Pesticide Monitoring in Kintore Creek

1990 Final Report

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March, 1991

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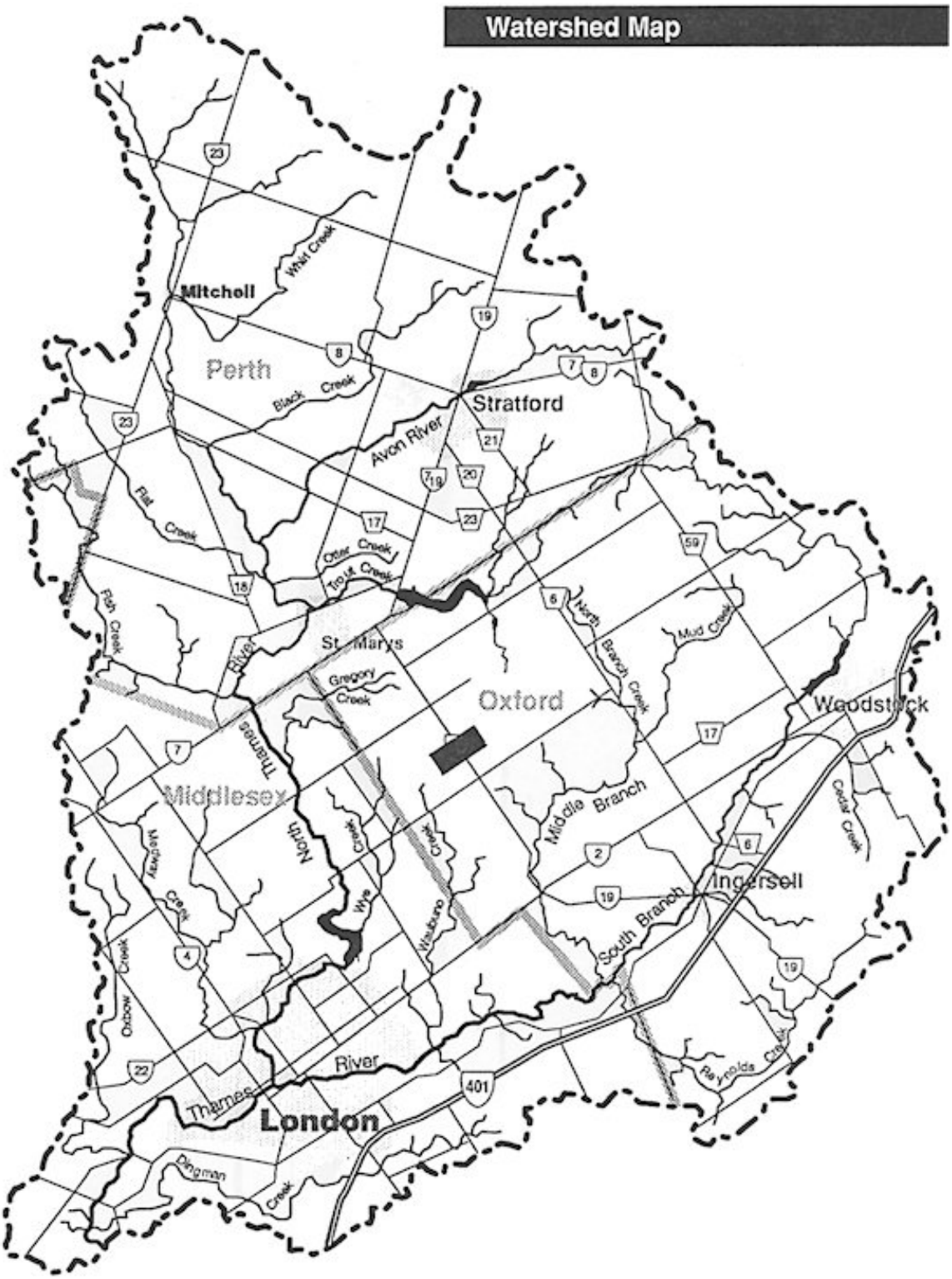

Figure 1: Location of Kintore Creek Watershed.

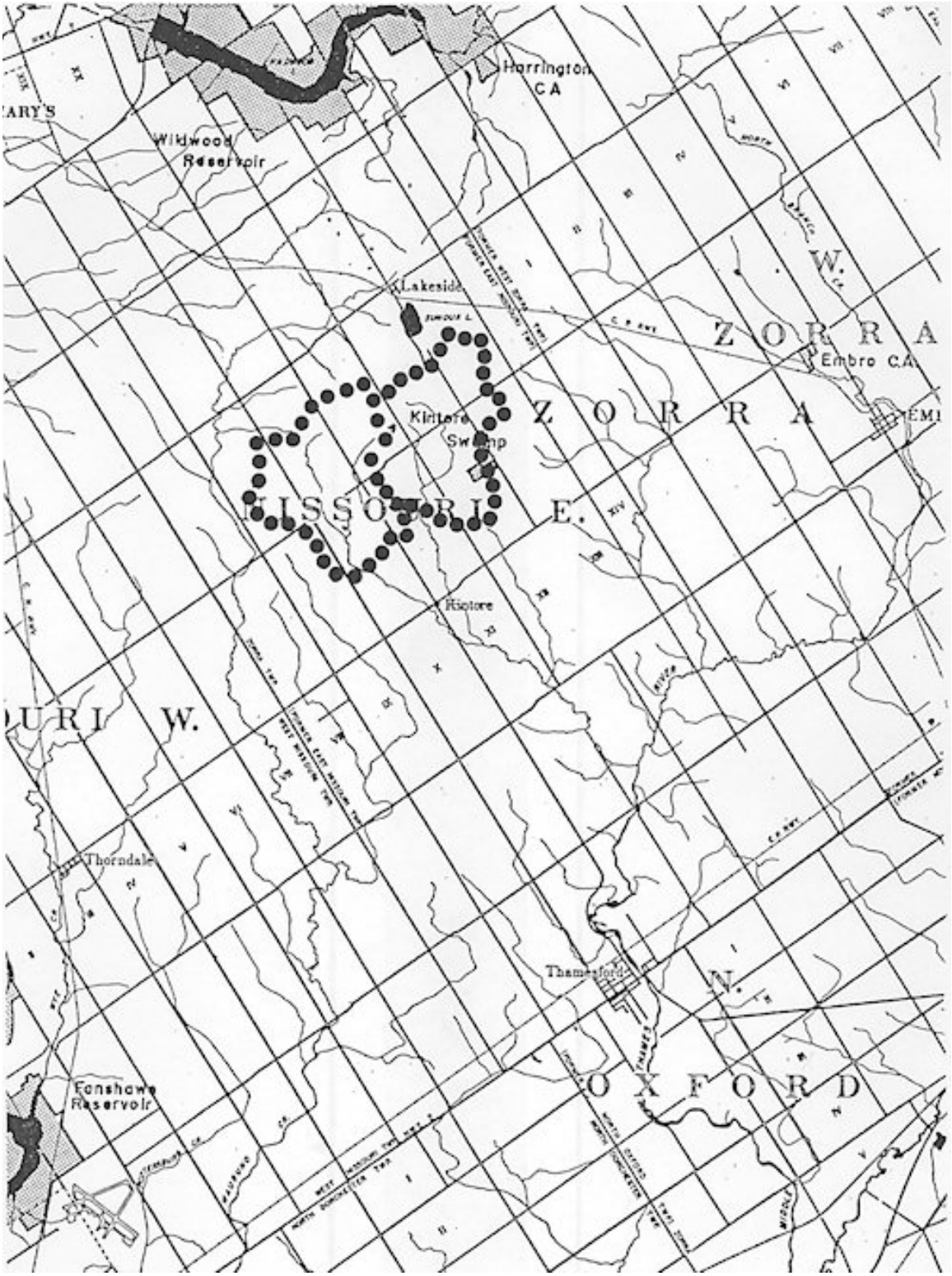

Figure 2: Township Map of Kintore Creek Watershed.

1. BACKGROUND

The Kintore Creek Watershed is located in Oxford County just North of the village of Kintore along Highway 19. It is a paired watershed composed of two sub-basins, each approximately 600 hectares in size (Figure 1,2).

The western sub-basin is drained by the Arthur-Vannatter Municipal Drain and the eastern sub-basin is drained by the Logan Municipal Drain. Kintore Creek is formed by the confluence of these drains just south of Kintore. The creek flows for approximately 17 kilometers south to its outlet into the middle branch of the Thames River near Thamesford (Figure 2).

This watershed has been monitored for water quality since 1984 by the Upper Thames River Conservation Authority. Conservation farming practices were initiated in the western sub-basin in 1988. Each sub-basin contains 19 farms, with 4 common to both areas. Refer to Figures 7 and 8 for land ownership details.

Farms within the watershed range in size from 16 hectares to 121 hectares. The primary land use is mixed agriculture, with an equal number of livestock and cash crop farms in each sub-basin.

The fields typically have long slopes, soils are mainly silt loam. Forty-five percent of the watershed has high delivery of sediment to the watercourse based on Environment Canada's sediment/delivery maps.

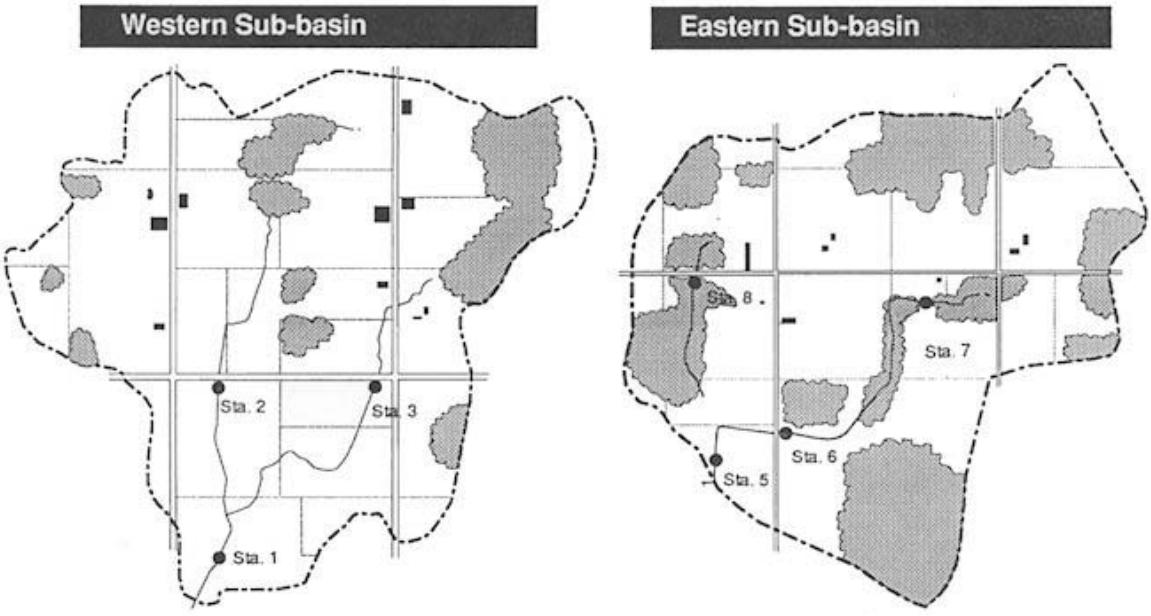

Figure 3: Water Sampling Locations.

2. PURPOSE

This is a final report for the year of 1990 in fulfillment of the study output requirements of the Pesticide Monitoring in Kintore Creek contract. This report contains a summary of data collected during 1990 and water quality data for 1989. Analysis of this information will be presented in a future report.

The purpose of this study is multi-fold. Comparison of the data from both west and east sub-basins will help to assess the impacts that conservation farming practices have on reducing pesticide delivery to the watercourse. Data collected will be utilized to identify pesticides of concern from a water quality perspective for the Inland Waters Directorate. Field data on atrazine and metolachlor are needed to assist in determining Canadian Water Quality Guidelines. Baseline field data will also show the possible effects of agricultural pesticides on water quality.

The objectives for the year 1990 were to collect biweekly water samples, sample storm events, and conduct a pesticide usage and crop acreage survey for all landowners.

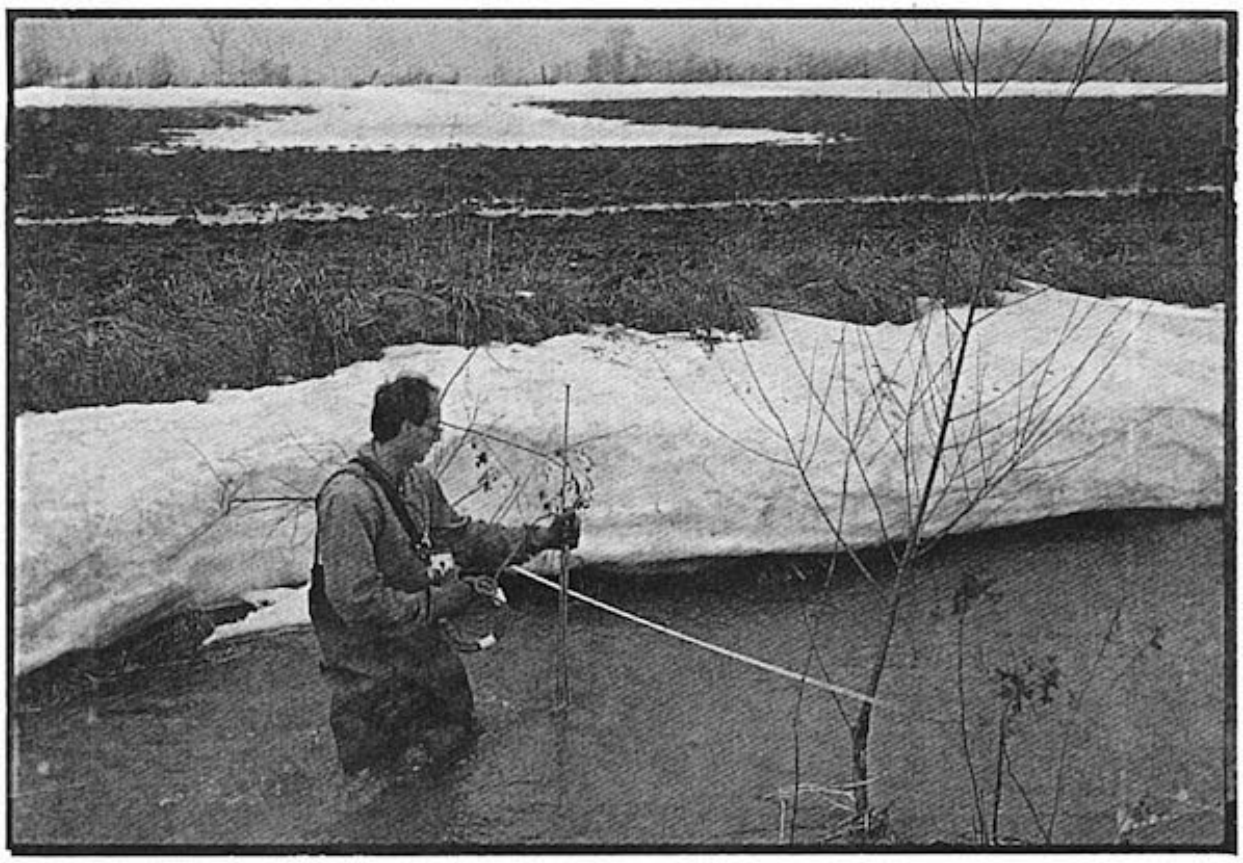

Figure 4: Stream flows are monitored by Authority staff.

3. SAMPLING PROGRAM

The water monitoring program of 1990 consisted of the collection of weekly composite samples, biweekly grab samples and rain event samples within the western and eastern sub-basins at stations 1 and 5 respectively (Figure 3). All samples collected were kept refrigerated until their subsequent delivery to the CCIW laboratory in Burlington for analysis.

Flow measurements were taken with a Montedoro-Whitney Velocity Meter during periods of low, normal and flood stream conditions within both sub-basins. Through the use of observed discharge and Stevens Recorder charts, hourly discharge was calculated and this data will be used to determine pesticide loadings to be presented in a future report.

3.1. BACKGROUND SAMPLES

Composite samplers were installed in each watershed on May 3 of 1990 and emptied each week until the final sampling date December 17,1990. Time of sampling, depth of equipment, total volume within each composite and other related data were recorded (Tables 1,2).

Biweekly grab samples were collected at each outlet. As of the date of this report, the 1990 water samples have not yet been analyzed for pesticide concentrations. A list of the data received to date for the 1989 calendar year is presented in Table 3.

3.2. RAIN EVENT SAMPLES

A total of 17 rain events were monitored in 1990 by the ISCO automatic samplers within each sub-basin. Each ISCO was equipped with a liquid level actuator triggered to appropriate water level. Due to equipment malfunctions not all events were sampled at both stations 1 and 5. Data received to date for 1989 rain event sample pesticide content are listed in Table 4.

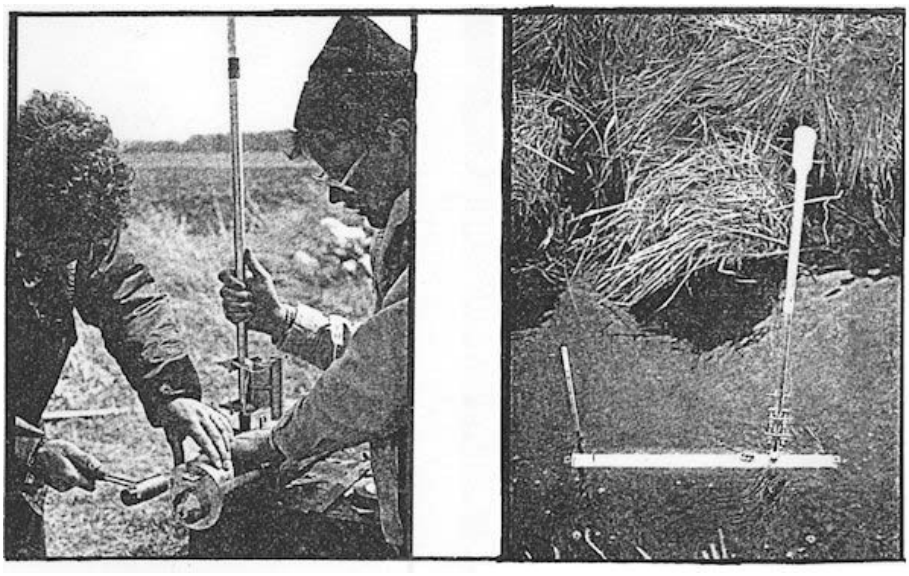

Figure 5: Composite samplers are monitored weekly.

Table 1. Western Sub-Basin Pesticide Data (Station 1) 1990.

Sampling Date	Time Out	Depth Out (cm)	Time In	Depth In (cm)	Snorkel Setting	Total Volume (ml)	Gauge Height (m)	--- Temperature --- Max. (C)	Min. (C)	Current (C)	Rain (mm)	Grabs Taken (3)	Composite Taken (3)	Comments
90/05/03	-	-	11:44	11.4	15		0.485	-	-	-	-	N	N	- composite emptied and reset, thermometer in sediment
90/05/07	12:18	12.3	12:30	11.7	15	1060	0.485	17.0	3.0	-	-	N	Y	
90/05/14	9:45	13.8	9:55	14.4	15	2200	0.505	21.5	4.0	8.5	-	Y	Y	
90/05/22	12:51	21.0	13:00	20.0	15	3690	0.574	17.5	-	12.0	42.2	N	Y	- rain gauge installed on the 14th
90/05/28	10:27	12.0	10:37	15.0	20	2070	0.494	18.0	7.0	11.0	0.0	Y	Y	
90/06/04	9:44	14.0	9:51	11.0	20	2040	0.485	21.0	6.0	10.0	17.2	N	Y	
90/06/12	12:04	9.0	12:10	10.5	20	2210	0.469	23.0	6.5	15.0	13.0	Y	Y	- estimated rainfall
90/06/18	9:41	13.0	9:54	11.5	20	1500	0.459	-		17.0	2.0	N	Y	- thermometer in air
90/06/25	9:15	12.0	9:20	12.0	20	2090	0.466	25.0	9.0	11.0	26.7	Y	Y	
90/07/03	9:03	11.5	9:09	11.5	20	2070	0.463	25.0	10.0	13.0	19.0	N	Y	- depth actuator reset to 0.51
90/07/10	9:46	25.0	9:56	25.5	20	4590	0.595	29.0	2.0	16.0	78.5	Y	Y	
90/07/14	-	-	-	-	20	-	0.545	-	-	-	-	N	N	
90/07/16	11:40	16.5	11:45	17.0	20	1750	0.498	22.0	4.0	18.0	22.4	N	Y	- rain from July 10
90/07/19	-	-	-	-	20	-	0.480	-	-	-	4.5	N	N	
90/07/23	11:06	17.5	11:12	17.5	20	2850		24.5	12.0	16.0	30.6	Y	Y	- depth actuator reset to 0.55
90/07/30	9:05	13.0	9:12	13.5	20	1850	0.461	25.0	10.0	15.0	2.0	N	Y	- depth actuator reset to 0.62
90/08/20	10:55	27.0	11:33	27.0	20	4490	0.597	23.5	10.0	15.0	30.8	N	Y	
90/08/27	11:09	15.5	11:14	16.0	20	1690	0.483	21.0	10.5	16.5	3.0	Y	Y	
90/08/31	-	-	-	-	20	-	-	-	-	-	50.5	N	Y	- depth actuator reset to 0.58 (up to 0.69 on the 28th)
90/09/04	11:10	16.5	11:19	17.5	20	3250	0.488	22.5	11.0	19.0	1.0	N	Y	
90/09/07	-	-	-	-	20	-	0.560	-	-		17.5	N	Y	
90/09/10	10:35	17.0	10:40	16.8	20	1500	0.492	19.5	12.0	16.5	2.0	Y	Y	
90/09/17	10:50	25.5	10:57	22.0	20	2750	0.577	12.0	11.0	11.5	51.0	N	Y	- composite cylinder moved up one notch
90/09/24	10:15	26.5	10:39	26.5	20	2000	0.612	14.0	11.0	11.5	24.4	Y	Y	
90/10/01	10:00	20.0	10:15	20.0	20	1690	0.548	15.5	9.0	9.0	13.2	N	Y	
90/10/09	-	-	-	-	20	-	0.875	15.0	10.0	11.5	47.5	Y	N	- water level too high to sample composite
90/10/15	9:25	25.0	9:32	24.0	20	5070	0.598	14.5	10.0	10.5	34.0	N	Y	- depth actuator reset to 0.6
90/10/22	9:57	23.5	10:03	23.5	20	3050	0.583	12.5	9.0	10.0	27.9	Y	V	- depth actuator reset to 0.64
90/10/29	9:50	20.5	9:56	20.5	20	2090	0.553	11.0	5.5	6.5	8.4	N	Y	
90/11/06	-	-	-	-	20	-	0.936	-	-	6.0	49.6	Y	N	- water level too high to sample composite
90/11/08	10:33	30.5	10:40	30.5	20	4050	0.650	11.0	2.5	2.5		N	Y	
90/11/12	11:06	23.0	11:14	23.5	20	1510	0.582	8.0	6.0	6.0	8.0	Y	Y	- rain from Nov 6
90/11/19	13:35	20.0	13:41	20.0	20	1990	0.545	8.5	6.0	6.0	2.4	N	Y	
90/11/26	12:55	22.5	13:05	23.0	20	2970	0.564	7.0	4.0	6.0	24.0	Y	Y	
90/12/05	13:55	26.0	14:01	26.5	20	2920	0.596	-	-	-	25.0	N	Y	
90/12/10	9:48	27.0	9:53	27.5	20	1635	0.600	9.0	1.5	4.0	-	Y	Y	- thermometer removed from creek
90/12/17	10:29	23.0	10:36	23.0	20	2710	0.563	-	-	5.0	-	N	Y	

N - no composite samples taken
Y - 3 composite samples taken

Table 2. Eastern Sub-Basin Pesticide Data (Station 5) 1990.

Sampling Date	Time Out	Depth Out (cm)	Time In	Depth In (cm)	Snorkel Setting (ml)	Total Volume (m)	Gauge Height (C)	- - - Temperature - - - Max. (C)	Min. (C)	Current	Rain (mm)	Grabs Taken (3)	Composite Taken	Comments
90/05/03	-	-	14:40	6.9	7.5	-	0.210	-	-	-	-	N	N	- composite reset: flushed stilling well; new SG installed (old 0.238)
90/05/07	14:00	8.5	14:07	8.8	7.5	3300	0.218	23.0	2.0	-	-	N	Y	
90/05/14	13:45	15.8	13:53	15.0	10	3760	0.242	12.0	6.0	10.0	-	Y	D	
90/05/22	14:52	19.5	15:00	13.5	10	6000	0.261	14.0	8.0	11.0	30.8	N	D	- composite swamped-out; depth actuator moved to 0.34
90/05/28	13:01	2.0	13:14	5.0	10	4240	0.204	-	-	16.5	0.0	Y	D	
90/06/04	11:03	6.5	11:07	6.0	10	1900	0.205	17.0	8.0	11.0	15.0	N	Y	
90/06/12	13:34	3.0	13:41	7.0	10	1870	0.188	17.0	10.0	15.0	11.2	Y	Y	
90/06/18	10:55	7.5	11:03	6.5	10	1650	0.175	-	-	-	1.8	N	Y	- thermometer out of water
90/06/25	13:08	7.5	13:13	7.5	10	1830	0.185	-	-	16.0	23.3	Y	Y	- thermometer out of water
90/07/03	10:18	6.5	10:24	6.5	10	2110	0.176	21.0	12.0	15.0	15.6	N	Y	- depth actuator reset to 0.24
90/07/10	10:55	25.0	11:03	25.0	15	2350	0.340	-	-	-	75.0	Y	D	- rainfall estimated
90/07/14	-	-	-	-	15	-	0.329	-	-	-	-	N	N	
90/07/16	14:22	13.0	14:28	13.5	15	4370	0.278	26.0	9.0	19.0	25.1	N	Y	- depth actuator reset to 0.27
90/07/19	-	-	-	-	15	-	-	-	-	-	5.5	N	N	
90/07/23	13:38	14.0	13:46	14.0	15	3850	0.283	-	-		28.0	Y	Y	- new composite body installed
90/07/30	10:38	7.0	10:43	6.5	15	2070	0.220	-	-	16.5	2.0	N	Y	
90/08/20	13:20	19.5	13:30	19.5	15	6000	0.340	-	-	-	75.0	N	N	- composite swamped-out: construction Sta. 6
90/08/27	12:30	7.5	12:34	7.5	15	1880	0.240	21.0		21.0	3.0	Y	Y	
90/08/31	-	-	-	-	15	-	-	-	-	-	41.0	N	N	- depth actuator reset to 0.32
90/09/04	13:35	8.5	13:53	8.5	15	5650	0.248	22.0	1.0	16.0	1.0	N	Y	
90/09/07	-	-	-	-	15	-	0.378	-	-	-	21.6	N	N	
90/09/10	9:05	9.5	9:10	10.0	15	4750	0.266	20.0	12.0	14.0	1.5	Y	Y	
90/09/17	13:10	170	13:17	14.0	15	5310	0.330	21.0	12.0	14.0	51.0	N	Y	
90/09/24	14:13	16.0	14:20	16.0	15	5050	0.341	14.5	10.0	12.5	21.4	Y	Y	
90/10/01	11:10	11.5	11:15	11.5	15	3650	0.307	16.0	10.0	11.5	11.8	N	Y	
90/10/09	11:22	59.5	11:30	59.5	15	5350	0.664	-	-	-	46.6	Y	Y	
90/10/15	11:54	17.5	12:00	7.0	15	6000	0.347	16.5	8.5	11.5	33.0	N	Y	- composite swamped-out
90/10/22	12:30	6.0	12:37	6.0	15	5800	0.342	13.5	8.0	11.0	24.2	Y	Y	- depth actuator reset to 0.37
90/10/29	12:50	4.0	12:56	7.0	20	4250	0.323	11.0	5.5	8.0	6.4	N	Y	
90/11/06	-	-	-	-	20	-	0.677	-	-	5.0	49.0	Y	N	- water level too high to get composite
90/11/08	11:46	17.0	11:50	18.0	20	6000	0.419	12.0	5.0	6.0	-	N	Y	- composite swamped-out; depth actuator reset to 0.45
90/11/12	10:17	9.5	10:23	9.5	30	5050	0.353	5.0	4.0	4.0	7.0	Y	Y	
90/11/19	14:31	4.0	14:35	5.0	30	4850	0.314	8.0	4.0	5.5	2.3	N	Y	- depth actuator reset to 0.40
90/11/26	11:35	7.0	11:40	7.5	30	4580	0.326	6.5	3.0	4.0	21.4	Y	Y	
90/12/05	14:31	13.0	14:38	13.0	30	4550	0.360	-	-	-	25.0	N	Y	- snow in drain
90/12/10	10:22	10.0	10:26	10.0	30	3730	0.340	9.0	0.0	2.5	-	Y	Y	- thermometer pulled
90/12/17	11:14	8.0	11:19	8.0	30	4050	0.381	-	-	4.0	-	N	Y	

D - duplicate sample taken (6 total)

N - no samples taken

Y - 3 composites taken

Table 3. 1989 BACKGROUND DATA - KINTORE CREEK: WESTERN / EASTERN SUB-BASIN.

SAMPLING DATE	DATE FUNCTION	FIELD ID	SAMPLE NUMBER	SAMPLE MEDIA	SCHEMA TYPE	SAMPLE VOLUME	ATRAZINE (µg/L)	METOLACHLOR (µg/L)
JAN.18,89	32526	El	8815515	1	1	1050	0.08	ND
JAN.18,89	32526	W1	8815516	1	1	1050	0.05	ND
FEB.22,89	32561	E1	8815519	1	1	1050	0.05	ND
FEB.22,89	32561	W1	8815520	1	1	1050	0.05	ND
MAR.31,89	32598	E1	8901420	1	1	1050	0.29	ND
MAR.31,89	32598	W1	8901421	1	1	1050	0.35	ND
APR.04,89	32602	E1	8901424	1	1	1050	0.63	ND
APR.04,89	32602	W1	8901425	1	1	1050	0.73	ND
APR.04,89	32602	QE L1	8900089	1	1	1050	0.05	ND
APR.05,89	32603	QEL2	8900090	1	1	1050	0.05	ND
APR.21,89	32619	E1	8901426	1	1	1050	0.15	ND
APR.21,89	32619	W1	8901427	1	1	1050	0.20	ND
APR.27,89	32625	E1	8901428	1	1	1050	0.14	ND
APR.27,89	32625	W1	8901429	1	1	1050	0.05	ND
MAY 09,89	32637	CE1	8901821	1	1	1050	0.08	ND
MAY 09,89	32637	CW1	8901822	1	1	1050	0.10	ND
MAY 15,89	32643	E1	8901430	1	1	1050	ND	ND
MAY 15,89	32643	W1	8901431	1	1	1050	ND	ND
MAY 15,89	32643	CE1	8901823	1	1	1050	0.10	ND
MAY 15,89	32643	CW1	8901824	1	1	1050	0.06	ND
MAY 23,89	32651	CW1	8901861	1	1	1050	0.12	ND
MAY 23,89	32651	CW2	8901862	1	1	1050	0.19	ND
MAY 23,89	32651	CE1	8901863	1	1	1050	0.34	ND
MAY 23,89	32651	W1	8901864	1	1	1050	0.10	ND
MAY 23,89	32651	E1	8901865	1	1	1050	0.12	ND
MAY 29,89	32657	E1	8901866	1	1	1050	0.25	ND
MAY 29,89	32657	W1	8901867	1	1	1050	0.12	ND
MAY 29,89	32657	CE1	8901868	1	1	1050	0.18	ND
MAY 29,89	32657	CW1	8901869	1	1	1050	0.34	ND
MAY 29,89	32657	CW2	8901870	1	1	1050	0.31	ND
JUN.05,89	32664	CE1	8902651	1	1	1050	27.40	7.54
JUN.05,89	32664	CW1	8902652	1	1	1050	8.99	1.14
JUN.05,89	32664	CW2	8902653	1	1	1050	7.00	0.99
JUN.12,89	32671	E1	8904070	1	1	1050	0.30	ND
JUN.12,89	32671	WI	8904071	1	1	1050	0.14	ND
JUN.12,89	32671	CE1	8904074	1	1	1050	6.30	0.10
JUN.12,89	32671	CW1	8904075	1	1	1050	0.77	ND
JUN.19,89	32678	CE1	8904076	1	1	1050	3.92	0.10
JUN.19,89	32678	CW1	8904077	1	1	1050	ND	ND
JUN.26,89	32685	E1	8904078	1	1	1050	3.70	ND
JUN.26,89	32685	W1	8904079	1	1	1050	0.08	ND
JUN.26,89	32685	CE1	8904082	1	1	1050	27.07	0.60
JUN.26,89	32685	CW1	8904083	1	1	1050	1.49	0.20
JUN.26,89	32685	CW2	8904084	1	1	1050	2.35	0.20
JUL.04,89	32693	CE1	8904582	1	1	1050	0.05	ND
JUL.04,89	32693	CW1	8904583	1	1	1050	0.05	ND
JUL.04,89	32693	CW2	8904584	1	1	1050	0.05	ND
JUL.10,89	32699	CE1	8904585	1	1	1050	ND	ND
JUL.10,89	32699	CW1	8904586	1	1	1050	ND	ND
JUL.10,89	32699	CW2	8904587	1	1	1050	ND	ND
JUL.10,89	32699	E1	8904588	1	1	1050	ND	ND
JUL.10,89	32699	W1	8904589	1	1	1050	ND	ND
JUL.17,89	32706	E1	8904595	1	1	1050	0.39	ND
JUL.17,89	32706	W1	8904596	1	1	1050	0.07	ND
JUL.17,89	32706	CE1	8904593	1	1	1050	0.56	ND
JUL.17,89	32706	CW1	8904594	1	1	1050	0.14	ND
JUL.26,89	32715	E1	8906005	1	1	1050	0.41	ND
JUL.26,89	32715	W1	8906006	1	1	1050	0.05	ND
JUL.26,89	32715	CE1	8906010	1	1	1050	0.97	0.10
JUL.26,89	32715	CW1	8906011	1	1	1050	0.11	0.10
JUL.31,89	32720	CE1	8906012	1	1	1050	2.22	0.10
JUL.31,89	32720	CW1	8906013	1	1	1050	0.14	ND

Table 3. (Cont'd)

SAMPLING DATE	DATE FUNCTION	FIELD ID	SAMPLE NUMBER	SAMPLE MEDIA	SCHEMA TYPE	SAMPLE VOLUME	ATRAZINE (µg/L)	METOLACHLOR (µg/L)
AUG.08,89	32728	E1	8906007	1	1	1050	0.26	ND
AUG.08,89	32728	W1	8906008	1	1	1050	0.06	ND
AUG.08,89	32728	CE1	8906014	1	1	1050	0.34	0.50
AUG.08,89	32728	CW1	8906015	1	1	1050	0.08	0.10
AUG.11,89	32731	CB1	8906009	1	1	1050	ND	ND
AUG.15,89	32735	CE1	8907005	1	1	1050	0.28	ND
AUG.15,89	32735	CW1	8907006	1	1	1050	0.06	ND
AUG.21,89	32741	E1	8907009	1	1	1050	2.65	ND
AUG.21,89	32741	W1	8907010	1	1	1050	0.12	ND
AUG.21,89	32741	CE1	8907007	1	1	1050	16.42	ND
AUG.21,89	32741	CW1	8907008	1	1	1050	0.51	ND
AUG.28,89	32748	CE1	8909801	1	1	1050	0.47	ND
AUG.28,89	32748	CW1	8909802	1	1	1050	0.06	ND
SEP.06,89	32757	E1	8909805	1	1	1050	0.21	ND
SEP.06,89	32757	W1	8909806	1	1	1050	ND	ND
SEP.06,89	32757	CE1	8909803	1	1	1050	0.24	ND
SEP.06,89	32757	CW1	8909804	1	1	1050	ND	ND
SEP.12,89	32763	E1	8909812	1	1	1050	0.22	ND
SEP.12,89	32763	W1	8909813	1	1	1050	ND	ND
SEP.12,89	32763	W2	8909861	1	1	1050	0.05	ND
SEP.12,89	32763	CE1	8909810	1	1	1050	0.19	ND
SEP.12,89	32763	CW1	8909811	1	1	1050	ND	ND
SEP.18,89	32769	E1	8909864	1	1	1050	0.28	ND
SEP.18,89	32769	W1	8909865	1	1	1050	0.08	ND
SEP.18,89	32769	CE1	8909862	1	1	1050	0.24	ND
SEP.18,89	32769	CW1	8909863	1	1	1050	0.06	ND
SEP.25,89	32776	E1	8911569	1	1	1050	ND	ND
SEP.25,89	32776	E2	8911570	1	1	1050	ND	ND
OCT.11,89	32792	E1	8910064	1	1	1050	0.32	ND
OCT.11,89	32792	E2	8910065	1	1	1050	0.36	ND
OCT.11,89	32792	WI	8910066	1	1	1050	0.36	ND
OCT.11,89	32792	W2	8910067	1	1	1050	0.46	ND
OCT.11,89	32792	CE1	8910068	1	1	1050	0.26	ND
OCT.11,89	32792	CW1	8910069	1	1	1050	0.11	ND
OCT.18,89	32799	E1	8910070	1	1	1050	0.27	ND
OCT.18,89	32799	E2	8910071	1	1	1050	0.19	ND
OCT.18,89	32799	W1	8910072	1	1	1050	0.08	ND
OCT.18,89	32799	W2	8910073	1	1	1050	0.08	ND
OCT.18,89	32799	CE1	8910074	1	1	1050	0.21	ND
OCT.18,89	32799	CW1	8910075	1	1	1050	0.12	ND
OCT.18,89	32799	CB1	8910076	1	1	1050	ND	ND
OCT.18,89	32799	CB2	8910077	1	1	1050	0.05	ND
OCT.23,89	32804	E1	8911304	1	1	1050	ND	ND
OCT.23,89	32804	W1	8911305	1	1	1050	ND	ND
OCT.30,89	32811	E1	8911308	1	1	1050	0.98	ND
OCT.30,89	32811	W1	8911309	1	1	1050	0.29	ND
NOV.07,89	32819	E1	8911314	1	1	1050	0.27	ND
NOV.08,89	32820	W1	8911317	1	1	1050	ND	ND
NOV.14,89	32826	E1	8911563	1	1	1050	ND	ND
NOV.14,89	32826	W1	8911564	1	1	1050	ND	ND

E1 = East Sub-Basin (Logan Watershed);grab (bi-weekly) sample
W1 = West Sub-Basin(Arts Watershed);grab (bi-weekly) sample
CE1 = Continuous flow proportional samples from Logan watershed
CW1 = Continuous flow proportional samples from Arts watershed
CW2 = Duplicate continuous flow proportional sample from Arts watershed
CB1,2= Catch-basin samples
QEL = Contamination checks
ND = Non detectable; 0.05 µg/L for atrazine and 0.10 µg/L for metolachlor

Table 4. 1989 STORM EVENT DATA - KINTORE CREEK: WESTERN / EASTERN SUB-BASINS.

SAMPLING DATE	DATE FUNCTION	FIELD ID	SAMPLE NUMBER	SAMPLE MEDIA	SCHEMA TYPE	SAMPLE VOLUME	ATRAZINE (µg/L)	METOLACHLOR (µg/L)
JUN.02,89	32661	E1	8902635	1	1	1050	8.630	1.750
JUN.02,89	32661	E2	8902636	1	1	1050	8.480	1.650
JUN.02,89	32661	E3	8902637	1	1	1050	12.050	2.350
JUN.02,89	32661	E4	8902638	1	1	1050	4.680	1.070
JUN.02,89	32661	E5	8902639	1	1	1050	6.000	1.320
JUN.02,89	32661	E6	8902640	1	1	1050	6.280	1.410
JUN.02,89	32661	E7	8902641	1	1	1050	3.810	1.190
JUN.02,89	32661	E8	8902642	1	1	1050	2.690	0.790
JUN.02,89	32661	W1	8902643	1	1	1050	17.000	2.470
JUN.02,89	32661	W2	8902644	1	1	1050	14.600	1.920
JUN.02,89	32661	W3	8902645	1	1	1050	11.200	1.500
JUN.02,89	32661	W4	8902646	1	1	1050	11.200	1.430
JUN.02,89	32661	W5	8902647	1	1	1050	9.930	1.430
JUN.02,89	32661	W6	8902648	1	1	1050	4.310	0.610
JUN.02,89	32661	W7	8902649	1	1	1050	2.450	0.350
JUN.02,89	32661	W8	8902650	1	1	1050	4.550	0.530
JUN.22,89	32681	E1	8904049	1	1	700	27.720	0.100
JUN.22,89	32681	E2	8904050	1	1	1050	90.010	0.300
JUN.22,89	32681	E3	8904051	1	1	1050	53.560	1.100
JUN.22,89	32681	E4	8904052	1	1	700	62.500	2.700
JUN.22,89	32681	E5	8904053	1	1	1050	47.31	1.600
JUN.22,89	32681	E6	8904054	1	1	1050	11.920	1.100
JUN.22,89	32681	E7	8904055	1	1	1050	10.600	1.300
JUN.22,89	32681	E8	8904056	1	1	1050	8.250	0.900
JUN.22,89	32681	W1	8904057	1	1	1050	9.260	0.700
JUN.22,89	32681	W2	8904058	1	1	1050	7.180	0.800
JUN.22,89	32681	W3	8904059	1	1	1050	12.850	1.100
JUN.22,89	32681	W4	8904060	1	1	1050	9.870	1.300
JUN.22,89	32681	W5	8904061	1	1	1050	9.890	1.300
JUN.22,89	32681	W6	8904062	1	1	1050	ND	ND
JUN.22,89	32681	W7	8904063	1	1	1050	4.250	0.500
JUN.22,89	32681	W8	8904064	1	1	1050	3.390	0.400
AUG.15,89	32735	E1	8907025	1	1	700	40.76	0.2
AUG.15,89	32735	E2	8907026	1	1	700	27.6	0.2
AUG.15,89	32735	E3	8907027	1	1	700	11.19	0.2
AUG.16,89	32736	E4	8907028	1	1	700	11.35	0.2
AUG.16,89	32736	E5	8907029	1	1	700	9.8	0.2
AUG.16,89	32736	E6	8907030	1	1	700	9.28	0.2
AUG.16,89	32736	E7	8907031	1	1	1050	7.61	0.3
AUG.16,89	32736	E8	8907032	1	1	1050	6.88	0.2
AUG.15,89	32735	W1	8907033	1	1	1050	0.34	ND
AUG.15,89	32735	W2	8907034	1	1	1050	0.13	ND
AUG.15,89	32735	W3	8907035	1	1	1050	0.82	ND
AUG.15,89	32735	W4	8907036	1	1	1050	0.43	ND
AUG.15,89	32735	W5	8907037	1	1	1850	0.34	ND
AUG.16,89	32736	W6	8907038	1	1	1050	0.56	ND
AUG.16,89	32736	W7	8907039	1	1	1050	4.51	ND
AUG 16,89	22736	WR	8407040	1	1	loco	7 04	NI)
OCT.03,89	32784	E1	8909853	1	1	1050	ND	ND
OCT.03,89	32784	E2	8909854	1	1	1050	0.07	ND
OCT.03,89	32784	E3	8909855	1	1	1050	0.07	ND
OCT.03,89	32784	E4	8909856	1	1	1050	0.13	ND
OCT.03,89	32784	E5	8909857	1	1	1050	0.17	ND
OCT.03,89	32784	E6	8909858	1	1	1050	0.27	ND
OCT.03,89	32784	E7	8909859	1	1	1050	0.4	ND
OCT.03,89	32784	E8	8909860	1	1	1050	0.45	ND
NOV.07,89	32819	E1	8911348	1	1	1050	0.83	ND
NOV.07,89	32819	E2	8911349	1	1	1050	1.24	ND
NOV.07,89	32819	E3	8911350	1	1	1050	1.24	ND
NOV.07,89	32819	E4	8911351	1	1	1050	0.98	ND
NOV.07,89	32819	E5	8911352	1	1	1050	3.07	ND
NOV.07,89	32819	E6	8911353	1	1	1050	0.63	ND
NOV.07,89	32819	E7	8911354	1	1	1050	ND	ND
NOV.07,89	32819	E8	8911355	1	1	1050	0.25	ND

NOV.07,89	32819	W1	8911356	1	1	1050	ND	ND
NOV.07,89	32819	W2	8911357	1	1	1050	ND	ND
NOV.07,89	32819	W3	8911358	1	1	1050	ND	ND
NOV.07,89	32819	W4	8911359	1	1	1050	0.22	ND
NOV.07,89	32819	W5	8911360	1	1	1050	0.41	ND
NOV.07,89	32819	W6	8911361	1	1	1050	ND	ND
NOV.07,89	32819	W7	8911362	1	1	1050	0.24	ND

E1 - E8 = Eastern sub-basin(Logan watershed) storm event samples
W1- W8 = Western sub-basin(Arts watershed) storm event samples
ND = Non detectable; 0.05 µg/L for atrazine and 0.10 µg/L for metolachlor

4. PESTICIDE SURVEY

The total amount and types of pesticides being applied to each sub-basin must be compared in order to accurately interpret the impacts of conservation farming practices on pesticide delivery to the watercourse from water quality data.

A detailed pesticide usage survey was completed in 1990 for each landowner in the western and eastern sub-basins. This information has been presented in two formats within this report, grouped by pesticide (Tables 5,6) and grouped by landowner (Tables 7,8).

Landowners have stated types of pesticides used and rates. Fields for each landowner have been numbered for easy reference (Figures 7,8).

Areas where atrazine and/or metolachlor were applied are illustrated for the western sub-basin in Figure 9 and for the eastern sub-basin in Figure 10.

A summary of total atrazine and metolachlor usage within each watershed since 1988 can be seen in Figure 6.

Conservation farming practices aid in decreasing the delivery of sediments to the watercourse through erosion. The tillage treatment for each field for the 1989/1990 cropping season for each sub-basin is listed in Table 9 (west) and Table 10 (east).

5. SUMMARY

Environment Canada precipitation records for London airport show that we received 45 percent more rainfall than average during 1990. This is reflected by the large number of rain events monitored by authority staff. The water quality data from samples collected during 1990 will be valuable in achieving the objectives of this study, as below average rainfall occurred during the previous two field seasons limiting the number of samples collected.

Implementation of conservation farming practices is increasing in the western sub-basin. Beginning in 1991, adoption of conservation farming practices within the eastern sub-basin will be encouraged by authority staff.

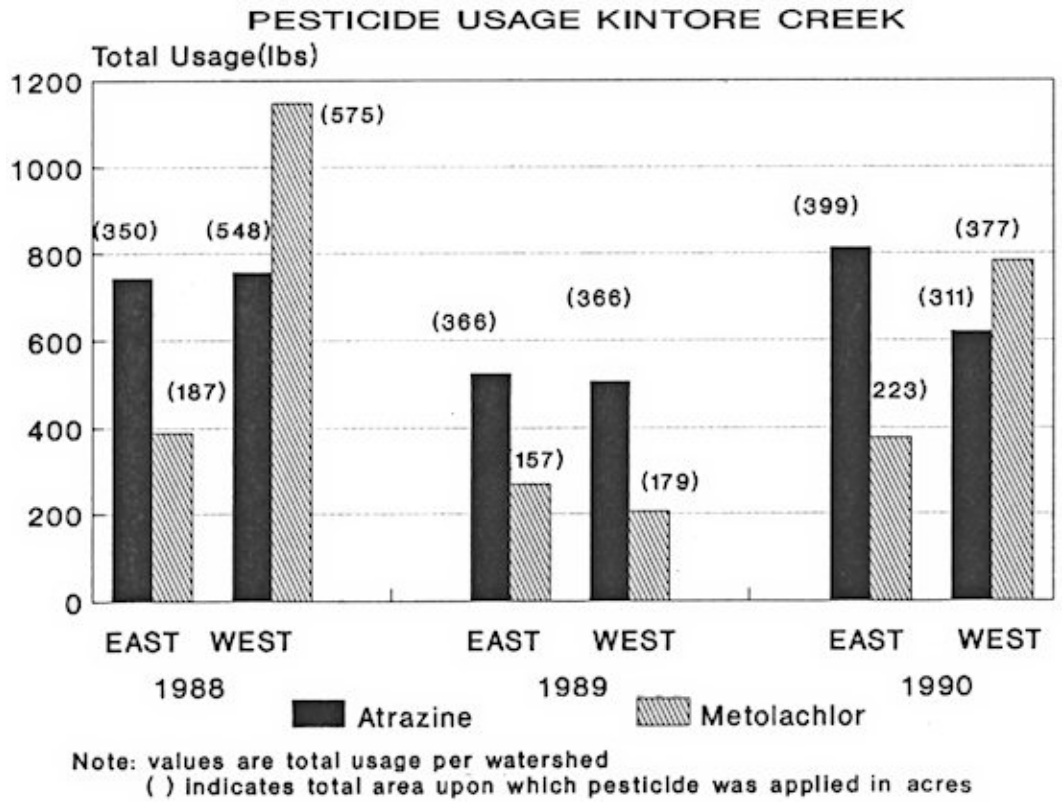

Figure 6: Atrazine and Metolachlor usage.

Table 5. 1990 PESTICIDE USE SUMMARY - KINTORE CREEK WESTERN SUB-BASIN.

Pesticide	Landowner	Field Number *	Acreage	Crop	Rate	Totals
2,4-D	Arther	1	11	barley	0.75 L/ac	8.25 L
	McMurray	1	10	barley	0.75 L/ac	7.5 L
	McMurray	4	7	soybeans	0.50 L/ac	3.5 L
	Pelkmans	1	12	barley	0.50 L/ac	6.0 L
						25.25 L
Aflon	Ball, B.	3	12	nano beans	1 L/ac	12.0 L
	McKay	1,2	30	soybeans	1 L/ac	30.0 L
	McMurray	4	7	soybeans	1 L/ac	7.0 L
						49.0 L
Ambutox	Deslippe	3,5	32	alfalfa	0.7 L/ac	2.4 L
Atrazine	Brekelmans	3	47	corn	1.5 lbs/ac	70.5 lbs
	Brekelmans	1	49	corn	1.5 lbs/ac	73.5 lbs
	Deslippe	1,2,4,6	53	corn	1.17 L/ac	68.2 lbs
	Ebert(Pearson)		25	corn	0.75 lbs/ac	18.75 lbs
	Leonhardt		12	corn	1.0 lb/ac	12.0 lbs
	VanMaar(Jackson)	2	18	corn	4.0 lbs/ac	72.0 lbs
						314.95 lbs
Banvel	Aarts		24	corn	0.33 L/ac	7.9 L
	Ball, B.	1,5	41	corn	0.50 L/ac	20.5 L
	McMurray	2,6	44	corn	0.50 L/ac	22.0 L
	McMurray	5	12	corn	0.50 L/ac	6.0 L
	VanMaar(Jackson)	1	''''	corn	0.33 L/ac	7.9 L
	VanMaar(Jackson)	2	18	corn	0.33 L/ac	6.0 L
						70.3 L
Counter-15	Arts	1,2	47	corn	9.0 lbs/ac	423 lbs
	Arts	4,5	30	corn	7.0 lbs/ac	210 lbs
	Ball, B.	1,5	41	corn	9.0 lbs/ac	369 lbs
	Brekelmans	3	47	corn	7.0 lbs/ac	329 lbs
	Ebert(Pearson)		25	corn	7.0 lbs/ac	175 lbs
	Leonhardt		12	corn	9.0 lbs/ac	108 lbs
	McMurray	5	12	corn	8.5 lbs/ac	102 lbs
						1716 lbs
Dual	Arts	1.2	47	corn	1.4 L/ac	65.8 L
	Arts	4,5	30	corn	1.0 L/ac	30.0 L
	Ball, B.	1,5	41	corn	1.0 L/ac	41.0 L
	Brekelmans	3	47	corn	0.6 L/ac	28.2 L
	McMurray	5	12	corn	1.0 L/ac	12.0 L
	McMurray	2,6	44	corn	1.0 L/ac	44.0 L
	McMurray	4	7	soybeans	0.8 L/ac	5.6 L
	VanMaar(Jackson)	1	24	corn	1.0 L/ac	24.0 L
	VanMaar(Jackson)	2	18	corn	1.0 L/ac	18.0 L
						268.6 L
Dyfonate	Aarts		24	corn	7 lbs/ac	168 lbs
	McMurray	2,6	44	corn	5 lbs/ac	220 lbs
	Pelkmans	2,4	45	corn	5 lbs/ac	225 lbs
	VanMaar(Jackson)	1	24	corn	7 lbs/ac	168 lbs
	VanMaar(Jackson)	2	18	corn	7 lbs/ac	126 lbs
	Vanstrien	1,3	150	corn	5 lbs/ac	750 lbs
						1657 lbs
Edge	Henderson/Rounds	1	23	white beans	0.6 L/ac	13.8 L
	Henderson/Rounds	3	27	kidney beans	0.6 L/ac	16.2 L
						30.0 L
Eptam	Vanstrien	5	53	white beans	2 L/ac	106.0 L

Table 5. (Cont'd)

Pesticide	Landowner	Field Number*	Acreage	Crop	Rate	Totals
Eradicane	Aarts		24	corn	2 L/ac	48.0 L
	Brekelmans	1	49	corn	3 L/ac	147.0 L
	Ebert(Pearson)		25	corn	2 L/ac	50.0 L
	Vanstrien	1,3	150	corn	3 L/ac	450.0 L
						695.0 L
Marksman	Arts	4,5	30	corn	1.6 L/ac	48.0 L
	Arts	1,2	47	corn	1.8 L/ac	84.6 L
	Brekelmans	3	47	corn	1.8 L/ac	84.6 L
	Brekelmans	1	49	corn	1.8 L/ac	88.2 L
						305.4 L
MCPA	Arts	3	36	barley/red clover	0.5 L/ac	10 L
	Brekelmans	2	40	barley	0.5 L/ac	20.0 L
	Henderson/Rounds	2	23	wheat	1 L/ac	23.0 L
						61.0 L
Pardner	Ebert(Pearson)		25	corn	0.6 L/ac	15.0 L
	Pelkmans	2,4	45	corn	0.9 L/ac	40.5 L
	Pelkmans	5	15	corn	0.9L/ac	13.5 L
	Vanstrien	1,3	150	corn	1 L/ac	150.0 L
						219.0 L
Patoran	Henderson/Rounds	1	23	white beans	1 L/ac	23.0 L
	Henderson/Rounds	3	27	kidney beans	1 L/ac	27.0 L
	McKay	1,2	30	soybeans	1 L/ac	30.0 L
	Vanstrien	5	53	white beans	2 L/ac	106.0 L
						186.0 L
Pursuit	Ball, B.	3	12	natto beans	0.17 L	2.04 L
Primextra	Arts	1,2	47	corn	3 L/ac	141.0 L
	Pelkmans	2,4	45	corn	3 L/ac	135.0 L
	Pelkmans	5	15	corn	3 L/ac	45.0 L
						321.0 L
Round-up	McMurray	5	12	corn	spot	spot
	McMurray	4	7	soybeans	0.5 L/ac	3.5 L
Sutan	Leonhardt		12	corn	0.4 L/ac	4.8 L

* refer to figure 7 page 16

Table 6. 1990 PESTICIDE USE SUMMARY - KINTORE CREEK EASTERN SUB-BASIN.

Pesticide	Landowner	Field Number	Acreage	Crop	Rate	Totals
2,4 D	Aarts, F.	1	20	barley	0.5 L/ac	10.0 L
	Ball, W.	5	14	oats	0.5 L/ac	7.0 L
	McLeod (Home)	4	20	wheat	0.35L/ac	7.0 L
	Pelkmans	2	11	barley	0.5 L/ac	5.5 L
						29.5 L
Afesin	Vucko (B.Ball)		46	kidney beans	2.2 L/ac	35.2 L
Afton	Ball, B.	3	18	natto beans	1 L/ac	18.0 L
	Boeringa	3,6	16	soybeans	1 L/ac	16.0 L
						34.0 L
Atrazine	Aarts, F.	2,3,4	120	corn	1 lb/ac	120.0 lbs
	Ball, S.	2	15	corn	2 lbs/ac	30.0 lbs
	Ball, S.	4	21	corn	2 lbs/ac	42.0 lbs
	Boeringa	1,2	32	corn	5.2 lbs/ac	165.4 lbs
	Leonhardt		42	corn	1 lb/ac	42.0 lbs
	McLeod (2nd farm)		28	corn	0.95 lbs/ac	26.5 lbs
	McLeod (Home)	6,7	14	corn	1.5 lbs/ac	35.0 lbs
	Palmer	6	18	corn	3.3 lbs/ac	59.4 lbs
						520.3 lbs
Atrazine/	McLeod(2nd farm)		28	corn	0.4 lbs/ac	11.0 lbs
Banvel	Doherty		23	corn	0.4 L/ac	9.2 L
	Kew (Waud)		17	corn	0.5 L/ac	8.5 L
	McLeod (2nd farm)		28	corn	0.36 L/ac	10.08L
						27.78L
Bladex	Kew (Waud)		17	corn	0.8 L/ac	13.6 L
Counter-15	Aarts, F.	2,3,4	120	corn	12 lbs/ac	440.0 lbs
	Ball, S.	2	15	corn	9 lbs/ac	135.0 lbs
	Doherty		23	corn	9 lbs/ac	207.0 lbs
	Kew (Waud)		17	corn	7 lbs/ac	119.0 lbs
	Leonhardt		42	corn	9 lbs/ac	378.0 lbs
						1279.0 lbs.
Dual	Boeringa	1,2	32	corn	0.94 L/ac	30.0 L
	Boeringa	3,6	16	soybeans	1 L/ac	16.0 L
	Doherty		23	corn	0.8 L/ac	18.4 L
	Impens	1,3	28	corn	0.6 L/ac	16.8 L
	Glennie (Impens)		25	corn	0.6 L/ac	15.0 L
						96.2 L
Dyfonate	McLeod (2nd farm)		28	corn	3.4 lbs/ac	95.2 lbs
	McLeod (Home)	6,7	24	corn	3.4 lbs/ac	82.0 lbs
	Glennie (Impens)		25	corn	7.0 lbs/ac	175.0 lbs
	Impens	1,3	28	corn	7.0 lbs/ac	196.0 lbs
	Pelkmans	1,3	53	corn	5.0 lbs/ac	265.0 lbs
						813.2 lbs
Eradicane	Aarts, F.	2,3,4	120	corn	3 L/ac	360.0 L
	McLeod (2nd farm)		28	corn	2.8 L/ac	78.0 L
	McLeod (Home)	6,7	24	corn	3.75 L/ac	90.0 L
						528.0 L
Marksman	Ball, W.	2	13	corn	1.8 L/ac	23.4 L
MCPA	Ball, S.	3	20	wheat	0.5 L/ac	10.0 L
Pardner	Ball, S.	2	15	corn	0.8 L/ac	12.0 L
	Ball, S.	4	21	corn	0.8 L/ac	16.8 L
	Impens	3	28	corn	0.8 L/ac	22.4 L
	Glennie (Impens)		25	corn	0.8 L/ac	20.0 L
	Palmer	4	12	corn	0.6 L/ac	7.2 L
	Pelkmans	1,3	53	corn	0.6 L/ac	31.8 L
						110.2 L

Pursuit	Ball, B.	3	18	natto beans	0.17 L/ac	3.06 L
Primextra	Palmer	6	18	corn	3 L/ac	54.0 L
	Palmer	4	12	corn	3 L/ac	36.0 L
	Palmer	7	4	corn	3 L/ac	12.0 L
	Pelkmans	1,3	53	corn	3 L/ac	159.0 L
						261.0 L
Rival	Vucko (B.Ball)		16	kidney beans	0.5 L/ac	8.0 L
Round-up	Kew (Waud)		17	corn	1 L/ac	17.0 L
	McLeod (Home)	1,2,3	15	wheat	1 L/ac	15.0 L
						32.0 L
Sutan	Leonhardt		42	corn	0.4 L/ac	16.8 L

* refer to figure 8 page 17

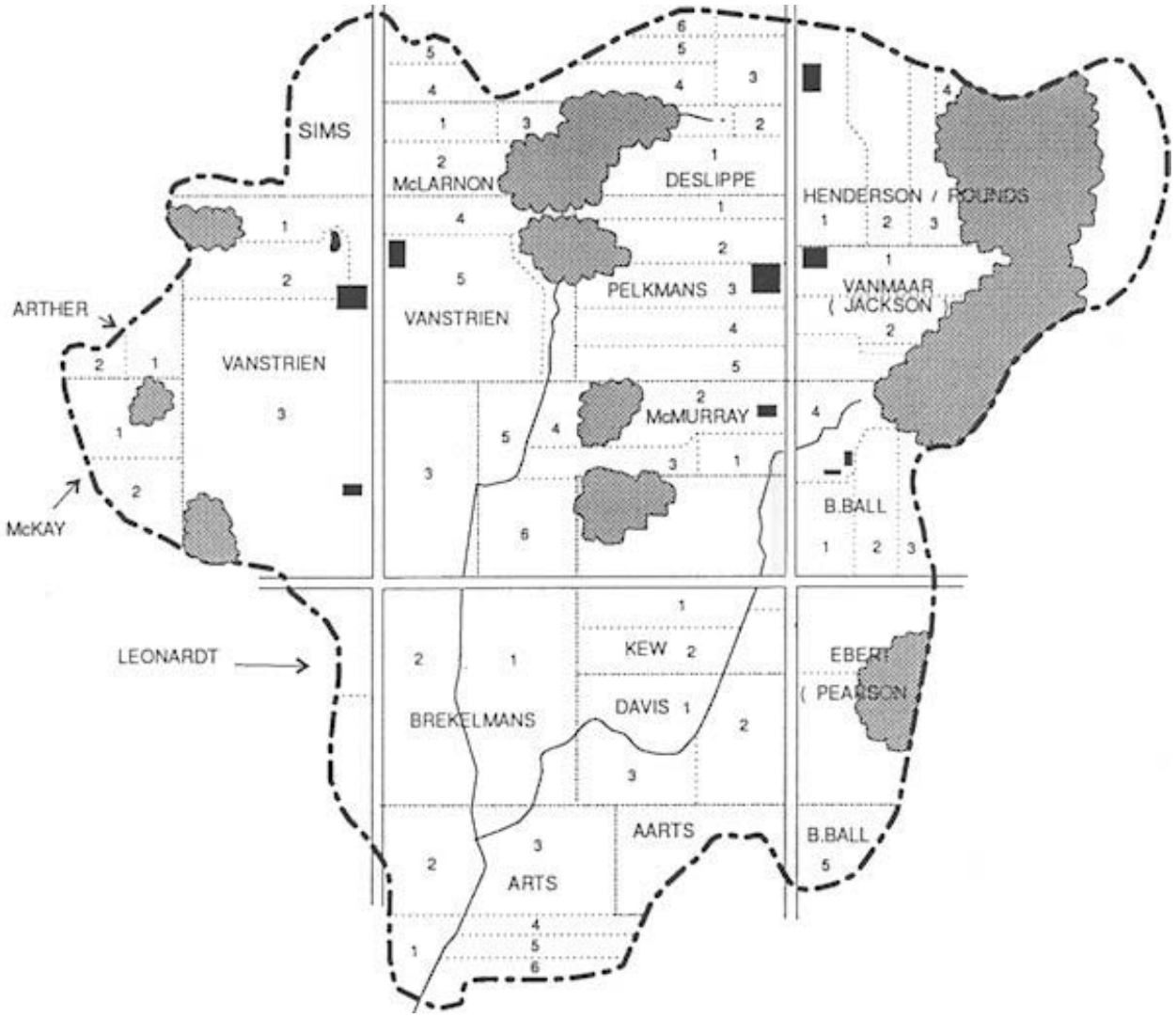

Figure 7: Western Sub-basin Land Ownership.

Figure 8: Eastern Sub-basin Land Ownership**.**

Table 7. 1990 PESTICIDE USE SUMMARY - KINTORE CREEK WESTERN SUB-BASIN.

Landowner	Field Number*	Acreage	Crop	Pesticide	Rate	Totals
Aarts		24	corn	Eradicane	2 L/ac	48 L
				Banvel	0.33 L/ac	7.9 L
				Dyfonate	7 lbs/ac	168 lbs
Arts	1,2	47	corn	Dual	1.4 L/ac	65.8 L
				Marksman	1.8 L/ac	84.6 L
				Primextra	3 L/ac	141 L
				Counter-15	9 lbs/ac	423 lbs
	4,5	30	corn	Dual	1 L/ac	30 L
				Marksman	1.6 L/ac	48 L
				Counter-15	7 lbs/ac	210 lbs
	3	36	barley/red clover	MCPA	0.5 L/ac	18 L
Arther	1	11	barley	2,4D	0.75 L/ac	8.25 L
	2	6	alfalfa	-	-	-
B. Ball	1.5	41	corn	Dual	1 L/ac	41 L
				Banvel	0.5 L/ac	20.5 L
				Counter-15	9 lbs/ac	369 lbs
	3	12	n. beans	Afton	1 L/ac	12 lbs
				Pursuit	0.17 L/ac	2 L
	2	27	alfalfa	-	-	
	4	9	pasture	-		
Brekelmans	3	47	corn	Atrazine	1.5 lbs/ac	70.5 lbs
				Marksman	1.8 L/ac	84.6 L
				Dual	0.6 L/ac	28.2 L
				Counter-15	7 lbs/ac	329 lbs
	1	49	corn	Atrazine	1.5 lbs/ac	73 lbs
				Marksman	1.8 L/ac	88.2 L
				Eradicane	3 L/ac	147 L
	2	40	barley	MCPA	0.5 L/ac	20 L
Davis	1	10	oats	-	-	-
	2,3	30	alfalfa	-	-	-
Deslippe	1,2,4,6	53	corn	Aatrex	1.17 L/ac	-
	3,5	32	alfalfa	Anbutox	0.7 L/ac	-
Henderson/						
Rounds	1	23	wt. beans	Edge	0.6 L/ac	13.8 L
				Patoran	1 L/ac	23 L
	3	27	k. beans	Edge	0.6 L/ac	16.2 L
				Patoran	1 L/ac	27 L
	2	23	wheat	MCPA	1 L/ac	23 L
	4	7	barley	-	-	-
Kew	1	20	barley	-	-	-
	2	22	alfalfa	-	-	
Van Maar	1	24	corn	Dual	1 L/ac	24 L
(Jackson)				Banvel	0.33 L/ac	7.9 L
				Dyfonate	7 lbs/ac	168 lbs
	2	18	corn	Atrazine	4 lbs/ac	72 lbs
				Dual	1 L/ac	18 L
				Banvel	0.33 L/ac	6 L
				Dyfonate	7 lbs/ac	126 lbs
Leonhardt		12	corn	Atrazine	1 lbs/ac	12 lbs
				Sutan	0.4 L/ac	4.8 L
				Counter-15	9 lbs/ac	108 lbs
McKay	1,2	30	soybeans	Patoran	1 L/ac	30 L
				Aflon	1 L/ac	30 L
McLarnon	2,3	20	barley	-	-	-

Table 7. (Cont'd)

Landowner	Field Number*	Acreage	Crop	Pesticide	Rate	Totals
	1	21	alfalfa	-	-	-
McMurray	5	12	corn	Round-up (spot)		
				Dual	1 L/ac	12 L
				Banvel	0.5 L/ac	6 L
				Counter-15	8.5 lbs/ac	102 lbs
	2,6	44	corn	Dual	1 L/ac	44 L
				Banvel	0.5 L/ac	22 L
				Dyfonate	5 lbs/ac	220 lbs
	1	10	barley	2,4D	0.75 L/ac	7.5 L
	4	7	soybeans	2,4D	0.5 L/ac	3.5 L
				Round-up	0.5 L/ac	3.5 L
				Dual	0.8 L/ac	5.6 L
				Aflon	1 L/ac	7 L
	3	15	alfalfa		-	
Ebert (Pearson)		25	corn	Atrazine	0.75 L/ac	18.75 lbs.
				Eradicane	2 L/ac	50 L
				Pardner	0.6 L/ac	15 L
				Counter-15	7 lbs/ac	175 lbs.
Pelkmans	2,4	45	corn	Primextra	3 L/ac	135 L
				Pardner	0.9 L/ac	40L
				Dyfonate	5 lbs/ac	225 lbs
	5	15	corn	Primextra	3 L/ac	45 L
				Pardner	0.9 L/ac	13.5 L
	1	12	barley	2,4-D	0.5 L/ac	6 L
	3	16	alfalfa	-	-	
Sims		47	corn	n/a		
Vanstrien	1,3	150	corn	Eradicane	3 L/ac	450 L
				Pardner	1 L/ac	150L
				Dyfonate	5 lbs/ac	750 lbs
	5	53	wt. beans	Eptam	2 L/ac	106 L
				Patoran	2 L/ac	106L
	2	23	wheat	-		-
	4	19	alfalfa	-	-	-

* refer to figure 7 page 16

Table 8. 1990 PESTICIDE USE SUMMARY - KINTORE CREEK EASTERN SUB-BASIN.

Landowner	Field Number*	Acreage	Crop	Pesticide	Rate	Total
F. Aarts	2,3,4	120	corn	Atrazine	1 lbs/ac	120 lbs
				Eradicane	3 L/ac	360 L
				Counter-15	12 lbs/ac	1440 lbs
	1	20	barley	2,4D	0.5 L/ac	10 L
B. Ball		18	n. beans	Afton	1 L/ac	18 L
				Pursuit	0.17 L/ac	3.06 L
S. Ball	2	15	corn	Atrazine	2 lbs spot	15 lbs
				Pardner	0.8 L/ac	12 L
				Counter-15	9 lbs/ac	135 lbs
	4	21	corn	Atrazine	2 lbs spot	21 lbs
				Pardner	0.8 L/ac	16.8 L
	3	20	wheat	MCPA	0.5 L/ac	10 L
	1	26	alfalfa	-		
W. Ball	2	13	corn	Marksman	1.8 L/ac	23.4 L
	1,3a	20	corn	-	-	-
	5	14	oats	2,4D	0.5 L/ac	7 L
	3b	6	oats	-	-	-
	4 ,6 ,7	45	alfalfa	-	-	-
Boeringa	1, 2	32	corn	Aatrex 48	4.7 L/ac	150 L
				Dual	0.94 L/ac	30 L
	3, 6	16	soybeans	Dual	1 L/ac	16 L
				Afton	1 L/ac	16 L
	4, 5	16	alfalfa		-	-
Doherty		23	corn	Dual	0.8 L/ac	18.4 L
				Banvel	0.4 L/ac	9.2 L
				Counter-15	9 lbs/ac	207 lbs
Impens	1,3	28	corn	Dual	0.6 L/ac	16.8 L
				Pardner	0.8 L/ac	22.4 L
				Dyfonate	7 lbs/ac	196 lbs
	2	4	wheat	-	-	-
Glennie		25	corn	Dual	0.6 L/ac	15 L
(Impens)				Pardner	0.8 L/ac	20 L
				Dyfonate	7 lbs/ac	175 lbs
Kew		17	corn	Banvel	0.5 L/ac	8.5 L
(Waud)				Bladex	0.8 L/ac	13.6 L
				Round-up	1 L/ac	17 L
				Counter-15	9 lbs/ac	153 lbs
Leonhardt		42	corn	Atrazine	1 lbs/ac	42 lbs
				Sutan	0.4 L/ac	16.8 L
				Counter-15	9 lbs/ac	378 lbs
Logan	2,3	7	corn	n/a		
	1,4	7	alfalfa	-	-	-
McLeod	6,7	24	corn	Atrazine	1.5 lbs/ac	35 lbs
(home)				Eradicane	3.75 L/ac	90L
				Dyfonate	3.4 lbs/ac	82 lbs
	1,2,3	15	wheat	Round-up	1 L/ac	15 L
	4	20	wheat	2,4D	3.5 L/ac	7 L
	5	6	wheat	-	-	-
McLeod		28	corn	Atrazine	0.95 lbs/ac	26.5 lbs
(2nd farm)				Eradicane	2.8 L/ac	78 L
				Atrazine/	0.4 lbs/ac	11 lbs
				Banvel	0.36 L/ac	10 L
				Dyfonate	3.4 lbs/ac	95.2 lbs
Palmer	6	18	corn	Atrazine	3 L/ac	54 L
				Primextra	3 L/ac	54 L
	4	12	corn	Pardner	0.6 L/ac	7.2 L

				Primextra	3 L/ac	36 L
	7	4	corn	Primextra	3 L/ac	12 L
	2	11	grain	-	-	-
	1,3,5,8	48	alfalfa	-	-	-
Pelkmans	1,3	53	corn	Pardner	0.6 L/ac	31.8 L
				Primextra	3 L/ac	159.0 L
				Dyfonate	5 lbs/ac	265.0 lbs
	2	11	barley	2,4D	0.5 L/ac	5.5 L
	4	8	alfalfa	-	-	-
Vucko		16	k. beans	Rival	0.5 L/ac	8.0 L
(B.Ball)				Afesin	2.2 L/ac	35.2 L

* refer to figure 8 page 17

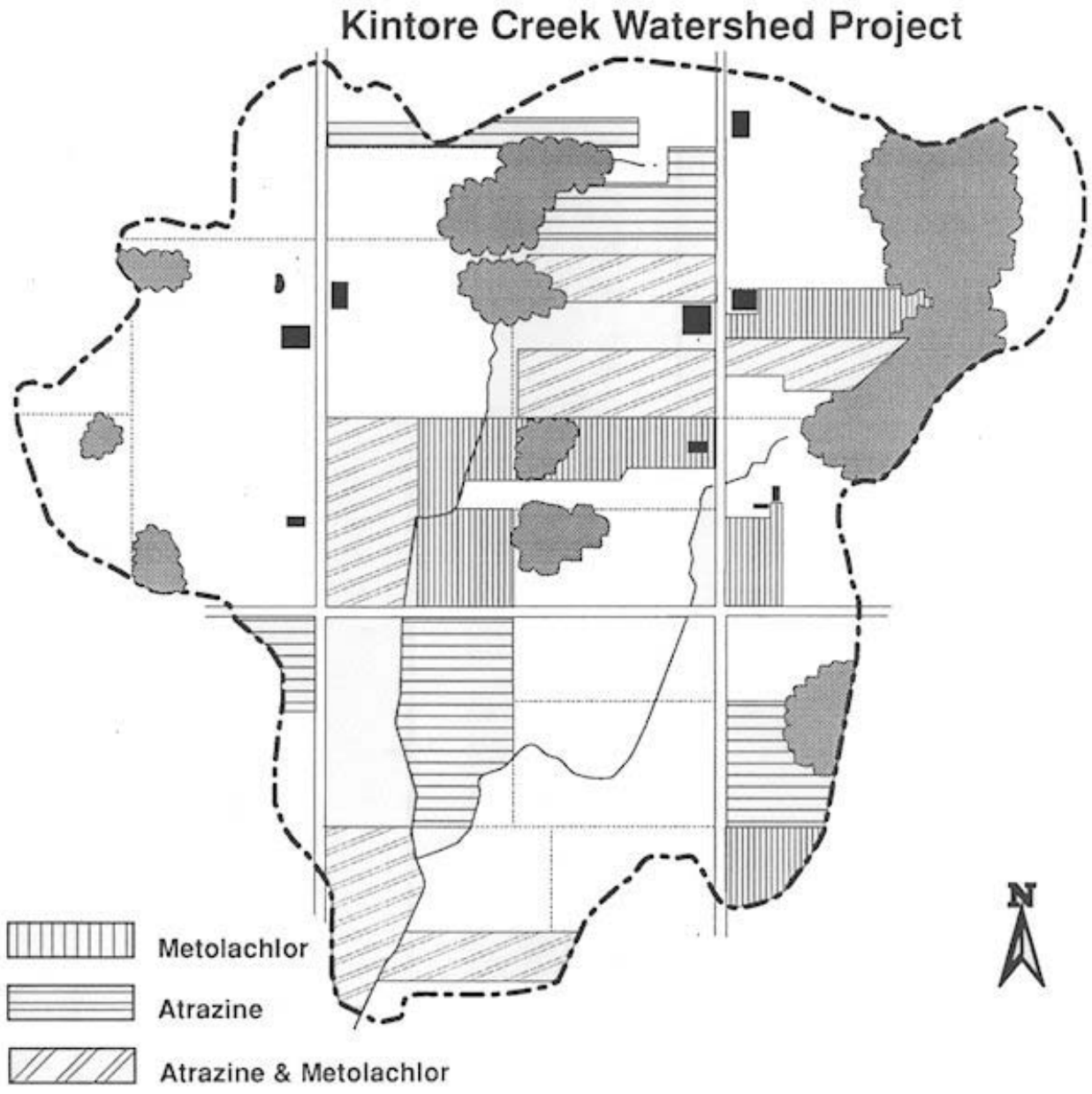

Figure 9: Western Sub-Basin - 1990 Pesticide Usage

Figure 10: Eastern Sub-Basin - 1990 Pesticide Usage

Table 9. 1989/90 WINTER COVER - KINTORE CREEK WESTERN SUB-BASIN

Landowner	Field Number	Acreage	Tillage Treatment
Aarts		24	spring moldboard
Arts	1,3	59	spring chisel
	2	24	red clover; spring moldboard
	4,5	30	spring moldboard
	6	7	alfalfa; unplowed
Arther	1	11	spring moldboard
	2	6	alfalfa; unplowed
Ball, B.	1,3,5	53	fall moldboard
	2	27	alfalfa: unplowed
	4	9	permanent pasture; unplowed
Brekelmans	2	40	spring moldboard
	1,3	96	spring chisel
Davis	1	10	fall moldboard
	2,3	30	alfalfa; unplowed
Deslippe	4	17	fall moldboard
	2,6	16	fall chisel
	1,3,5	52	alfalfa; unplowed
Henderson/Rounds	1	23	spring moldboard
	2	23	winter wheat
	3	27	fall chisel
	4	7	fall chisel
Kew	1	20	fall moldboard
	2	22	alfalfa; unplowed
VanMaar (Jackson)	1,2	42	spring chisel
Leonhardt		12	fall moldboard (½) spring moldboard (½)
McKay	1,2	30	spring moldboard
McLarnon	1	21	alfalfa; unplowed
	2,3	20	spring moldboard
McMurray	1,2	32	fall chisel
	3	15	alfalfa; unplowed
	4,5	19	spring no-till fields
	6	22	spring moldboard
Ebert(Pearson)		25	fall chisel remainder planted in trees
Pelkmans	5	15	alfalfa; spring moldboard
	3	16	alfalfa; unplowed
	1,2,4	57	fall chisel
Sims		47	fall moldboard
Vanstrien	1,3,5 (S½)	175	fall moldboard
	5 (N½)	28	spring moldboard
	4	19	alfalfa: unplowed
	2	23	winter wheat

*refer to figure 7 page 16

Table 10. 1989/90 WINTER COVER KINTORE CREEK EASTERN SUB-BASIN.

Landowner	Field Number*	Acreage	Tillage Treatment
Aarts, F.	1,2,3,4	140	fall moldboard
Ball, B.	3	18	fall moldboard
Ball, S.	2,4	36	fall chisel
	1	26	alfalfa; unplowed
	3	20	winter wheat
Ball, W.	1,3a,3b	26	fall moldboard
	2,5	27	spring moldboard
	4,6,7	45	alfalfa; unplowed
Boeringa	1,2	32	fall moldboard
	3,6	16	spring moldboard
	4,5	16	alfalfa; unplowed
Doherty		23	spring moldboard
Impens	1,3	28	fall moldboard
	2	4	winter wheat
Glennie (Impens)		25	fall moldboard
Kew (Waud)		17	spring moldboard
Leonhardt		42	fall moldboard
Logan	1,4	7	alfalfa; unplowed
	2,3	7	fall moldboard
McLeod (Home)	6,7	24	spring moldboard
	1,2,3,4,5	41	winter wheat
McLeod (2nd Farm)	South ½	23	fall moldboard
	North ½	5	spring moldboard
Palmer	2(½),4,9	23	fall moldboard
	7	8	spring moldboard
	2(½),6	17	fall chisel
	1,3,5,8	48	alfalfa; unplowed
Pelkmans	1	31	fall chisel
	2,3	23	spring moldboard
	4	8	alfalfa; unplowed
Vucko (B.Ball)		16	fall moldboard

* refer to figure 8 page 17