	Fish	Inverts	Inverts	NonVascular	Vascular
Detected	Type	Detections	Detection	Acute	Chronic	Acute	Chronic	Acute	Acute
2,4-D	H	6	0.55	1,000	—	7,500	—	932	—
Atrazine	H	3	0.052	2,650	65	360	60	1	37
Bromacil	H	11	0.55	18,000	3,000	60,500	8,200	6.8	45
Bromoxynil	H	2	0.29	26.5	18	48	2.5	51	—
Chlorpyrifos	I	1	0.073	0.9	0.57	0.05	0.04	140	—
		1	0.052	0.9	0.57	0.05	0.04	140	—
		1	0.038	0.9	0.57	0.05	0.04	140	—
Desethyl Atrazine	D	10	0.057	2,650	65	360	60	1	37
Dicamba	H	2	0.16	14,000	—	17,300	—	60	—
Diuron	H	10	1.2	200	26	80	200	2.4	15
Ethalfluralin	H	2	0.096	16	0.4	30	24	25	—
Ethoprop	I	1	0.38	150	24	22	0.8	8,400	—
Hexazinone	H	2	0.094	137,000	17,000	75,800	20,000	7	37
MCPA	H	2	0.45	380	—	90	—	170	20
Methomyl	I	3	0.16	160	12	2.5	0.7	—	—
Metolachlor	H	3	0.23	1,600	1,000	550	1	8	21
Oxyfluorfen	H	2	0.063	102	1.3	40	13	0.29	0.35
Pendimethalin	H	9	0.93	69	6.3	140	14.5	5.2	12.5
Terbacil	H	6	0.13	23,100	1,200	32,500	640	11	140

Purdum Drain

Purdum drain had a total of 16 pesticide compounds identified in 2011 with 11 herbicides, four insecticides and one degradate of atrazine (desethyl atrazine). Overall there was a total of 65 pesticide detections with 45 herbicide detections, 10 insecticide detections, and 10 detections of desethyl atrazine (Table 5).

There were four detections of chlorpyrifos with two exceeding both the acute and chronic levels for invertebrates and two were ≥50% of both acute and chronic levels. One detection of ethoprop and one detection of malathion exceeded the chronic invertebrate concentration while one detection of methomyl was ≥50% of the chronic invertebrate level. In addition, one detection of the herbicide metolachlor exceeded the chronic invertebrate concentration (Table 5).

Table 5. Purdum Drain pesticide detections, POC in red.

Purdum Drain				EPA Aquatic Life Benchmarks (ug/L)					
Pesticides Detected	Pesticide Type	Number of Detections	Highest Detection	Fish Acute	Fish Chronic	Inverts Acute	Inverts Chronic	NonVascular Acute	Vascular Acute
2,4-D	H	6	0.58	1,000	—	7,500	—	932	—
Bromacil	H	4	0.058	18,000	3,000	60,500	8,200	6.8	45
Bromoxynil	H	1	0.2	26.5	18	48	2.5	51	—
Chlorpyrifos	I	4	0.065	0.9	0.57	0.05	0.04	140	—
			0.055	0.9	0.57	0.05	0.04	140	—
			0.033	0.9	0.57	0.05	0.04	140	—
			0.029	0.9	0.57	0.05	0.04	140	—
Desethyl Atrazine	D	10	0.041	2,650	65	360	60	1	37
Dicamba	H	1	0.13	14,000	—	17,300	—	60	—
Diuron	H	9	0.48	200	26	80	200	2.4	15
EPTC	H	1	0.11	7,000	—	3,245	810	1,400	5,600
Ethoprop	I	3	6.5	150	24	22	0.8	8,400	—
Malathion	I	1	0.061	16.4	8.6	0.3	0.035	2,400	—
MCPA	H	1	0.39	380	—	90	—	170	20
Methomyl	I	2	0.41	160	12	2.5	0.7	—	—
Metolachlor	H	2	1.6	1,600	1,000	550	1	8	21
Oxyfluorfen	H	3	0.089	102	1.3	40	13	0.29	0.35
Pendimethalin	H	5	0.044	69	6.3	140	14.5	5.2	12.5
Terbacil	H	12	0.82	23,100	1,200	32,500	640	11	140

Observations/Conclusions

There were 25 pesticides identified during this study which consisted of 19 herbicides, five insecticides, and one degradate (desethyl atrazine). Overall there were 316 pesticide detections (sum of all sites) with 235 herbicides, 43 insecticides, and 38 degradate of atrazine (desethyl atrazine).

The herbicides with the greatest number of detections were diuron (41), terbacil (39), desethyl atrazine (38), 2,4-D (27) and pendimethalin (27). The greatest number of insecticide detections were chlorpyrifos (17), methomyl (12), ethoprop (9), and malathion (4).

Figure 3 shows the total number of pesticides detected from each drain that enters Mason Creek and the total detections within Mason Creek. The two smaller drainages in acreage (Solomon and Noble) contributed a higher number of pesticide detections than the larger Purdum Drain.

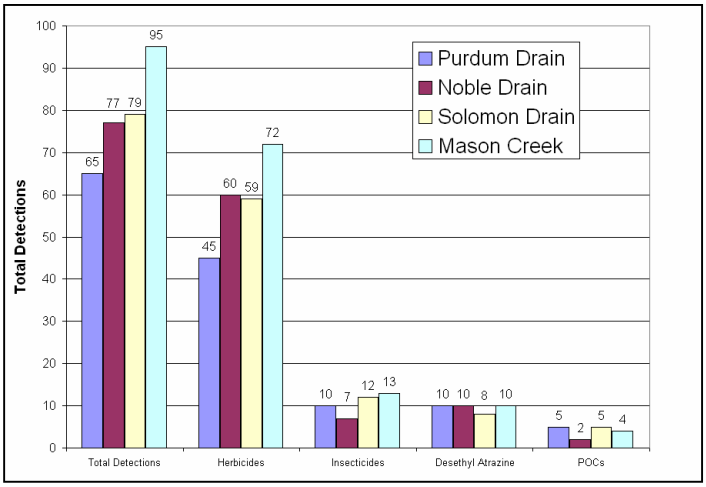

Figure 3. Overall breakdown of pesticide sources.

The pesticides of concern (POC) for this study remained relatively consistent with the two previous studies (2009, 2010) conducted by ISDA, within the Lower Boise River watershed. The POC insecticides for the 2011 study are chlorpyrifos, ethoprop, malathion, methomyl and the herbicides linuron, diuron, and metolachlor.

The continued presence of insecticides within the watershed that are highly toxic to aquatic species, at very low concentration, is still a major concern. Linuron, which has not been detected in previous studies, is a herbicide that is chronically toxic to aquatic invertebrates at low concentrations. The persistence of low level herbicides within the watershed (long term exposure) may have an effect on aquatic primary production.

ISDA's water group will continue to work with cooperators to evaluate the pesticide issues within the Lower Boise River and its tributaries. We will continue to work with applicators and cooperators on education and BMP practices. We will work with ISDA's pesticide inspectors to evaluate the sales, handling and usage areas for POC.

References

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