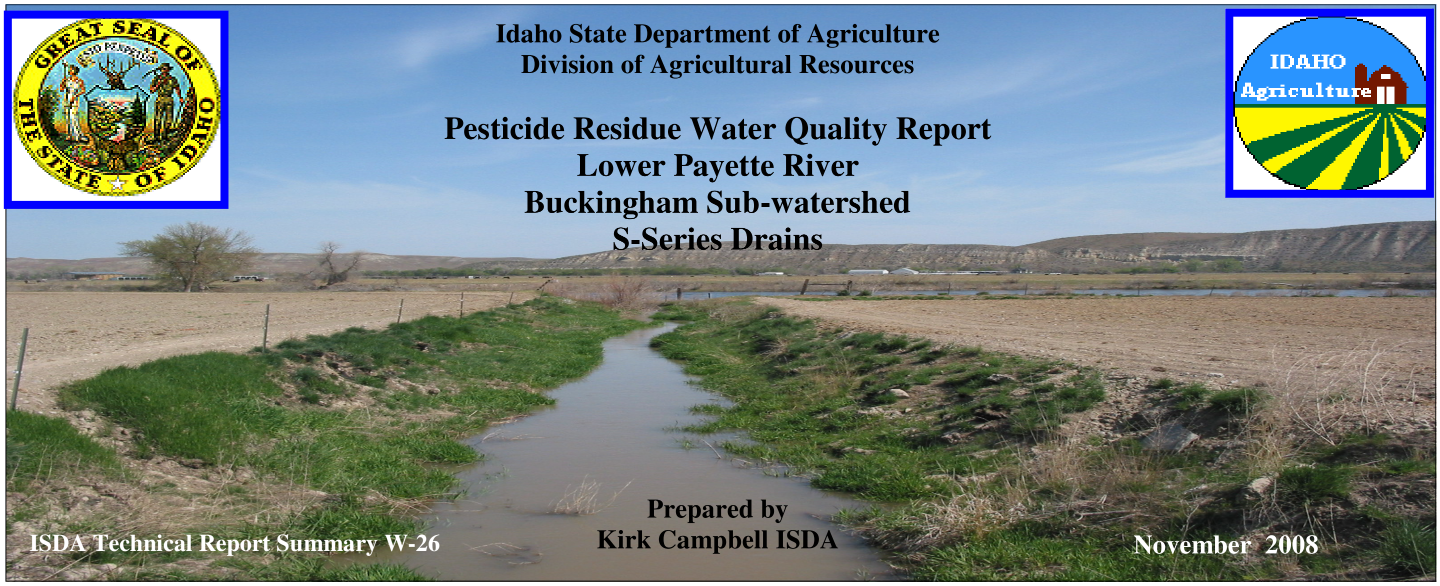

Idaho State Department of Agriculture
Division of Agricultural Resources

Pesticide Residue Water Quality Report Lower Payette River Buckingham Sub-watershed S-Series Drains

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ISDA Technical Report Summary W-26

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Introduction

The Idaho State Department of Agriculture (ISDA), with discretionary funding provided by the U.S. Environmental Protection Agency (EPA) Region X, conducted a surface water quality monitoring program for pesticide residues on six major irrigation water return drains (S-Drains) within the Buckingham Sub-watershed. These drains discharge irrigation wastewater directly into the Lower Payette River along a 5.7 mile reach upstream of the City of Payette, Idaho (Figure 1).

Monitoring was conducted on a bi-weekly schedule from May through July of 2008. A total of seven samples were collected from each drain with the exception of drains S-12 and S-10. These two drains were severely backwatered, on 5/20/08, due to high water levels on the Payette River, and samples could not be collected.

The six drains were identified as the S-drains from historical work conducted by both the Idaho Department of Environmental Quality (IDEQ), and ISDA. The drains are identified from upstream to downstream as S-15, S-14, S-13, S-12, S-10, and S-8 (Figure 1).

These six drains transport the majority of irrigation return water along with any canal spill water for approximately 10,350 agricultural acres within the Buckingham Sub-watershed. Table 1 lists the approximate acreage serviced by each drain.

Table 1. Approximate acreage serviced by each drain.

Drains	S-15	S-14	S-13	S-12	S-10	S-8
Acreage	1600	1580	3423	520	1414	1813

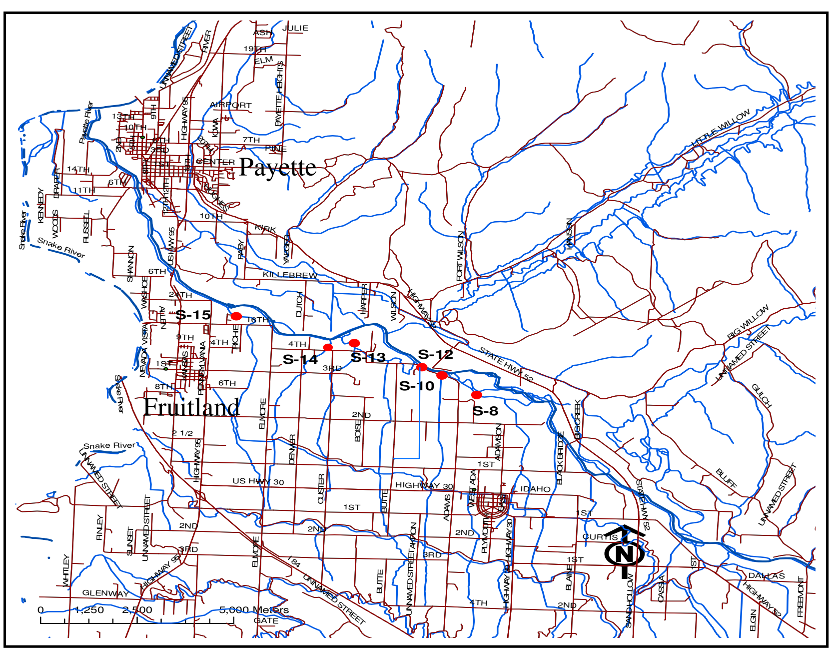

Figure 1. S-drains monitoring locations.

Analytical Methods and Quality Assurance

All analytical testing for this study was completed by the University of Idaho Analytical Science Laboratory (ASL) Moscow, Idaho. ASL follows strict quality control guidelines that requires the extraction and analysis of samples be accompanied by laboratory fortified blanks, laboratory reagent blanks, laboratory fortified sample matrix (matrix spikes), quality control samples, and performance check standards to evaluate and document data quality. Analytical methods and techniques used for this study consisted of the following: EPA method 507 , EPA 632 , EPA 508 , and EPA 515.2.

During this study, all analytes spikes and surrogate standard recoveries were within acceptable ranges (70-120%) indicating that pesticide residues were accurately recovered. All field 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 duplicate samples submitted to ASL had an overall mean of 6%, and a median of 1.5%.

Sampling Methods

Due to the small size of these drains all samples were collected by hand directly from a well mixed section of each reach. Three, laboratory clean, one-liter glass amber sample bottles were collected at each site. Each bottle was slowly lowered through the water column until filled, avoiding contact with the bottom of each drain.

Duplicate samples were collected by compositing creek water into a clean 2.5 gallon glass carboy. The resultant composite was then mixed and carefully poured off into 6 one-liter amber bottles. Cleaning of the carboy between sampling events consisted of a thorough washing with deionized water and Liqui-Nox detergent, followed by a deionized water rinse, acetone rinse, and a final deionized rinse. Field bottle blanks were collected by transferring deionized water directly from a Nalgene carboy into three clean one-liter amber bottles. All blanks and duplicates were submitted to the lab as blind samples.

All of the resultant samples from each study were placed within a cooler, on ice, for shipment directly to the University of Idaho ASL in Moscow, Idaho. All samples were shipped priority overnight and Chain-of-Custody forms accompanied each sample set.

Overall Evaluation

Over the three month study period a total of 21 separate pesticides were identified (Table 2). Of the 21 compounds 18 were herbicides while 3 were insecticides.

The toxicity class in Table 2 indicates the relative toxicity to humans for each of the listed pesticides.

Table 2. S-drains toxicity class for detected pesticides.

Pesticides Detected	[1]Pesticide Type	[2]Common Name	Toxicity Class	Water Solubility	Soil Adsorption
2,4-D	H	Curtail	Class III	moderate	low
Alachlor	H	Lasso	Class III	moderate	low
Bentazon	H	Basagran	Class III	high	no
Bromacil	H	Krovar	Class IV	moderate	slight
Chlorpyrifos	I	Dursban	Class II	low	high
DCPA	H	Dacthal	Class IV	moderate	moderate
Desethyl Atrazine	[3]degredate	Atranex	Class III	moderate	moderate/high
Dicamba	H	Banvel D	Class III	high	slight
Dimethoate	I	Cygon	Class II	high	poor
Diuron	H	Karmex	Class III	stable	high
EPTC	H	Eptam	Class III	short half-life	low
Ethalfluralin	H	Sonalan	[4]Class III/IV	low	high
Hexazinone	H	Velpar	Class III	high	very poorly
Malathion	I	Carbophos	Class III	high	moderate
MCPA	H	Banlene	Class III	high	slight
Methomyl	I	Lannate	Class I	high	low
Metolachlor	H	Dual	Class III	slightly	moderate
Metribuzin	H	Sencore	Class III	High	poor
Oxyfluorfen	H	Goal	Class III	low	very high
Pendimethalin	H	Prowl	Class III	low	high
Terbacil	H	Sinbar	Class IV	high	low

1. pesticide type H = herbicide, I = Insecticide
2. Other common names may be used.
3. A degredate of atrazine.
4. Class III for Inhalation, Class IV oral and dermal

Table 3 lists the toxicity class used in Table 2 and their level of toxicity.

Table 3. Pesticide class identification and toxicity.

Class Identification	Label	Toxicity
Class I	Danger Poison	Highly toxic
Class II	Warning	Moderately Toxic
Class III	Caution	Slightly Toxic
Class IV	—	Non-Toxic

Numerous detections of the 21 pesticides were found within each drain (Table 4).

Table 4. Pesticide detections for each S-drain.

Compounds	S-15	S-14	S-13	S-12	S-10	S-8	Total
2,4-D	1	1	3	2	3	1	11
Alachlor		2			1		3
Bentazon		1	3	5		1	10
Bromacil					4	1	5
Chlorpyrifos	2				1	2	5
Dacthal	7	6	7	6	3		29
Desethyl Atrazine			1	1	1	2	5
Dicamba			1		1		2
Dimethoate						1	1
Diuron	1		6	1	1	5	14
EPTC	2	1					3
Ethalfluralin	1	1		1			3
Hexazinone	1		5	3		1	9
Malathion					1	1	2
MCPA			1				1
Methomyl			1				1
Metolachlor	1	1		3	1		6
Metribuzin						1	1
Oxyfluorfen		2	2	4		4	12
Pendimethalin	2	4	6	5	3	4	24
Terbacil	2	6	6	4	2	1	21
Total	20	25	42	35	22	25	—

Table 4 indicates that the S-13 drain had the greatest amount of pesticide detections (42) and Dacthal (29) was the herbicide detected most often during this study.
Table 2 indicates the ability of each pesticide to adsorb to

soils or how readily the pesticide becomes water soluble. This information helps determine whether a particular pesticide would be associated with soil erosion or tail waters leaving an irrigated field. The majority of pesticides encountered during this study were highly soluble in water and there was no correlation between the suspended sediment concentrations (SSC) of each drain and the number of pesticide detections (Figure 2).

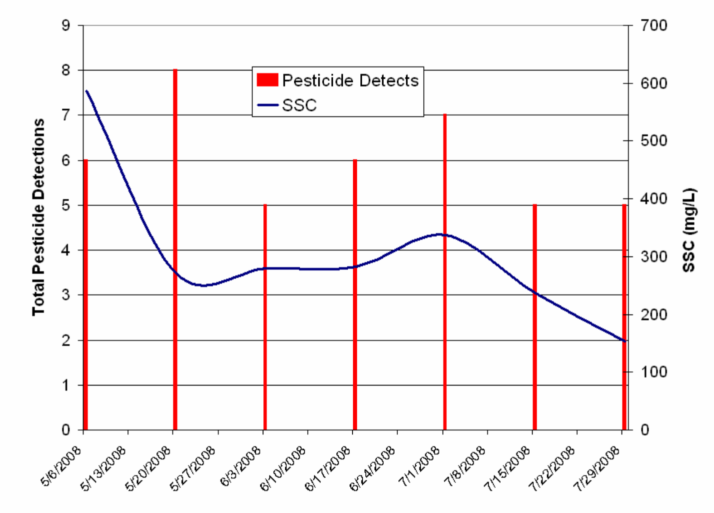

Figure 2. S-13 drain comparison of SSC and the number of pesticide detections.

Table 5 lists the pesticides detected, the highest concentration detected, and various aquatic life bench marks or risk quotients (RQ) that have been established by the EPA for pesticides (EPA, 2007). Aquatic life bench marks are only used as indicators and are estimates of concentrations below levels that are not expected to effect aquatic life.

Table 5. Aquatic Life Benchmarks for pesticides.

			Aquatic Life Benchmarks (ug/L)				
Station I.D.	Detected Compounds	Highest Detect.	Acute Fish	Chronic Fish	Acute Invert.	Chronic Invert.	Pesticide Type
S-13	2,4-D	5.9	50,000	14,200	12,500	16,400	Herb
S-14	Alachlor	0.067	900	187	1,600	110	Herb
S-12	Bentazon	0.43	50,000	—	50,000	—	Herb
S-10	Bromacil	0.13	18,000	—	60,500	—	Herb
S-15	Chlorpyrifos	0.2	0.9	0.57	0.05	0.04	Insect.
S-14	Dacthal	0.89	15,000	—	13,500	—	Herb
S-8	Desethyl Atrazine	0.031	2,650	62	360	62	Herb
S-10	Dicamba	0.13	14,000	—	17,300	—	Herb
S-8	Dimethoate	0.3	3,000	430	21.5	40	Herb
S-10	Diuron	0.26	355	26	80	160	Herb
S-14	EPTC	0.38	7,000	—	3,250	—	Herb
S-12	Ethalfluralin	0.13	16	0.4	30	24	Herb
S-13	Hexazinone	0.2	180,000	17,000	151,600	20,000	Herb
S-10	Malathion	0.07	2	4	0.25	0.06	Insect.
S-13	MCPA	0.61	380	12,000	90	11,000	Herb
S-13	Methomyl	0.052	265	57	4.4	0.4	Insect.
S-12	Metolachlor	1.1	1,950	780	12,550	—	Herb
S-8	Metribuzin	0.035	21,000	3,000	2,100	1,290	Herb
S-12	Oxyfluorfen	0.17	100	38	40	13	Herb
S-10	Pendimethalin	0.44	69	6.3	140	14.5	Herb
S-10	Terbacil	0.53	46,200	—	65,000	—	Herb

As can be seen in Table 5 the herbicide detections during this study, although numerous, were all very low and did not come close to reaching any acute or chronic levels for fish or invertebrates. Three insecticides (Chlorpyrifos, Methomyl, and Malathion) did exceed benchmarks for acute and chronic invertebrates (Table 4). Chlorpyrifos had five detections during this study with only one exceeding the EPA benchmark for acute and chronic invertebrates. Methomyl only had one detection and it exceeded the benchmark for chronic invertebrates and Malathion had two detections with one exceeding the chronic invertebrate bench mark.

Conclusion

The S-drains are not natural streams or creeks and do not support the traditional aquatic life associated with natural systems. They do however discharge directly into a 303 (d) listed stream and what they transport could have an overall effect on the Payette River.

The levels of the three insecticides detected are very low and the volume of water within the Payette River would quickly dilute these compounds below any aquatic bench mark threshold. The numerous herbicide detections indicate there is movement of these compounds from field application to water sources. Overall the herbicide levels are well below any water quality bench marks and the low levels indicate minimum persistence in the environment. One herbicide, Ethalfluralin (Table 5), has been shown to be highly toxic to fish (bluegill sunfish, rainbow trout) and was present on one occasion at one-third (0.13 µg/L) of the chronic fish bench mark (0.40 µg/L). Recommendations for application to alfalfa states for furrow or flood irrigation, do not allow tail waters from the first irrigation after application to enter aquatic habitats.

The three insecticides that exceeded an aquatic benchmark (Chlorpyrifos, Malathion, and Methomyl) are considered non persistent with half lives of 30 days or less (Utah State 2004). They are considered toxic to aquatic species so buffer areas around surface water bodies are recommended when applying these compounds.

Current research on various pesticide mixtures and their combined toxicity on aquatic species is still underway with some ability to predict and understand the toxicity of like pesticides within the same class. The unknown factor is the relevant toxicity of across-class pesticide mixtures such as herbicides mixing with insecticides.

Given the size of the study area and the amount of furrow irrigated agriculture in the sub-watershed, the overall results from this study were very encouraging for limited pesticide concentrations entering the Payette River. By following proper label directions for pesticide handling and application along with proper water management this predominate agricultural area should continue to minimize the effects of pesticides on the environment.

Recommendations

- ISDA review of pesticide uses in study area with emphasis on the three insecticide compounds.
- Educate producers on the findings and promote additional BMPs.
- Report findings to the Payette Soil Conservation District, Lower Payette Watershed Advisory Group, and Department of Environmental Quality.

References

Environmental Protection Agency, updated March 7, 2007. Technical Overview of Ecological Risk Assessment Aquatic Life Benchmark Table.

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Utah State University Extension. Pesticide Adsorption and Half-Life, Pesticides No. 15, October 2004.