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### Land Use Activities in Eleven Agricultural Watersheds in Southern Ontario, Canada, 1975-76

Ontario. Ministry of Agriculture and Food

International Reference Group on Great Lakes Pollution from Land Use Activities

R. Frank

B. D. Ripley

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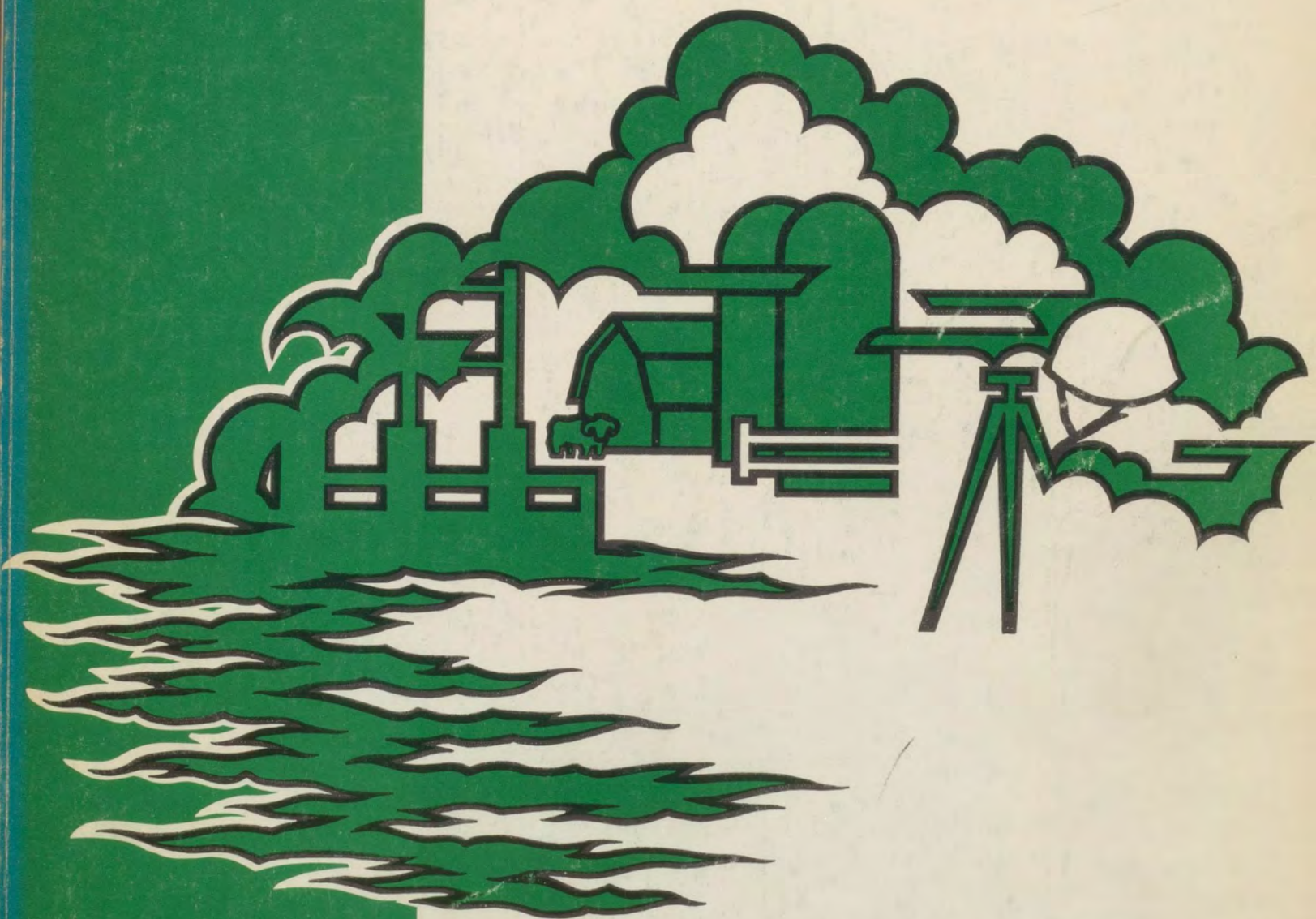
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**INTERNATIONAL REFERENCE GROUP  
ON GREAT LAKES POLLUTION  
FROM LAND USE ACTIVITIES**

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**INTERNATIONAL  
JOINT  
COMMISSION**

**LAND USE ACTIVITIES IN ELEVEN  
AGRICULTURAL WATERSHEDS  
IN SOUTHERN ONTARIO, CANADA, 1975-76**

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79-053

**LAND USE ACTIVITIES IN ELEVEN  
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by  
**R. Frank & B.D. Ripley**

**Ontario Ministry of Agriculture and Food**

**March, 1977**

LAND USE ACTIVITIES IN ELEVEN  
AGRICULTURAL WATERSHEDS  
IN SOUTHERN ONTARIO, CANADA, 1975-76

PROJECT 5 - LAND USE ACTIVITIES  
TASK GROUP C (CANADIAN SECTION) ACTIVITY 1  
INTERNATIONAL REFERENCE GROUP ON GREAT LAKES  
POLLUTION FROM LAND USE ACTIVITIES  
INTERNATIONAL JOINT COMMISSION

PROJECT 80645  
EDUCATION, RESEARCH AND SPECIAL SERVICES DIVISION  
ONTARIO MINISTRY OF AGRICULTURE AND FOOD

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MARCH, 1977

DISCLAIMER

The study discussed in this document was carried out as part of the efforts of the Pollution from Land Use Activities Reference Group, an organization of the International Joint Commission, established under the Canada - U.S. Great Lakes Water Quality Agreement of 1972. Funding was provided through Education, Research and Special Services Division, Ontario Ministry of Agriculture and Food, Project No. 80645.

Findings and conclusions are those of the authors and do not necessarily reflect the views of the Reference Group or its recommendations to the Commission.

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# SUMMARY

To determine various land use parameters, eleven mini-agricultural watersheds were surveyed by questionnaire; ten were surveyed in 1975 whereas AG-5 was surveyed in 1976. These selected watersheds were typical of larger areas in the Province with respect to soil type, topography and agricultural activity.

The selected mini-watersheds (Table S-1) were located in southern Ontario on ten larger watersheds draining into the Great Lakes; three drained into Lake Huron (Ausable River, Maitland River and Saugeen River), one drained into Lake St. Clair (Thames River), three drained into Lake Erie (Big Creek, Grand River and Hillman Creek) and three drained into Lake Ontario (Humber River, Shelter Valley Creek and Twenty Mile Creek).

## Size

The mini-watersheds ranged in size from 21 to 75 km<sup>2</sup> and represented from 0.4 to 22% of the main watershed draining to the Great Lakes. The total area, agricultural land area, improved land area and non-agricultural land in the various mini-watersheds (Table S-2) were compiled from data provided on the questionnaires (Appendices E and F). Areas determined by planimeter from topographical maps (1:50,000) and aerial photographs were used to ensure the completeness of the surveys.

In this study, agricultural land was defined as all land on agricultural properties whereas improved land included all land under cropping, lying fallow and in pasture but excluded any unimproved land such as woodlots, river flats, fence rows and farm buildings. Non-agricultural land included road allowances, industrial and institutional properties, residences, recreational areas and Crown Land.

The total areas in each of the eleven mini-watersheds varied from 2,070 to 7,534 ha in size and of this area, 77-98% was devoted to agricultural production. The non-agricultural land usage was high in AG-7 (22.9%) and AG-13 (16.9%) because of Crown Land and urban dwellings whereas in the other watersheds it represented 2-9%.

## AGRICULTURAL ACTIVITIES

### Crop Production

The crop production in the various watersheds is summarized in Table S-3. The diversity, yet similarity, of the cropping practice illustrates the reason for the selection of the particular watersheds.

TABLE S-1

## Size of Major and Mini-watersheds

Great Lakes	<u>Major Watershed</u> Name	Size(km <sup>2</sup> )	AG-	<u>Mini-Watershed</u> Name	Size(km <sup>2</sup> )	Distance a/ from Lake (km)
Lake Huron	Ausable River	1562	3	Little Ausable River	57	121
	Maitland River	2686	6	Trib. of Upper Maitland River	52	110
	Saugeen River	3972	14	Mill Creek	51	36.7
Lake St. Clair	Thames River	5882	1	Big Creek	52	16.7
			5	Holiday Creek	30	253
Lake Erie	Big Creek	742	2	Venison Creek	75	19.6
	Grand River	6671	4	Canagagigue Creek	25	214
	Hillman Creek	162	13	Hillman Creek	21	7.4
Lake Ontario	Humber River	317	11	Salt Creek	25	34.9
	Shelter Valley Creek	944	7	Shelter Valley Creek	62	7.7
	Twenty Mile Creek	280	10	North Creek	30	26.5

a/Distance from flow gauging station and water sampling site to river mouth

TABLE S-2

## Land Use in the Various Mini-Agricultural Watersheds

Watershed AG-	Area <sup>a</sup> (hectares)	PERCENT LAND USE (%)			
		Agricultural Land	Improved <sup>b</sup> Land	Row Crops	Non <sup>c</sup> Agricultural
1	5,180	94.9	90.9	62.1	5.1
2	7,534	97.9	61.6	30.8	2.1
3	5,670	97.2	89.6	45.3	2.8
4	2,477	98.0	91.2	18.7	2.0
5	2,950	96.3	80.9	46.0	3.7
6	5,230	96.1	67.9	12.3	3.9
7	6,230	77.1	53.3	12.0	22.9
10	2,980	96.6	78.9	16.3	3.4
11	2,499	91.2	85.1	14.7	8.8
13	2,070	83.1	76.2	67.2	16.9
14	5,069	97.6	88.2	9.5	2.4

a/ Total area from questionnaire and topographical maps

b/ All crop hectares including fallow and pasture except unimproved land

c/ All other land including roads, residences, industries, institutions, Crown Land, etc.

The watersheds can be divided into high, medium and low intensity areas based on the percentage area devoted to row crop production:

<u>High Intensity</u> (over 40%)	<u>Medium Intensity</u> (20 - 40%)	<u>Low Intensity</u> (Less than 20%)
AG-1,3,5,13	AG-2	AG-4,6,7,10,11,14

### Livestock Production

Animal units of livestock production (Table S-4) were calculated from the data in the Agricultural Code of Practice for Ontario (Appendix B; Reference 1). Few livestock units were maintained in the high intensity crop production watersheds with the exception of AG-3. AG-4 and 5 were primarily milk producing areas, however, in 1975 AG-4 had a large number of farms also maintaining beef and swine. AG-3, 6 and 14 had primarily beef orientated operations whereas AG-7 and 10 had mixed livestock operations.

The density of livestock production in the various watersheds based on animal units per hectare was:

<u>High</u> (> 0.5 animal units/ha)	<u>Medium</u> (0.25-0.50 animal units/ha)	<u>Low</u> (<0.25 animal units/ha)
AG-4,5,6,10,14	AG-3,7,11	AG-1,2,13

### Land Preparation

Plowing of land for the disposition of crop residue and to prepare the land for crop production varied from watershed to watershed. In general, fall plowing was practiced in those watersheds with predominantly clay and clay loam soils whereas spring plowing predominated in those watersheds with mainly sand and sandy loam soils. Where neither fall nor spring plowing predominated, the soils were loam or sandy loam.

The plowing period and the main soil type in the watersheds were as follows:

<u>Fall</u>	<u>Mixed</u>	<u>Spring</u>
AG-1 (clay)	AG-5,6 (loam)	AG-2 (sand)
AG-3,10,11 (clay loam)	AG-7 (sandy loam)	AG-13 (sandy loam)
AG-4,14 (loam)		

Tillage operations for spring planted crops occurred in the spring. Land planted to wheat was prepared between July and September in all watersheds.

### Manure Use

Farmers found the question regarding manure application to land

difficult to answer. In AG-14, few farmers responded to the question of rate of application of manure and an estimate was made for this parameter based on the few reported results and the experience of the County Agricultural Representative. In general, most farmers used the manure available from their livestock operation; exceptions occurred in AG-2 where manure was brought into the watershed from livestock operations outside the drainage basin and in AG-5 and 10 where some manure was sold outside the watershed. Manure use is summarized in Tables S-4 and S-5.

The use of manure by hectare of the whole watershed may be classed as:

<u>High</u> ( <u>&gt; 3 tonnes/ha</u> )	<u>Medium</u> ( <u>1-3 tonnes/ha</u> )	<u>Low</u> ( <u>&lt; 1 tonne/ha</u> )
AG-3,4,5,6,10	AG-2,11,14	AG-1,7,13

In most of the watersheds, the manure was piled outside the barns and was left unprotected from runoff by rain until application to the field. Application of manure occurred at various times of the year in different watersheds depending on soil requirements, crops treated and availability of manure.

Time of application of manure to the land varied greatly as observed from the following information:

<u>Summer/Fall</u>	<u>Year round</u>	<u>Spring</u>
AG-1	AG-3,4,5,6,10,11	AG-2,7,13,14

(wheat was treated in August or September)

Municipal sludge was used in AG-6.

#### Fertilizer Use

The use of fertilizer in the watersheds (Tables S-5 and S-6) was calculated on the basis of pre-planting or at planting time and after planting application. Data are provided on the total use of both types of fertilizer on each crop in the various watersheds. The rates of application and type of fertilizer used were determined from the mean of the data and the most commonly used nutrient respectively. In some watersheds a very consistent pattern of fertilizer use was evident whereas in others a wide variety in rate of application and type of fertilizer used was apparent, probably reflecting the various soil requirements and previous and/or following crop.

Commonly used commercial fertilizers are summarized in Appendix C and information on their use may be found in Reference 2.

The use of fertilizer in the various watersheds may be characterized by:

	High Use ( $\geq$ 50 kg/ha N,K) ( $\geq$ 30 kg/ha P )	Medium Use (25-50 kg/ha N,K) (15-30 kg/ha P )	Low Use ( $\leq$ 25 kg/ha N,K) ( $\leq$ 15 kg/ha P )
N	AG-1,13	AG-2,3,5	AG-4,6,7,10,11,14
P	AG-13	AG-1,2,3,5	AG-4,6,7,10,11,14
K	AG-2,13	AG-1,3,5	AG-4,6,7,10,11,14

#### Total Nutrient

The total nutrient from manure and fertilizer used in the watersheds is summarized in Table S-5. The use of total nutrients may be classed by the level of use as follows:

	High Use ( $\geq$ 66 kg/ha N,K) ( $\geq$ 36 kg/ha P )	Medium Use (33-66 kg/ha N,K) (18-36 kg/ha P )	Low Use ( $\leq$ 33 kg/ha N,K) ( $\leq$ 18 kg/ha P )
N	AG-3,5,13	AG-1,4,6,10,11,14	AG-2,7
P	AG-13	AG-1,2,3,4,5	AG-6,7,10,11,14
K	AG-5,13	AG-2,3,4,5,6,10,11,14	AG-7

#### Pesticide Use

A wide variety of pesticides was used in the different watersheds depending upon the crop, degree of protection required and the intensity of the cropping practice. The use of pesticides by class is shown in Table S-7 and individual pesticide usage is shown in Tables S-8 to S-11.

For convenience, pesticides were divided into insecticides, herbicides, fungicides and nematicides and their use was recorded in 7, 11, 3 and 3 watersheds respectively. The use of each class of pesticide was ranked into high, medium, low and no use depending on the average rate of toxicant used per hectare. Only one watershed, AG-13, had a high use of all four classes of pesticides. AG-13, being a high intensity agricultural watershed, with large-scale production of fruits and vegetables, required the greatest volume of pest control products. AG-3 and 5, having a high intensity of cash corn production, used large amounts of herbicides. Nematicides and growth regulators (for sucker control) were used on tobacco in AG-2 and 7 and in AG-13 on vegetables.

All pesticides are listed by their common name. Appendix D lists the common and trade names of all pesticides mentioned in this report.

The use of pesticides may be characterized by:

	High Use (>1000 g/ha)	Medium Use (500-1000 g/ha)	Low Use (<500 g/ha)	No Use (0 g/ha)
Insecticides	AG-13		AG-1,2,3,4, 5,7	AG-6,10,11, 14
Herbicides	AG-3,5,13	AG-1,4	AG-2,6,7, 10,11,14	
Fungicides	AG-13		AG-1,4	AG-2,3,5,6, 7,10,11,14
Nematicides	AG-2,7,13			AG-1,3,4,5, 6,10,11,14

#### Limestone Use

Limestone was applied in six watersheds (Table S-12) at rates of application between 2.4 and 89 kg/ha.

#### Irrigation

The use of stream water for irrigation was practiced in only 3 watersheds (Table S-12).

#### Land Drainage

Land drainage through tiles by either systematic or random drainage systems is characterized by percent land tiled:

High Density (> 75%)	Medium Density (10-75%)	Low Density (<10%)
AG-1,5,13	AG-3,4,6,11,14	AG-2,7,10

Land drainage through municipal drains, ditches and streams is characterized by area of watershed occupied by these structures:

High % (> 1%)	Low % (< 1%)	None (0%)
AG-1,3,5,13	AG-2,4,6	AG-7,10,11,14

#### NON-AGRICULTURAL LAND USE

##### Road Allowance and Railroads

The road allowance, representing provincial, county and township roads and railroad allowance in the various watersheds, was determined from the non-agricultural questionnaire (Appendix F) and the topographical maps.

This transportation right-of-way represented 1-3% of the area in the watersheds. Railroads occupying less than 0.5% of the area were located in AG-1, 5,6,10 and 13. Herbicides (information included in Table S-9) were used in nine watersheds (no herbicides used in AG-2 and 10) and information on winter sanding on the road allowance was obtained from data provided by township offices. Road construction occurred in AG-2 and 7 in 1975.

### Residences

All farm and non-farm residences (Table S-13) were enumerated in the watersheds. Residential home density ranged from one house per 5.8 ha in AG-13 to one house per 77 ha in AG-14. All the watersheds, except AG-2, had homes with septic tanks, often with weeping tiles, for sewage disposal; in AG-2 sewage was removed from the watershed by the township. Generally, it was considered that all the septic systems were adequate to meet the requirements of the Public Health Authorities.

### Industries and Institutions

Most watersheds had a very low density of industrial operations or institutions such as schools and museums.

### Crown Land and Reforestation

AG-7, Shelter Valley Creek, had a large area (13.5%) of Crown Land. Farmers in AG-3 complained of the lack of reforestation to prevent wind erosion of the soil on agricultural land.

### Water Quality

Water for livestock was obtained from farm wells, farm ponds and streams or ditches (Table S-14). Farm wells were the most common source followed by streams or ditches and ponds. In most watersheds, farmers were satisfied with the quality of the watershed; however, some specific problems occurred with low water tables and the presence of human or fecal matter and soil runoff in some streams.

### REFERENCES

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.
- (2) Field Crop Recommendations, Publication 296, O.M.A.F., 1976.



TABLE S-3

## Cropping Practice in the Various Mini-Watersheds

Crop	Cropping Practice (% total agricultural land)										
	AG-1	AG-2	AG-3	AG-4	AG-5	AG-6	AG-7	AG-10	AG-11	AG-13	AG-14
<u>Row Crops</u>											
Corn	24.5	10	32	19	44	13	13	17	12	27.5	10
Tobacco	<1	20					2			6	
Soybeans	39.5	0.5							2	9	
White Beans			12								
Beans (other)										4	
Potato										16	
Tomato										11	
Turnips			1								
Vegetables	2	1			4		<1			3	
<u>Drilled Crops</u>											
Mixed grain			16	32	5	19	1	1	19		10
Oats	2	0.5	1		4		5	10.5	1		<1
Barley	<1		6		3	4	3	1	1		2
Wheat	26	13	5	4	0.5		1	4	11	10.5	
Rye		12					4			1	
Peas			1								
<u>Others</u>											
Hay & Alfalfa	1		10	32	2.5	19	14	33	28		23
Hay & Pasture	1	3			21						
Pasture			8	6		16	23	12.5	18		45
Fallow		3					3	2			
Orchard							<1			4	
Tree Nursery									1		
Unimproved	4	37	8	7	16	29	31	19	7	8	10
<u>Total (ha)</u>											
Agricultural	4,915	7,373	5,511	2,428	2,840	5,026	4,810	2,879	2,279	1,721	4,945

TABLE S-4

Livestock Maintained in the various Mini-Watersheds,  
and Manure and Sludge Application to Land

Watershed AG-	Livestock (animal units) <sup>a/</sup>	Livestock Density (animal unit/WS ha)	MANURE APPLICATION TO LAND			
			Treated (ha)	Area <sup>b/</sup> (%)	Total (tonnes)	Use of Manure (tonne/WS ha)
1	395	0.08	100	2	198	0.04
2	281	0.04	1,235	17	14,864	1.97
3	2,734	0.48	1,078	20	30,439	5.37
4	1,865	0.75	951	39	20,963	8.46
5	1,787	0.61	499	22	10,081	3.42
6	2,685	0.51	894	18	23,164	4.43
7	1,744	0.28	613	13	4,763	0.76
10	2,290	0.77	536	18.5	13,489	4.53
11	790	0.32	416	18	5,817	2.33
13	27	0.01	19	1	168	0.08
14	2,723	0.54	996	20	c	1.97 <sup>d/</sup>

SLUDGE APPLICATION TO LAND						
6			32	<0.1	133	0.03

a/ see Appendix B or Reference 1

b/ % agricultural land

c/ not answered on questionnaire, estimated to be 4,900-15,000 tonnes

d/ estimated from c/

TABLE S-5

Total Nutrient Use in the Various Mini-Watersheds

Watershed AG-	USE OF NUTRIENTS (kg/ha)					
	N	Fertilizer P	K	N	Manure <sup>a</sup> P	K
1	58.4	18.9	26.3	3.7	1.0	2.5
2	27.9	21.0	50.1	1.5	0.4	1.3
3	35.3	19.4	25.3	35.2	14.5	29.8
4	12.3	10.1	17.7	45.5	14.5	42.2
5	45.6	16.8	29.9	43.7	10.0	39.8
6	11.3	5.3	11.7	42.0	8.0	29.9
7	14.7	6.0	14.8	17.1	3.4	12.3
10	13.6	5.5	4.8	48.1	8.8	42.6
11	12.0	8.4	10.0	23.9	5.7	24.4
13	67.0	40.5	83.4	1.1	0.3	1.1
14	8.1	4.9	7.0	28.9	7.7	26.8

a/ calculated manure nutrient contribution, from D. Coote and R. Leuty, Technical Report, Project 1B, Task C, Activity 1, IJC

TABLE S-6

## Fertilizer Use in the Various Mini-Watersheds

Watershed AG-	USE OF FERTILIZER			% Pre-plant Fertilizer		
	Total Nutrient (kg) N	P	K	N	P	K
1	302,604	98,040	136,112	21.7	97.1	98.2
2	210,073	158,386	377,181	51.0	91.3	89.9
3	200,409	109,944	143,268	71.8	96.7	96.7
4	30,569	24,995	43,912	81.5	100.	100.
5	134,501	49,545	88,071	77.6	95.5	85.1
6	59,230	27,688	60,983	70.5	100.	100.
7	91,448	37,445	92,002	65.9	98.2	98.1
10	40,507	16,421	14,286	65.0	100.	100.
11	29,984	20,921	25,036	94.6	94.5	93.1
13	138,670	83,813	172,726	58.5	97.2	96.4
14	41,212	24,938	35,580	92.3	91.2	91.0

TABLE S-7

Use of Pesticides <sup>a</sup> by Class in the Various Mini-Watersheds

Pesticide Class	USE OF PESTICIDES (kg)										
	AG-1	AG-2	AG-3	AG-4	AG-5	AG-6	AG-7	AG-10	AG-11	AG-13	AG-14
<u>Insecticides</u>											
organochlorine	12	519	350		32		29			81	
organophosphate	5	1860	210	0.5	111		66			3357.8	
carbamate	6	91	576	1.5	124					1033	
other	0.5	109			9					84	
Total (kg/ha)	0.005	0.34	0.20	<0.001	0.09	0	0.02	0	0	2.20	0
<u>Herbicides</u>											
triazine	922	1589	3298.5	969	2339	1007	1088	497	318	690.5	965
phenoxy acids	488	622	902	393	263.5	578	357.5	89.5	244	53	257
carbamate		301	373		71	245	611	150	175	438	
benzoic acids	1853		42							180.5	
phenyl ureas	43	92	600		78				4	502	
others	308.3	597	892.5	33	1113	56	165		263	776	104
Total (kg/ha)	0.70	0.42	1.08	0.56	1.31	0.36	0.36	0.25	0.40	1.28	0.26
<u>Fungicides</u>											
others	913	0	0	2.3	0	0	0	0	0	6626.5	0
Total (kg/ha)	0.18	0	0	<0.001	0	0	0	0	0	3.20	0
<u>Nematicides</u>											
others	0	90383	0	0	0	0	8326	0	0	5,331	0
Total (kg/ha)	0	12.0	0	0	0	0	1.34	0	0	2.58	0

a/ except growth regulators

TABLE S-8

Insecticide Use <sup>a/</sup>in the Different Watersheds

Common Name	USE OF INSECTICIDES (kg a.i.)						
	AG-1	AG-2	AG-3	AG-4	AG-5	AG-7	AG-13
azinphos-methyl	4						2,420.5
<i>B. thuringiensis</i>		109			9		25
carbaryl	6	91		1.5			640
carbofuran			566		117		368
chinomethionate	0.5						
chlordane			350				
chlordimeform							45
chlorfenvinphos			72				7
chlorpyrifos		912				42	14
cyhexatin							3
demeton							2.5 <sup>b/</sup>
diazinon					6		2
dimethoate							70
endosulfan	11	519			32	29	34
fensulfothion			86				11
leptophos		568				24	34
malathion	1	7					11
metalkamate			10		7		25
methomyl							11
methoxychlor	1						0.8
mevinphos							
parathion			52				
phorate					105		
phosalone				0.5			213
phosmet							664
trichlorfon		373					
Total	23.5	2579	1136	2.0	276	95	4,555.8

a/ No insecticides were used in AG-6,10,11 or 14.

b/ One mushroom farm used diazinon but rate is not known

TABLE S-9

Herbicides used in the Different Watersheds (including road allowance)

Common Name	USE OF HERBICIDES (kg a.i.)										
	AG-1	AG-2	AG-3	AG-4	AG-5	AG-6	AG-7	AG-10	AG-11	AG-13	AG-14
alachlor	92	283	677	33	1,072	11	163		236	37	104
amitrole	4	50			1						
atrazine	751	1,289	1,951	932	1,939	1,001	475	497	318	595	922
basogran	49		43							15	
bromacil			0.5								
butylate		257				245	611	150	175	322	
chloramben	1,841									180.5	
chlorthal										33	
cyanazine	14	300	1,041	19	382	6	613				43
cyprazine				18							
2,4-D	458	622	542	174.5	194	304	295.5	57	181.5	53	178
2,4-DB			31		3	90		32.5	20		18
diallate						37					
dicamba	12		42								
dinitramine					16						
dinoseb	12									0.3	
diphenamid		263								145	
EPTC		44	373		71					15	
linuron	43	83			7				4	170	
MCPA	8		272	201	16	162	62				
mecoprop	7		28								
metobromuron		9	600		71					286	
metribuzin	134									81.5	
monolinuron										41	
monuron										5	
naptalam	24									0.7	
niclofen										3	
paraquat	7	1				8			27	146	

Continued. . . . .

TABLE S-9

Continued .....

Common Name	USE OF HERBICIDES (kg a.i.)										
	AG-1	AG-2	AG-3	AG-4	AG-5	AG-6	AG-7	AG-10	AG-11	AG-13	AG-14
pebulate										101	
picloram							2			14	
simazine	23		306.5		18						61
2,4,5-T	15		29	17.5	50.5	22			42.5		
terbacil										14	
trifluralin	120.3		172		24					382	
Total	3,614.3	3,201	6,108	1,395	3,864.5	1,886	2,221.5	736.5	1,004	2,640	1,326
Oil <sup>a/</sup>	357	1,314	1,041	-	2,175	-	-	-	-	-	1,173

a/ Litres of oil used to apply atrazine to corn



TABLE S-10 Fungicide Use<sup>a/</sup> in the Different Watersheds

Common Name	USE OF FUNGICIDES (kg a.i.)		
	AG-1	AG-4	AG-13
benomyl			111
captan		2	1,409
captafol	235		775.5
chlorothalonil			5.5
copper (fixed)	314		1,222
dichloram			11
dicofol			38
dodine		0.3	
EBDC	364		1,626
folpet			3.5
oil <sup>b/</sup>			8,096 <sup>b/</sup>
sulphur			1,425
Total:	913	2.3	6,626.5 + 8,096 L oil

a/ No fungicides were used in AG-2,3,5,7,10,11 or 14  
 b/ L of dormant or superior oil (Fruit Production Recommendations, 1976, Publication 360, O.M.A.F.)

TABLE S-11

Other Pesticide Use in the Different Watersheds

Common Name	USE OF PESTICIDE (kg a.i.)			
	AG-1	AG-2	AG-7	AG-13
<u>Nematicides</u>				
1,2-dichloropropane + 1,3-dichloropropene		82,954	7,902	4,288
methyl isothiocyanate		7,429	424	1,043
Total:	0	90,383	8,326	5,331
<u>Growth Regulators</u>				
fatty alcohols		26,371	749	
ethephon	5			
Total:	5	26,371	749	0

TABLE S-12

Use of Limestone and Irrigation in the various  
Mini-watersheds

Watershed AG-	Use of Limestone (kg/ha)	Use of Irrigation (% Watershed)
1	50	0
2	10	17
3	0	0
4	0	0
5	0	0
6	2.4	0
7	0	1.3
10	39	0
11	18	0
13	89	5.6
14	0	0

TABLE S-13 Residences in the Various Mini-Watersheds

Watershed AG-	Farms (#)	Farm Homes (#)	Residences <sup>a/</sup> (#)	Total Homes (#)	Density (homes/ha)
1	106	179	33	212	0.041
2	151	151	35	186	0.025
3	94	94	52	146	0.026
4	81	81	12	93	0.038
5	52	39	3	42	0.014
6	111	111	38	149	0.028
7	75	75	127	202	0.032
10	96	96	64	160	0.054
11	85	85	110	195	0.078
13	100	187	171	358	0.173
14	61	61	3	64	0.013

a/ non-farm residences; does not include institutions (schools) garages, etc.

TABLE S-14

Sources of Drinking Water for Livestock

Watershed AG-	Farm Wells (#)	Farm Ponds (#)	Streams or Ditches (#)
1	31	2	-
2	21	4	3
3	77	4	5
4	56	3	27
5	34	-	-
6	71	17	23
7	36	8	20
10	63	12	4
11	27	11	9
13	2	-	-
14	54	2	18

TABLE 2-14  
Amounts of Principal Water for District

Watered Area (A)	Year Wells Completed (B)	Year Completed (C)	Principal Water (D)	Amount of Principal Water (E)
1	31	1917	1	170.0
2	37	1918	2	200.0
3	37	1918	3	200.0
4	38	1919	4	200.0
5	38	1919	5	200.0
6	37	1918	6	200.0
7	38	1919	7	200.0
10	39	1920	10	200.0
11	39	1920	11	200.0
12	39	1920	12	200.0
13	39	1920	13	200.0
14	39	1920	14	200.0
15	39	1920	15	200.0
16	39	1920	16	200.0
17	39	1920	17	200.0
18	39	1920	18	200.0
19	39	1920	19	200.0
20	39	1920	20	200.0
21	39	1920	21	200.0
22	39	1920	22	200.0
23	39	1920	23	200.0
24	39	1920	24	200.0
25	39	1920	25	200.0
26	39	1920	26	200.0
27	39	1920	27	200.0
28	39	1920	28	200.0
29	39	1920	29	200.0
30	39	1920	30	200.0
31	39	1920	31	200.0
32	39	1920	32	200.0
33	39	1920	33	200.0
34	39	1920	34	200.0
35	39	1920	35	200.0
36	39	1920	36	200.0
37	39	1920	37	200.0
38	39	1920	38	200.0
39	39	1920	39	200.0
40	39	1920	40	200.0
41	39	1920	41	200.0
42	39	1920	42	200.0
43	39	1920	43	200.0
44	39	1920	44	200.0
45	39	1920	45	200.0
46	39	1920	46	200.0
47	39	1920	47	200.0
48	39	1920	48	200.0
49	39	1920	49	200.0
50	39	1920	50	200.0
51	39	1920	51	200.0
52	39	1920	52	200.0
53	39	1920	53	200.0
54	39	1920	54	200.0
55	39	1920	55	200.0
56	39	1920	56	200.0
57	39	1920	57	200.0
58	39	1920	58	200.0
59	39	1920	59	200.0
60	39	1920	60	200.0
61	39	1920	61	200.0
62	39	1920	62	200.0
63	39	1920	63	200.0
64	39	1920	64	200.0
65	39	1920	65	200.0
66	39	1920	66	200.0
67	39	1920	67	200.0
68	39	1920	68	200.0
69	39	1920	69	200.0
70	39	1920	70	200.0
71	39	1920	71	200.0
72	39	1920	72	200.0
73	39	1920	73	200.0
74	39	1920	74	200.0
75	39	1920	75	200.0
76	39	1920	76	200.0
77	39	1920	77	200.0
78	39	1920	78	200.0
79	39	1920	79	200.0
80	39	1920	80	200.0
81	39	1920	81	200.0
82	39	1920	82	200.0
83	39	1920	83	200.0
84	39	1920	84	200.0
85	39	1920	85	200.0
86	39	1920	86	200.0
87	39	1920	87	200.0
88	39	1920	88	200.0
89	39	1920	89	200.0
90	39	1920	90	200.0
91	39	1920	91	200.0
92	39	1920	92	200.0
93	39	1920	93	200.0
94	39	1920	94	200.0
95	39	1920	95	200.0
96	39	1920	96	200.0
97	39	1920	97	200.0
98	39	1920	98	200.0
99	39	1920	99	200.0
100	39	1920	100	200.0

(Amounts principal water for each district are based on the amount of principal water for each district as shown in Table 2-13.)

# INTRODUCTION

## BACKGROUND

Article VI of the Great Lakes Water Quality Agreement, 1972, requested that the International Joint Commission inquire into and report on "pollution of the boundary waters of the Great Lakes System from agricultural, forestry and other land use activities, in accordance with the terms of reference attached to this agreement". The International Joint Commission (I.J.C.) established the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG) to plan and implement the requested study.

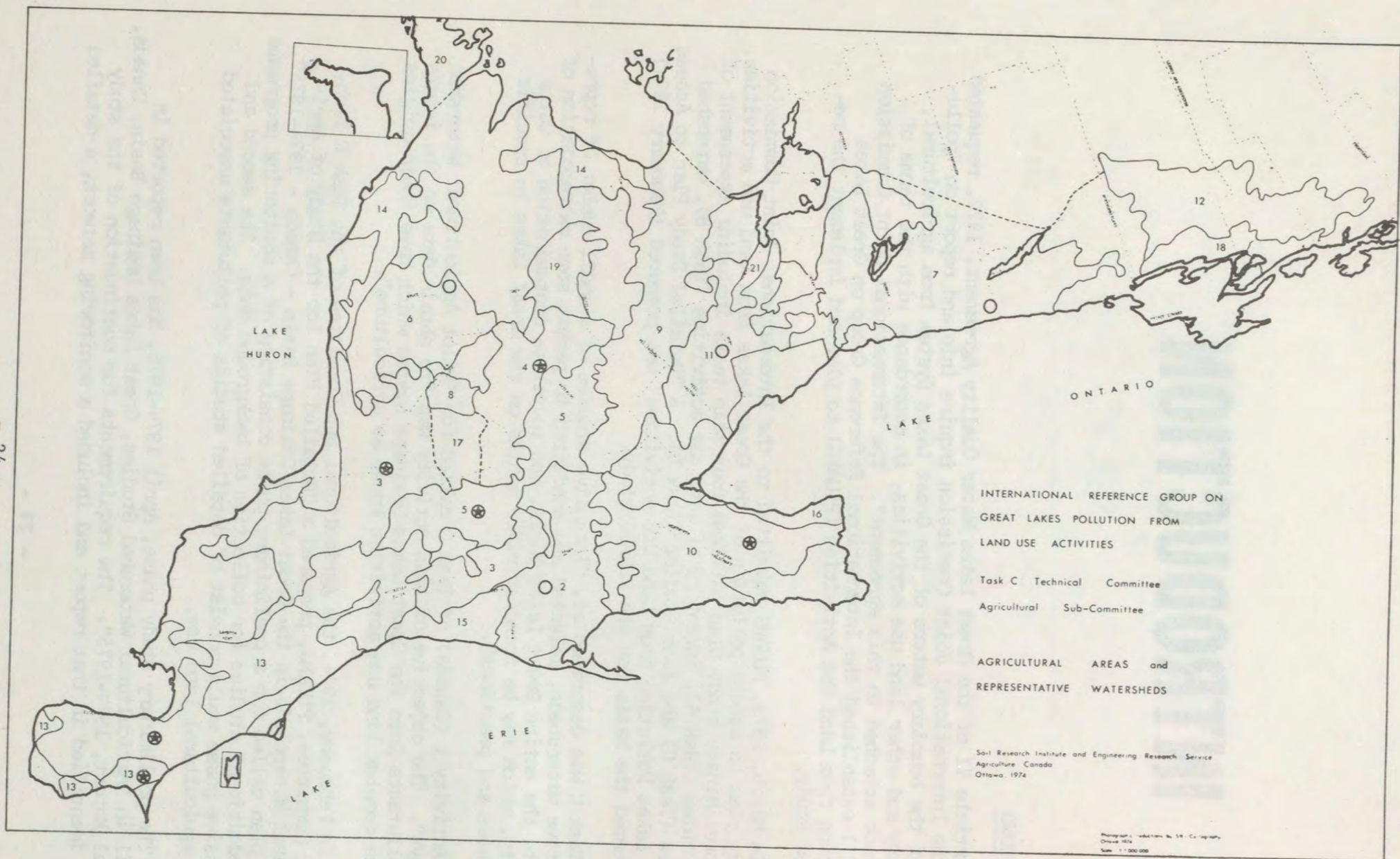
In March, 1973, PLUARG submitted to the International Joint Commission a study plan to assess pollution of the Great Lakes from land use activities. This preliminary study plan outlined four main tasks including assessment of the problem (Task A), inventory of land use activities (Task B), watershed studies (Task C) and lake studies (Task D). A "Detailed Study Plan to Assess Great Lakes Pollution from Land Use Activities" was prepared (February 1974) and formed the basis for the PLUARG study.

Task C was described as, "Intensive studies of a small number of representative watersheds, selected and conducted to permit some extrapolation of data to the entire Great Lakes Basin, and to relate contamination of water quality, which may be found at river mouths on the Great Lakes to specific land uses and practices".

Activity 1 (Canada) of Task C called for "Pilot Agricultural Watershed Surveys". The objective of this activity was "to obtain data on the inputs of pollutants into the Great Lakes Drainage System which have their origins in the complex land use activities known as agriculture".

In February, 1974, the Agricultural Sub-Committee of the Task C Technical Committee, PLUARG, prepared a "Detailed Plan for the Study of Agricultural Watersheds in the Great Lakes Drainage Basin - Canada - 1974-1975". This plan called for a preliminary phase consisting of a monitoring programme and additional studies for collection of background data. The second and intensive phase would consist of detailed studies of pollutants associated with agricultural land use.

The preliminary study phase, April 1974-1975, has been reported in detail in "Agricultural Watershed Studies, Great Lakes Drainage Basin, Canada, Annual Report, 1974-1975". The requirements for continuation of the study were identified in that report and included a monitoring network, a detailed



Location of Eleven Watersheds  
FIGURE I-1: AGRICULTURAL WATERSHEDS - TASK C (CANADIAN SECTION) - PLUARG

○ PHASE I (Monitoring Study)

⊗ PHASE II (Detailed Studies)



studies programme, and a programme for remedial measures or other future requirements.

The objective identified for the Phase I Monitoring Programme was to measure the ambient concentrations and loading rates for various pollutants that occur with agricultural land use. The Phase II Detailed Studies would be directed towards the determination of the effects of soil, land use and associated practices on concentrations and loading rates of selected pollutants, the study of mechanisms of transport and storage of these pollutants in selected agricultural watersheds; and finally, the development of a predictive capability to allow extrapolation to other areas. The Phase III Future Requirement would allow for the development of remedial measures as significant problems were identified.

Projects to be included in Monitoring and Detailed Studies Programmes were identified and an outline provided in the previously-mentioned "Annual Report, 1974-1975". The intensive phase of the Agricultural Watershed Studies Programme was initiated in April 1975.

#### PROJECT 5 - LAND USE ACTIVITIES

Project 5 was designed to collect and compile detailed information on land use practices in eleven selected watersheds located in southern Ontario. The information on material inputs in the watersheds was intended to help in the interpretation of output parameters that were measured in the water leaving the mini-watershed on the way to the Great Lakes. The project was also intended to help identify mini-point sources as well as non-point sources or diffusion inputs of materials. Control of these sources may become of great significance as known point sources of inputs are reduced.

Eleven mini-watersheds (Table I-1) were chosen for examination of land use activities. These small watersheds were not selected because of any particular problems but because they were unique and represented a much larger area of agricultural practice in the Province (Figure I-1). Agricultural environments in these watersheds ranged from high to low intensity crop production, from high to low livestock density, from sand to clay soils and from flat to undulating topography (Table I-2).

A survey of activities on all farms in each of the eleven watersheds was conducted by questionnaire (Appendix E) in the fall of 1975, except AG-5 which was surveyed in 1976, to classify management of material usage practices on both agricultural and non-agricultural properties. Agricultural representatives and engineers of O.M.A.F. acted as liaison between the authors and the farmers. Questions were asked to ascertain activities such as cropping practice, livestock, manure handling, fertilizer and pesticide use and domestic sewage disposal. In 1976, the agricultural representatives completed a supplementary questionnaire (Appendix F) on such non-agricultural activities as road allowance and roadside herbicide treatment, non-farm woodlots, institutions, industries, residential homes, general drainage in the watershed, municipal drains, and general agricultural trends that occurred in the watershed over the past 10-20 years.

TABLE I-1      LOCATION OF ELEVEN WATERSHED

Watershed	Watercourse	County
AG-1	Big Creek	Essex
AG-2	Venison Creek	Norfolk, Elgin
AG-3	Little Ausable River	Huron, Perth
AG-4	Canagagigue Creek	Wellington
AG-5	Holiday Creek	Oxford
AG-6	Tributary of Upper Maitland River	Huron, Wellington
AG-7	Shelter Valley Creek	Northumberland
AG-10	North Creek	Region of Niagara
AG-11	Salt Creek	Region of Peel
AG-13	Hillman Creek	Essex
AG-14	Mill Creek	Bruce

TABLE I-2

LAND USE, LIVESTOCK AND SOILS IN ELEVEN WATERSHEDS

Watershed	General Land Use	Livestock	Soils
AG-1	Cash crop, soybean, wheat, corn	few	clay
AG-2	Tobacco, cash crops	few	sand
AG-3	Cash corn, beans, grains, pasture	beef, swine dairy	clay loam
AG-4	Silage corn, mixed grain, pasture	dairy, beef	loam
AG-5	Corn, pasture	dairy, beef	loam, silt loam
AG-6	Mixed grain, pasture, corn	beef, dairy, swine	loam, silt loam
AG-7	Forage, pasture, tobacco	general	sandy loam
AG-10	Pasture, mixed grains, corn	dairy, poultry, beef	clay
AG-11	Pasture, mixed grains, corn	beef, dairy	clay loam
AG-13	Cash crops, fruit, vegetables	few	sandy loam, sand, clay
AG-14	Pasture, mixed grains	beef, dairy, swine	mixed loams

The results of the questionnaire were compiled and every effort was made to balance the area determined from the forms and that determined by planimeter on the detailed watershed maps.

In accordance with plans to change to the International System of Units (SI), all data in this report are reported in the metric system. Conversion factors to the British System are provided in Appendix A.

40-1	Great top, bottom, wheat, corn	Little Creek	dry
40-2	Tobacco, cash crops	Western Creek	dry
40-3	Cash corn, beans, pasture	Little Anselm River	dry
40-4	Grain, pasture	Condit Creek	dry
40-5	Grain, pasture	Tributary of Upper	dry
40-6	Corn, pasture	Little Anselm River	dry
40-7	Mixed grain, pasture	Little Valley Creek	dry
40-8	Grain, pasture	Little Valley Creek	dry
40-9	Grain, pasture	Little Valley Creek	dry
40-10	Grain, pasture	Little Valley Creek	dry
40-11	Grain, pasture	Little Valley Creek	dry
40-12	Cash crops, fruit, vegetables	Little Valley Creek	dry
40-13	Pasture, mixed grain	Little Valley Creek	dry

# 1 AG-1 BIG CREEK

## GENERAL INFORMATION

### Location

AG-1 represents the watershed draining the west branch of Big Creek, a tributary of the lower Thames River which flows into Lake St. Clair. This watershed covers parts of Mersea and Tilbury West Townships in Essex County (Fig. 1-1). The land is Class 2 by the Canada Land Inventory. The topography is very flat and the soil is composed of Brookston clay soil with sand spot phase overlays in the SE and SW corners; the watershed is drained by tile drains feeding into private and municipal drains and thence to Big Creek.

### Size

The total area is 5,180 ha and is occupied by 106 farms, 33 residential lots, 4 institutions and 2 industries. In 1975, 95% of the land (4,915 ha) was devoted to agriculture. Of the remainder, 2% was road allowance (102 ha), 0.5% was residential (9 ha), institutional (9 ha), industrial (1 ha) properties and railway right-of-way (3 ha) and 2.5% was in municipal drains and sundries (141 ha).

### Main Activity

Cash crop production is the main agricultural endeavour, the main crops being soybean, wheat and corn with a few vegetables. Livestock production was only a very minor activity in 1975.

### Historical

Over the past 15-20 years the type of agriculture has changed from one that was predominantly a mixed livestock-crop type of farming to one of cash crops with little animal feeding. The decline in livestock operations has occurred largely in the past ten years.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 106 farms in the watershed that operated properties ranging in size from 4-162 ha but with a mean area of 46 ha. The majority of full-time farmers operated a base unit of 40 ha and rented or share cropped an additional unit within 2-5 km. Part-time farmers operated 20-50 ha and usually worked away from the watershed.

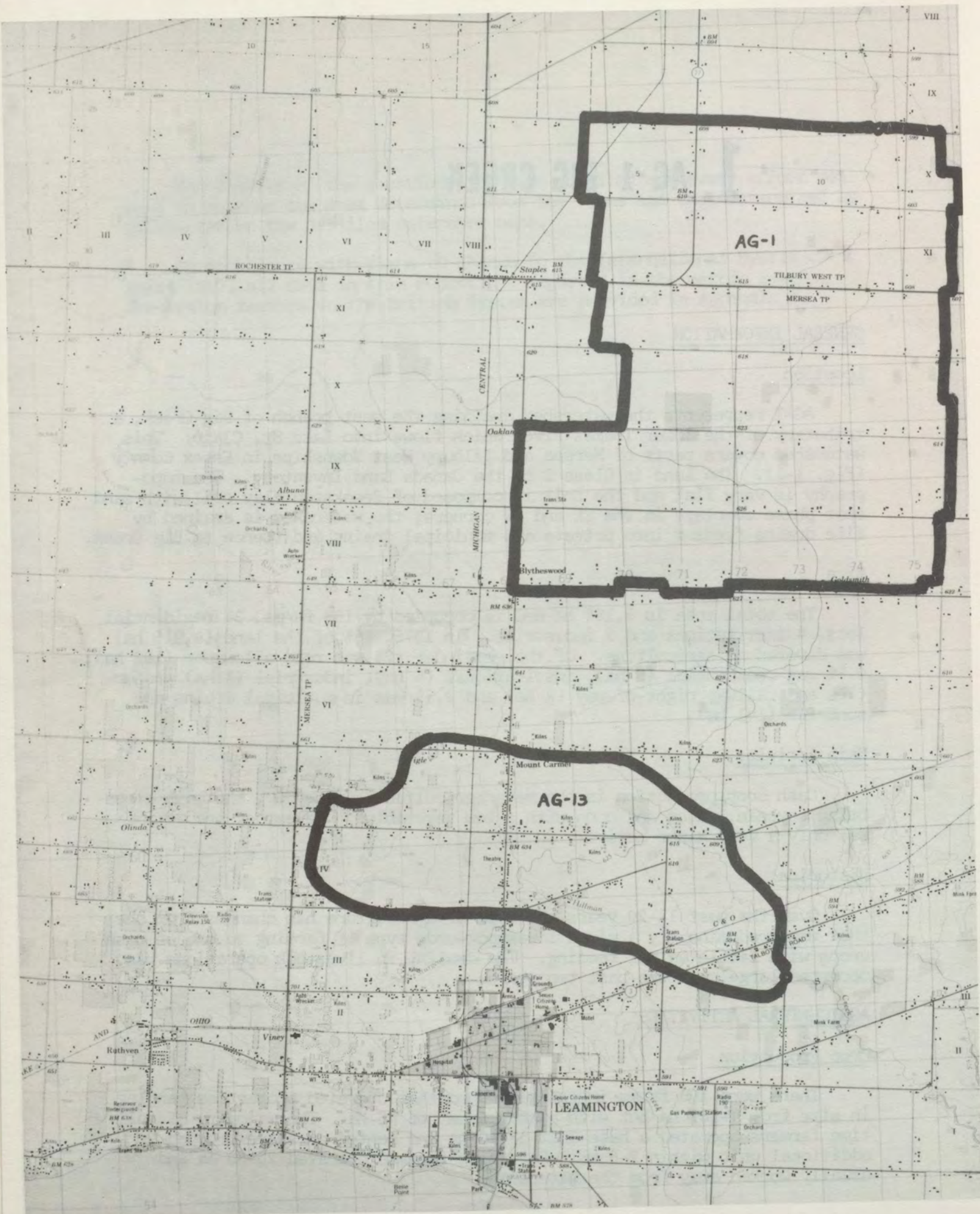


FIGURE 1-1: Location of AG-1, Big Creek  
 - 30 -

The major cash crops grown during 1975 were soybeans, wheat and corn with smaller hectares of oats and processing vegetables (Table 1-1). Soybeans occupied 39.5% (1,935 ha) of the agricultural land, wheat 26% (1,278 ha) and corn 24.5% (1,191 ha). These crops were generally grown in rotation. About 10% of the farms had the following additional crops: processing and fresh market vegetables (92.5 ha), hay (53 ha) and pasture (36 ha). The main vegetables were tomatoes, cucumbers, green peppers, beans and peas. Barley and tobacco were minor crops. There were a few small farm bush lots but overall there is only a small amount of bush cover in the watershed. Sixty-five farms had some unimproved land that averaged 3 ha/farm and ranged in size from 0.5-12 ha. The cropping practice is uniformly distributed throughout the watershed.

### Livestock Production

Livestock production was a minor agricultural endeavour that was spread throughout the watershed in 1975. Thirty-five farms had livestock but only 21 had commercial size units (Table 1-2); these operations were small compared to those found in other watersheds (See AG-10 or AG-14). Most of the reductions in livestock operations have occurred in the last 5 years. Thirty-six farms have either drastically curtailed their livestock operation or given up feeding livestock for commercial purposes. These included 19 swine, 14 dairy, 2 beef and 1 poultry producing units.

The source of the drinking water for livestock on the 33 farms was 31 farms wells and 2 farm ponds.

### Land Preparation

Crop residues from soybean, corn and vegetables were plowed down and incorporated into the soil. Wheat and oat straw was either plowed down, removed for sale or farm use, or burned in the field.

Land was normally fall plowed (September or October) following soybeans, corn, oats, vegetables and tobacco crops. Wheat lands were plowed in July or August. Spring tillage before planting soybeans, corn and vegetables involved 2 to 4 tillage operations from March to May and for oats only 1-2 operations. Fall wheat was planted following two tillage operations in September or October. Tobacco was planted following a norm of 3 tillage operations carried out in May.

### Manure Use

Only 18 farms applied manure to 2% of the agricultural land (100 ha). The total application was 198 tonnes and was applied at a mean rate of 2 tonnes/ha to various crops (Table 1-3). Most of the manure was applied during July and August.

Manure from beef operations was handled in the solid form after being stored in open piles. Swine manure from the larger operations was stored in liquid form in concrete holding tanks, while that from the smaller operations

was stored in solid form in open piles. Most barnyard wastes were not protected from runoff by rain.

### Fertilizer Use

(i) Pre-planting or planting fertilizer. Application of fertilizer for pre-planting or at planting time occurred on 93% of farms or 57% of the agricultural land. Over 90% of the corn, wheat, vegetables, oats, barley and tobacco crop land was treated. Only 13% of the soybean hectareage was treated. The total application of fertilizer on 2,826 ha was 65,740 tonnes N, 218,052 tonnes P<sub>2</sub>O<sub>5</sub> and 161,093 tonnes K<sub>2</sub>O (Table 1-4).

Mean application rates on the different crops were: 140 kg/ha of 9-27-18 on corn in May; 109 kg/ha of 8-31-22 on wheat in September or October, 295 kg/ha of 7-21-23 on vegetables in May; 115 kg/ha of 5-20-21 on soybeans in May or October; 120 kg/ha of 10-20-16 on oats and barley in April; and 1,135 kg/ha of 5-19-10 on tobacco in May. Some corn and vegetable land was also treated in October. The use of a complete fertilizer predominated and only a few farmers applied one nutrient.

(ii) After-planting fertilizer. Mean application rates of after-planting fertilizer were: 375 kg/ha of Aeroprill (34% N) on corn in May or June; 189 kg/ha Aeroprill on hay and pasture in April; and, 262 kg/ha Aeroprill on tobacco in June. Tomatoes on 10 farms (50 ha) were generally fertilized with 77 kg/ha of 16-58-10 followed by 40 kg/ha Aeroprill, while the other vegetables (mainly cucumbers and peppers, 9 ha) were treated with 159 kg/ha of 6-24-24 followed by 73 kg/ha of Aeroprill (Table 1-5). Ten farms applied manganese at a mean rate of 8.3 kg/ha on 296 ha of soybeans

### Limestone Use

Two farms applied 122 tonnes of limestone on 27 ha of wheat; one farm applied 137 tonnes of limestone on 20 ha of sweet corn.

### Irrigation

No crops were irrigated in AG-1 during 1975.

### Pesticide Use

A wide variety of insecticides, fungicides and herbicides were applied on the various crops in AG-1 during 1975 (Table 1-6).

Herbicides were used on 90% of the soybean (1,739 ha on 84 farms), 85% of the corn (1,009 ha on 75 farms), and 4% of the cereals (60 ha on 4 farms) Treatments were made in May and June.

Insecticides were used on vegetables (34 ha on 6 farms) in the period from June to August. Fungicides were also used on vegetables (56 ha on 9 farms) in the same period, however, applications were made 2 to 5 times per crop. Herbicides were also used on vegetables (74 ha on 9 farms) applied in



the May-June period. As far as could be determined, farmers treated the crops at rates of application in accordance with O.M.A.F. publications (1-3) recommending pesticide use. A large portion of the pesticides used, especially those applied to the soil around planting time, were banded so that one-third to one-quarter the amount recommended was applied per hectare.

Planting seed was treated commercially with insecticides and fungicides in most cases. Some farmers treated their own seed; these included wheat (51), corn (45), soybean (16), oats (6), green beans (1) and peas (1). The common seed treatment was D & L (diazinon, lindane, captan), Agrox NM (maneb) and Vitaflo (carboxin).

#### Land Drainage

Because of the flat topography, the watershed requires excavated drainage ditches. About 80% of the agricultural land is tile drained. This was done systematically rather than randomly. About 75% of the tiles are spaced 8.0 to 10 m apart while the remaining 25% are set at a wider spacing. The outlets of most tile drains empty into private or municipal drains and ditches located systematically throughout the watershed.

#### Farm Residences

There were 179 farm homes scattered along the concession roads in the watershed. Most have septic tanks that can be pumped, however, some of the older homes have weeping tiles.

#### NON-AGRICULTURAL ACTIVITIES

##### Municipal Drains and Ditches

Drains and ditches occupy 2.5% of the land area. These are cleaned and maintained by the municipality. Dredging is done every 20-30 years.

##### Road Allowance

Roads cover 102 ha or 2% of the watershed. Highway 77 passes through the NW corner and continues down the west side of the watershed. Other roads were gravel surfaced township roads. In 1975, 38% of the road allowance (39 ha) was treated with herbicides (2,4-D, 2,4,5-T and paraquat).

##### Railway

The Michigan Central Railway passes through the NW corner of the watershed and occupies 3 ha.

##### Residential Homes

There were 33 residential properties located in the watershed. They were scattered along the concession roads. Most are equipped with septic tanks.

## Industrial Sites

Two institutions (9 ha) and 1 industrial site (1 ha) were located in the watershed.

## REFERENCES

- (1) 1975 Field Crop Recommendations, Publication 296, O.M.A.F.
- (2) 1975 Fruit Production Recommendation, Publication 360, O.M.A.F.
- (3) 1975 Vegetable Production Recommendation, Publication 363, O.M.A.F.
- (4) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 1-1      LAND USE IN AG-1, 1975

Crop	Area (hectares)	Farmland (%)	Farms #	Farms %	Area (ha/crop) mean	Area (ha/crop) range
Soybean	1,935	39.5	97	92	20	1 - 74
Wheat	1,278	26	72	68	18	1 - 51
Corn	1,191	24.5	89	84	13	2 - 47
Oats	117	2	22	21	5	2 - 12
Vegetables	92.5	2	14	13	7	0.5 - 16
Hay	53	1	12	11	4	1 - 8
Pasture	36	1	10	9	4	1 - 8
Barley	7	<1	1	1	7	-
Tobacco	1	<1	2	2	1	0.4 - 0.6
Unimproved Land	204.5	4	65	61	3	0.5 - 12
Agricultural Total:	4,915	100	106 <sup>a</sup>	100	46	4 - 162
Non-agricultural total:	265					
Watershed total:	5,180					

a/ some farms grew more than one crop

TABLE 1-2 LIVESTOCK IN AG-1, 1975

Livestock	Farms (#)	Livestock (#)	Livestock (#)	
			mean	range
Dairy cows	2	24	12	1 - 23
Beef cows	6	16	3	1 - 7
Beef feeders: 400-1100 lb.	3	29	10	4 - 20
400-750 lb.	8	104	13	2 - 40
750-1100 lb.	9	283	31	1 - 100
Veal calves	4	7	2	1 - 3
Swine - farrowing sows	16	246	15	2 - 43
Feeder hogs	11	2,035	185	50 - 600
Horses	7	22	3	1 - 6
Laying hens	10	2,325	233	45 - 600
Chicken: broilers & roosters	2	300	150	100 - 200
Pullets	3	800	267	250 - 300
Total:	33 <sup>a</sup>	b		

a/ some farms maintained more than one type of livestock

b/ about 395 animal units (Reference 4)

TABLE 1-3 MANURE APPLICATION TO LAND IN AG-1, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure	
				Total (tonnes)	Mean (tonnes/ha)
Wheat	48	7	4	99	2.0
Oats	13	4	11	41	3.2
Hay	27	4	51	27	1.0
Corn	9	2	1	18	2.0
Tobacco	0.6	1	60	9	15.0
Vegetables	2	1	2	4	2.0
Total:	99.6	18 <sup>a</sup>	2	198	2.0

a/ some farms applied manure to more than one crop

TABLE 1-4

PRE-PLANT AND PLANTING TIME APPLICATION  
OF FERTILIZER IN AG-1, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Nutrients (kg)		
				N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	1,174	66	99	32,708	97,652	65,677
Wheat	1,211	83	95	22,941	89,734	64,425
Vegetables	87	13	94	3,939	12,047	12,901
Soybean	242	16	13	3,080	12,325	13,075
Oats & Barley	111	18	90	2,947	5,817	4,765
Tobacco	1	2	100	125	477	250
Total:	2,826	99 <sup>a</sup>	57	65,740	218,052	161,093

a/ some farms applied fertilizer to more than one crop

TABLE 1-5

AFTER PLANTING APPLICATION OF FERTILIZER IN AG-1, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	N	Use of Nutrients (kg)	
					P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	1,188	68	100	151,470	0	0
Wheat	1,199	83	94	77,043	0	0
Vegetables	59	12	64	6,609	6,492	2,940
Oats & Barley	58	8	6	1,498	0	0
Hay & Pasture	4	1	4	155	0	0
Tobacco	1	2	100	89	0	0
Total:	2,515	99 <sup>a</sup>	51	236,864	6,492	2,940

a/ some farms applied fertilizer to more than one crop

FOLIAR APPLICATION OF MANGANESE SULPHATE

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manganese Sulphate (kg)
Soybean	296	10	15	2,458

TABLE 1-6

PESTICIDE APPLICATIONS EXPRESSED AS ACID EQUIVALENT  
OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-1, 1975

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)
Vegetables: (tomatoes, cucumbers, peppers, green beans, etc.)	Insects (aphids, hornworms, beetles, etc)	endosulfan	11	2	11
		carbaryl	9	2	6
		azinphos-methyl	21	4	4
		methoxychlor	1	1	1
		malathion	1	1	1
		chinomethionate	2.5	1	0.5
	Disease (blight, anthrac- nose, scab, etc.)	EBDC	39	6	364
		fixed copper	36	8	314
		captafol	33	6	235
	Ripening (tomato)	ethephon	4	1	5
	Weeds	trifluralin	57	9	81
		naptalam	5	3	24
		basogran	16	1	18
dinoseb		5	3	12	
<u>Corn:</u>	Weeds	atrazine <sup>a</sup>	678	38	751
		2,4-D	397	24	357
		alachlor	55	4	84
		linuron	16	2	27
		simazine	32	4	23
		cyanazine	24	1	14
		dicamba	126	9	11
		mecoprop	106	8	6
<u>Cereals:</u> (oats, wheat, etc)	Weeds	2,4-D	24	3	15
		MCPA	11	1	8
		dicamba	8	1	1
		mecoprop	8	1	1
<u>Soybean:</u>	Weeds	chloramben	1,511	74	1,841
		metribuzin	205	9	134
		trifluralin	51	5	39
		basogran	27	4	31
		linuron	41	3	16
		alachlor	7	1	8

Continued . . . . .



TABLE 1-6 (continued.....)

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)
<u>Tobacco:</u>	Weeds	trifluralin	0.6	1	0.3
<u>Pasture:</u>	Weeds	amitrole	2	1	4
<u>Fence Rows:</u>	Weeds	2,4-D	3	5	2
		2,4,5-T	1	2	1
<u>Road Allowance:</u>	Weeds	2,4-D	37	-	84
		2,4,5-T	19	-	14
		paraquat	19	-	7
Totals:		Insecticides			23.5
		Fungicides			913
		Herbicides			3,614.3

a/ 97 ha of corn were sprayed with 357 litres of oil mixed with atrazine.

TABLE 1-9  
 Location of sites of ...  
 (continued)

Site No.	Location	Area (Ac.)	Use of Pesticides (Y/N)	Year of Survey	Total Insects	Insecticides	Fungicides
1	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...
27	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...
33	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...
37	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...
39	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...
41	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...
43	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...
47	...	...	...	...	...	...	...
48	...	...	...	...	...	...	...
49	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...
51	...	...	...	...	...	...	...
52	...	...	...	...	...	...	...
53	...	...	...	...	...	...	...
54	...	...	...	...	...	...	...
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56	...	...	...	...	...	...	...
57	...	...	...	...	...	...	...
58	...	...	...	...	...	...	...
59	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
61	...	...	...	...	...	...	...
62	...	...	...	...	...	...	...
63	...	...	...	...	...	...	...
64	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...
66	...	...	...	...	...	...	...
67	...	...	...	...	...	...	...
68	...	...	...	...	...	...	...
69	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...
71	...	...	...	...	...	...	...
72	...	...	...	...	...	...	...
73	...	...	...	...	...	...	...
74	...	...	...	...	...	...	...
75	...	...	...	...	...	...	...
76	...	...	...	...	...	...	...
77	...	...	...	...	...	...	...
78	...	...	...	...	...	...	...
79	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...
81	...	...	...	...	...	...	...
82	...	...	...	...	...	...	...
83	...	...	...	...	...	...	...
84	...	...	...	...	...	...	...
85	...	...	...	...	...	...	...
86	...	...	...	...	...	...	...
87	...	...	...	...	...	...	...
88	...	...	...	...	...	...	...
89	...	...	...	...	...	...	...
90	...	...	...	...	...	...	...
91	...	...	...	...	...	...	...
92	...	...	...	...	...	...	...
93	...	...	...	...	...	...	...
94	...	...	...	...	...	...	...
95	...	...	...	...	...	...	...
96	...	...	...	...	...	...	...
97	...	...	...	...	...	...	...
98	...	...	...	...	...	...	...
99	...	...	...	...	...	...	...
100	...	...	...	...	...	...	...

87 ha of corn were surveyed with 887 liters of oil mixed with atrazine

## 2 AG-2 VENISON CREEK

### GENERAL INFORMATION

#### Location

AG-2 represents the watershed that drains Venison Creek, a tributary of Big Creek that flows into Lake Erie. The watershed is located primarily in Houghton, Middleton and North Walsingham Townships in Norfolk County, with a small section in Bayham Township, Elgin County. Venison Creek is located about 17 km south of Tilsonburg (Fig. 2-1). The general topography of the watershed is flat; the creek has cut deeply into the sandy till and has produced river flats. The soils in the area are mainly sand with areas of muck and clay in the NW section. There is very little tile drainage in the watershed.

#### Size

The total area of the watershed is 7,534 ha on which 151 farms were located. In 1975, 98% of the land (7373 ha) was in agricultural land, including municipal ditches. Of the remainder, 136 ha was road allowance and 25 ha in 35 residences and lots (mainly in the town of South Middleton), 1 church, 1 cemetery and 1 lumberyard.

#### Main Activity

Venison Creek watershed is characterized by an intensive agriculture. The main practice is cash crops, especially tobacco, corn and wheat. A small hectareage was in hay, pasture, fallow land, vegetables and soybeans. A large percentage of the agricultural land (37%) was in unimproved land.

#### Historical

The watershed has always been intensively farmed. In recent years there has been a switch to a greater hectareage of corn from tobacco, and its rotation crop rye or wheat because of restrictions in tobacco production. Livestock production has been phased out in the last decade. Aldrin and DDT were extensively used in this watershed until their restriction in 1969 and 1972 respectively.

### AGRICULTURAL ACTIVITIES

#### Crop Production

There were 151 farms in the watershed that ranged in size from 5-508 ha

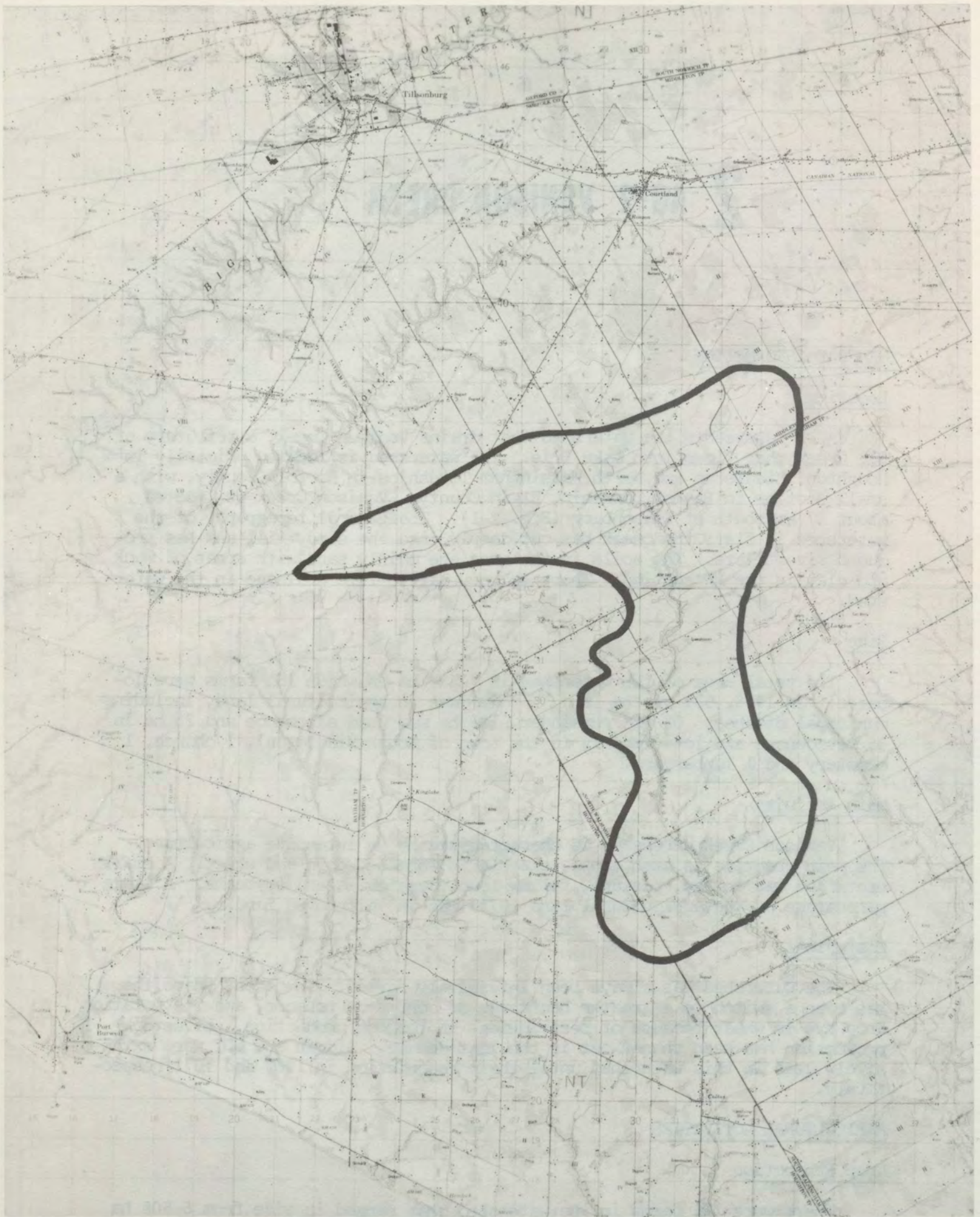


FIGURE 2-1: Location of AG-2, Venison Creek

with a mean area of 49 ha (Table 2-1). The major crops grown were tobacco and its rotation crops rye or wheat and corn. Tobacco occupied 20% (1,458 ha) of the agricultural land, wheat 13% (991 ha), rye 12% (865 ha) and corn 10% (759 ha). A lesser hectarage was planted in hay and pasture 223 ha (3%), summer fallow for nematode control in previous tobacco fields 212 ha (3%), vegetables 57 ha (1%), soybeans 44 ha (0.5%) and oats 30 ha (0.5%). Unimproved land on 145 farms (96%) accounted for 37% of the agricultural land (2,734 ha).

### Livestock Production

During 1975, only 25 farms (17%) were actively engaged in livestock production (Table 2-2). Most of these operations were small with a few animals per farm. Livestock production has been largely phased out over the last decade.

The sources for drinking water for the livestock were wells (21 farms), ponds (4 farms) and streams or ditches (3 farms).

### Land Preparation

Rye and wheat were grown as green manure for plow down prior to planting of tobacco. Tobacco, corn and vegetable residue was incorporated into the soil. Straw from wheat, rye, hay and oats was removed from the field for farm use or sale.

Land to be planted in rye and wheat was prepared by plowing followed by 2 tillage operations in September. In May these fields were plowed and tilled 2-4 times prior to planting tobacco. Corn fields were prepared for planting by plowing mainly in May and 3 tillage operations in May. All other crop land was prepared by plowing in April followed by 2-4 tillage operations in May.

### Manure Use

Most of the manure used in AG-2 during 1975 had to be brought in to the watershed from livestock areas in the east and north of the watershed, because of the low number of livestock within the watershed (Table 2-2). The incoming manure is dumped in the field in piles and is spread and worked into the soil in the spring.

Ninety-eight farms applied manure to 17% of the agricultural land with a total application of 14,864 tonnes on 1,235 ha at a mean rate of 12 tonnes/ha (Table 2-3). Tobacco was the most intensively treated crop with 1,162 ha (80% of crop) being treated at a mean application of 12 tonnes/ha. Corn (5%, 36 ha), wheat (2%, 18 ha), hay (1%, 2 ha) and various other crops (5 ha) also received treatments.

### Fertilizer Use

(i) Pre-plant or planting fertilizer. Application of fertilizer as pre-planting or at planting time occurred on 91% of the farms or 38% of the agricultural land. Over 95% of the tobacco, corn and oat land, 31% of the wheat, 18% of the rye and 1% of the hay land was treated at this time. The total

application of commercial fertilizer on 2,769 ha was 107,186 kg N, 331,074 kg  $P_2O_5$  and 408,608 kg  $K_2O$  (Table 2-4).

Mean application rate on the different crops was: 1,458 ha of tobacco was treated with 1,545 kg/ha of 2-11-15, 752 ha of corn with 880 kg/ha of 6-12-12, 304 ha of wheat with 310 kg/ha of 6-12-12 or 140 kg/ha of Aeroprill (34% N), 155 ha of rye with 85 kg/ha of Aeroprill. The other crops generally received an application of 315 kg/ha of 6-18-16. For all the crops, most of the pre-plant or planting time fertilizer was applied in April or May.

(ii) After planting. After planting fertilizer was applied to 2,603 ha of agricultural land (35%) on 124 farms (82%). The total application of this type of fertilizer was 102,887 kg N, 31,682 kg  $P_2O_5$  and 45,944 kg  $K_2O$  (Table 2-5). More than 60% of the wheat, corn and tobacco land and 48% of the rye, 11% of the hay and 2% of the other crop land was treated after planting.

Mean application rate on the different crops was: 511 ha of corn was treated with 235 kg/ha of Aeroprill (34% N) in June, 720 ha of wheat with 150 kg/ha of Aeroprill in April and May, 416 ha of rye with 125 kg/ha of Aeroprill in April or May, 909 ha of tobacco with 330 kg/ha of 2-10-14 in June, 24 ha of hay with 450 kg/ha of 5-20-20 or 100 kg/ha of Aeroprill in July. The other crops were treated at a mean rate of 115 kg/ha of Aeroprill.

Tobacco on 7 farms (205 ha) was also treated with sulfo-mag for a total application of 3,266 kg magnesium in June

#### Limestone Use

On three farms 50 ha were treated prior to planting tobacco with 75.7 tonnes of limestone. The mean application rate of limestone was 1.5 tonnes/ha.

#### Irrigation

Tobacco on 103 farms (87% of tobacco farms) was irrigated with a total of 1,291 ha being irrigated. The mean number of applications was 1.5 times per farm. No other crop was irrigated. The sources of water for irrigation were ponds (60), creeks (24), wells (4) and unspecified (15).

#### Pesticide Use

Nematodes in tobacco soil were controlled in May with 1,2-dichloropropane, 1,3-dichloropropene and related C-3 hydrocarbons (59 kg/ha) and/or methyl isothiocyanate (7.2 kg/ha).

Insecticides were applied to the tobacco to control a variety of pests. Cutworms were controlled on 1,423 ha (114 farms) in April and May with chlorpyrifos (912 ha, 75 farms) and/or leptophos (505 ha, 40 farms) at a mean rate of 1.6 kg/ha and 1.1 kg/ha respectively. Foliar insects on tobacco such as hornworms, aphids, flea beetles, grasshoppers, etc., were controlled with a variety of insecticides. A total of 1,262 ha of tobacco (87%) were treated

during July and August with one or more of endosulfan (0.9 kg/ha), *B. Thuringiensis* (0.3 kg/ha), trichlorfon (1.5 kg/ha), carbaryl (1.2 kg/ha) and malathion (0.4 kg/ha).

Herbicides were used on a variety of crops. Weeds in the tobacco were controlled on 45 ha (4 farms) with diphenamid at a mean rate of 5.8 kg/ha. Seventy percent of cereals (including wheat and rye) were treated with 2,4-D in May with 0.5 kg/ha of the acid. Corn was protected from weeds in May and June with atrazine, cyanazine, butylate and alachlor. Atrazine was sprayed on 88% of the corn at a mean rate of 2 kg/ha. Oil was used to apply the atrazine to 44% of the corn at a mean rate of 4.5 L/ha. The other herbicides used on corn were applied at 1.8-2.8 kg/ha. Linuron (1.9 kg/ha) was applied to 100% and alachlor (2.2 kg/ha) was applied to 43% of the soybeans. Weeds in white beans were eradicated with EPTC (3.5 kg/ha) and metobromuron (1.1 kg/ha). Spot treatments for weeds in hay, fallow land and waste land were made with amitrole, EPTC and paraquat.

Tobacco suckers were controlled with a variety of commercial products having fatty alcohols as the active ingredient. Most applications were made in August with one-half the farms using two applications. The mean application rate was about 18 kg/ha.

All these treatments fell within the O.M.A.F. guidelines for pesticide application (2-4).

#### Land Drainage

The topography of the watershed is fairly flat except for the areas around Venison Creek. The soils in the watershed are mainly sand with most of the runoff being natural or due to soil permeability. There is nothing consistent about the general drainage throughout the watershed. There is a small amount of tile drainage in the area with no estimate of actual area being available. Most of the drains empty into road ditches, streams, municipal drains or natural ditches. Wind erosion is a special problem in this watershed and a combination of tree planting and the planting of rye or wheat on soils after harvest is a general practice to hold the soil in place.

#### Farm Residences

There were 151 farm residences located in the watershed. Farm household wastes are collected by the municipality and delivered to a central waste disposal site located outside the watershed.

#### NON-AGRICULTURAL ACTIVITIES

##### Municipal Drains and Ditches

A large area in the north and south parts of the watershed is drained by municipal drains and ditches which cover about 21 km, while the remainder of the drainage water runs off into natural drainage courses. Approximately 9 km of three drains in the north end of the watershed were maintained and cleaned

in 1975. One new drain of about 2.5 km long in the south of the watershed was dug in 1975.

#### Road Allowance

Roads cover 136 ha or 2% of the watershed. Highway 59 crosses the NE section of the watershed for 3 km in a NS direction. All other roads were either paved or gravel surfaced township roads. New road construction on the township road between Concessions 9 and 10 cut across the watershed in a EW direction. This construction included grading, filling, ditch construction, use of binders ( $\text{CaCl}_2$ ) in conjunction with application of petroleum to the black top. This road construction could have resulted in a large amount of silt and calcium chloride being present at the measuring point of water quality parameters. In 1975, no roadside ditch cleaning or herbicide spraying was done in the watershed.

#### Railroads

There were no railroads located in the watershed.

#### Residential Homes

There were few non-agricultural residences in the watershed area. In 1975, 35 residences (22 ha) mainly in the hamlet of South Middleton were located in the watershed.

#### Industrial Sites

There were very few industries or institutions located in the watershed. A lumber yard (2 ha) and a church and cemetery (1 ha) were the only activities.

#### REFERENCES

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.
- (2) 1975 Tobacco Production Recommendations, Publication 298, O.M.A.F.
- (3) 1975 Field Crop Recommendations, Publication 296, O.M.A.F.
- (4) 1975 Vegetable Production Recommendations, Publication 363, O.M.A.F.



TABLE 2-1

## LAND USE IN AG-2, 1975

Crop	Area (hectares)	Farmland (%)	Farms (#)	Farms (%)	Area (hectares) mean	range
Tobacco	1,458	20	118	78	12	2 - 114
Wheat	991	13	72	48	13	0.5 - 156
Rye	865	12	75	50	12	1 - 32
Corn	759	10	60	40	13	0.5 - 97
Hay & Pasture	223	3	30	20	7	1 - 31
Summer fallow	212	3	35	23	6	1 - 36
Vegetables	57	1	8	5	7	2 - 20
Soybean	44	0.5	8	5	6	3 - 9
Oats	30	0.5	7	5	4	0.5 - 14
Unimproved land	2,734	37	145	96	19	0.5 - 201
Agricultural total:	7,373	100	151 <sup>a</sup>	100	49	5 - 508
Non-agricultural total:	161					
Watershed total:	7,534					

a/ some farms grew more than one crop

TABLE 2-2

## LIVESTOCK IN AG-2, 1975

Livestock	Farms (#)	Livestock (#)	Livestock (#) mean	Livestock (#) range
Dairy cows - milkers	4	8	2	1 - 3
- followers	4	13	3	2 - 4
Beef cows	7	162	27	3 - 45
Beef feeders: 400-1100 lb.	7	96	14	3 - 25
400-750 lb.	1	22	22	-
Veal calves	2	12	6	3 - 9
Swine - sows & boars	4	49	12	5 - 24
Feeder hogs	6	556	93	5 - 200
Laying hens	9	216	24	10 - 50
Horses	7	12	2	1 - 3
Pullets	1	10	10	-
Ducks	1	20	20	-
Total:	25 <sup>a</sup>	b		

a/ some farms maintained more than one type of livestock

b/ about 281 animal units (Reference 1)

TABLE 2-3

## MANURE APPLICATION TO LAND IN AG-2, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure total (tonnes)	mean (tonnes/ha)
Tobacco	1,162	93	80	13,925	12.0
Corn	36	6	5	538	14.8
Wheat	18	3	2	212	11.8
Hay	2	1	1	33	16.5
Others	5	3	-	156	9.2
Total:	1,235	98 <sup>a</sup>	17	14,864	12.0

a/ some farms applied manure to more than one crop

TABLE 2-4

PRE-PLANT AND PLANTING TIME APPLICATION  
OF FERTILIZER IN AG-2, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Nutrient (kg)		
				N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Tobacco	1,458	118	100	45,017	249,609	333,238
Corn	752	57	99	41,467	74,920	69,458
Wheat	304	23	31	13,930	418	418
Rye	155	11	18	4,888	574	336
Oats	29	6	97	713	1,946	1,946
Hay	2	1	1	33	132	132
Other	69	11	-	1,138	3,475	3,080
Total:	2,769	138 <sup>a</sup>	38	107,186	331,074	408,608

a/ some farms applied fertilizer to more than one crop

TABLE 2-5

## AFTER PLANTING APPLICATION OF FERTILIZER IN AG-2, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient (kg)	
					P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	511	36	67	40,906	-	-
Wheat	720	50	73	36,443	-	-
Rye	416	45	48	17,843	-	-
Tobacco	909	89	62	6,027	31,228	45,490
Hay	24	5	11	795	454	454
Oats	0.5	1	2	16	-	-
Other	22	3	-	857	-	-
Total:	2,602.5	124 <sup>a</sup>	35	102,887	31,682	45,944

a/ some farms applied fertilizer to more than one crop

## FOLIAR APPLICATION OF MAGNESIUM AS AFTER-PLANTING FERTILIZER

Crop	Treated (hectares)	Farms (#)	Crop (%)	kg Magnesium
Tobacco	205	7	14	3,266

TABLE 2-6 PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-2, 1975

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)
<u>Tobacco:</u>	Cutworm	chlorpyrifos	911	75	912
		leptophos	505	40	568
	Nematodes	1,2-dichloropropane + 1,3-dichloropropene	1,405	113	82,954
		methyl isothiocyanate	1,031	87	7,429
	Foliar	endosulfan	551	51	519
	Insects (hornworms, aphids, etc.)	<i>B. thuringiensis</i>	358	28	109
		trichlorfon	256	20	373
		carbaryl	77	7	91
		malathion	20	2	7
	Suckers	fatty alcohols			
(i) as n-decanol		882	74	15,366	
	(ii) as n-octanol + n-decanol	553	44	11,005	
	Weeds	diphenamid	45	4	263
<u>Cereals:</u> (wheat, rye, barley, grain)	Weeds	2,4-D	1,305	77	622
<u>Corn:</u>	Weeds	atrazine	665	42	1,289 <sup>a</sup>
		cyanazine	136	9	300
		butylate	92	7	257
		alachlor	131	9	242
<u>Soybeans:</u>	Weeds	linuron	44	8	83
		alachlor	19	3	41
<u>White bean:</u>	Weeds	EPTC	11	2	38
		metobromuron	8	1	9
<u>Hay, fallow, waste :</u>	Weeds	amitrole	22	1	50
		EPTC	3	2	6
		paraquat	1	1	1

TABLE 2-6 (continued.....)

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)
Agricultural totals:		Insecticides			2,579
		Nematacides			90,383
		Sucker control			26,371
		Herbicides			3,201

a/ atrazine was applied on 295 ha of corn on 17 farms with 1,314 L of oil (3)

Order	Family	Genus	Species	Number of specimens	Number of individuals	Number of plants	Number of fruits	Number of seeds	Number of fruits per plant	Number of seeds per fruit	
Rosales	Rosaceae	Rosa	R. blanda	100	100	100	100	100	100	100	
			R. pratincola	50	50	50	50	50	50	50	50
			R. rugosa	20	20	20	20	20	20	20	20
			R. carolina	10	10	10	10	10	10	10	10
			R. blanda	10	10	10	10	10	10	10	10
			R. blanda	10	10	10	10	10	10	10	10
			R. blanda	10	10	10	10	10	10	10	10
			R. blanda	10	10	10	10	10	10	10	10
			R. blanda	10	10	10	10	10	10	10	10
			R. blanda	10	10	10	10	10	10	10	10
Rosales	Rosaceae	Spiraea	S. alba	100	100	100	100	100	100	100	
			S. alba	50	50	50	50	50	50	50	50
			S. alba	20	20	20	20	20	20	20	20
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
Rosales	Rosaceae	Spiraea	S. alba	100	100	100	100	100	100	100	
			S. alba	50	50	50	50	50	50	50	50
			S. alba	20	20	20	20	20	20	20	20
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
Rosales	Rosaceae	Spiraea	S. alba	100	100	100	100	100	100	100	
			S. alba	50	50	50	50	50	50	50	50
			S. alba	20	20	20	20	20	20	20	20
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
Rosales	Rosaceae	Spiraea	S. alba	100	100	100	100	100	100	100	
			S. alba	50	50	50	50	50	50	50	50
			S. alba	20	20	20	20	20	20	20	20
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
Rosales	Rosaceae	Spiraea	S. alba	100	100	100	100	100	100	100	
			S. alba	50	50	50	50	50	50	50	50
			S. alba	20	20	20	20	20	20	20	20
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10
			S. alba	10	10	10	10	10	10	10	10



# 3 AG-3 LITTLE AUSABLE RIVER

## GENERAL INFORMATION

### Location

AG-3 is one of the watersheds that drains the upper reaches of Little Ausable River, a tributary of the Ausable River that flows into Lake Huron. The watershed is located in Usborne Township, Huron County and Blanshard Township, Perth County, about 29 km north of London (Fig. 3-1). The watershed is relatively flat and is composed mainly of clay loam with areas of loam and river flats. Land drainage is through both natural ditches and municipal drains.

### Size

The total area of the watershed is 5,670 ha and is occupied by 94 farms, 17 non-farm residences and a gravel pit. In 1975, 97% of the land (5,511 ha) was in agricultural use. Of the remainder, 2.5% was road allowance (137 ha) and 0.5% was residences and miscellaneous non-agricultural uses, including the gravel pit (22 ha).

### Main Activity

AG-3 is an area with small mixed and cash crop farms. Corn (field and sweet) is the main cash crop grown with lesser amounts of mixed grains, white beans, hay and pasture. There is also a small area of peas and turnips grown for sale to local commercial canners. There is a high density of livestock operations consisting primarily of dairy, beef and swine and a few small flocks of poultry and horse breeding. The watershed has a small number of non-farm dwellings.

### Historical

In the past, the watershed has been mainly small mixed farm units but presently, a greater hectarage of cash crops are produced. Livestock enterprises have always been present in the area and the trend is to fewer but larger operations.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 94 farms located in the watershed ranging in size from 1-446



FIGURE 3-1: Location of AG-3, Little Ausable River

hectares and having a mean area of 59 ha. The agricultural land use during 1975 was 32% in corn (1,776 ha), 16% in mixed grain (872 ha), 12% in white bean (686 ha), 10% in hay and alfalfa (558 ha), 8% in pasture (458 ha), 6% in barley (307 ha) and 5% in wheat (269 ha). Peas, oats and turnips accounted for 1% each of the agricultural area. Unimproved land on 74 farms (79%) accounted for 428 ha or 8% of the agricultural land (Table 3-1).

### Livestock Production

Livestock production was a major activity during 1975 with 80 farms (85%) maintaining some type of livestock operation (Table 3-2). Major livestock operations included 45 beef herds, 41 swine herds, 16 dairy herds, 2 horse farms, 7 small flocks of laying hens and 2 small flocks of chicken broilers. Several farms maintained more than one type of livestock. In the last few years, many operations changed their type of livestock production but no pattern was evident.

Sources of drinking water for livestock were 77 wells, 5 streams and ditches and 4 ponds. Generally speaking, the quality and quantity of this water was very satisfactory. However, several farms complained of lower water table levels in some years and in 1975 one farm had a creek so polluted with upstream human sewage that the water was not potable.

### Land Preparation

Crop residue from corn, mixed grain, wheat, oats and barley was either removed for silage, litter or incorporated during plow down. Most of the residue from white beans, peas and turnips was also incorporated. A small hectareage of wheat, white bean and barley residues were burned in the field.

The time of plowing and tilling of crop land prior to planting was fairly consistent throughout the watershed. Almost all the agricultural land was plowed in the fall (October and November) except wheat land that was plowed in August. Discing (2-4 times) of land to be planted to corn, mixed grain, barley and oats was carried out during May. Land to be planted to white bean, pea and turnip was tilled 2-4 times between April and June while that in wheat was tilled 2-3 times in September. Some clover was grown as a cover crop before being plowed down as green manure prior to planting white beans.

### Manure Use

Seventy-two farms applied manure to 20% of the agricultural land. A total of 30,439 tonnes of manure was applied to 1,078 ha at a mean rate of 28.2 tonnes/ha (Table 3-3). Less than 25% of crops and 71% of the hay was treated with manure. Manure was applied year round with the highest application being made in April, May, October, November and over the winter. Hay and pasture land was treated during the summer months only. Most of the manure is handled in the solid form in open piles, unprotected from runoff by rain. Storage of liquid manure is becoming more popular for the larger livestock operations.

## Fertilizer Use

(i) Pre-planting or planting fertilizer. Application of fertilizer for pre-planting or at planting time occurred on 89% of the farms or 76% of the agricultural land. Over 90% of the corn, white bean, mixed grain, barley, wheat and oats hectareage was treated while a lesser percentage of the pasture, hay, pea and turnip hectareage was treated at this time. The total application of fertilizer on 4,174 ha was 143,928 kg N, 243,468 kg  $P_2O_5$  and 167,037 kg  $K_2O$  (Table 3-4).

Mean application rate on the various crops was: 1,705 ha of corn with 320 kg/ha of 8-20-16 and 90 kg/ha Aeroprill (34% N), 655 ha of white bean with 340 kg/ha 8-17-11, 812 ha of mixed grain with 265 kg/ha of 6-18-11, 307 ha of barley with 255 kg/ha of 8-25-15, 262 ha of wheat with 265 kg/ha of 8-20-11, 153 ha of pasture with 310 kg/ha of 6-24-12, 141 ha of hay with 225 kg/ha of 8-19-16, 43 ha of peas with 450 kg/ha 8-8-16, 50 ha of oats with 250 kg/ha of 6-16-8, and 35 ha of turnip with 185 kg/ha of 5-20-17. Most of the crop hectareage was treated in the April to June period except wheat, which was fertilized in September. A small hectareage of corn, hay and alfalfa was treated during plowing in October.

(ii) After planting fertilizer. Forty-six farms fertilized 22% of agricultural land with after planting fertilizer. A large percentage of the corn (41%) and wheat (78%) was treated whereas less than 20% of the barley, mixed grain, white bean, hay and pasture was treated. The total application on 1,197 ha was 56,481 kg N, 8,339 kg  $P_2O_5$  and 5,619 kg  $K_2O$  (Table 3-5).

Nitrogen in various forms was the predominant form of after planting fertilizer. Mean application of actual N on the various crops was: 730 ha of corn with 55 kg/ha, 210 ha of wheat with 46 kg/ha, 57 ha of barley with 46 kg/ha and 6 ha of pasture with 36 kg/ha. White beans on 53 ha was treated with 250 kg/ha of 14-40-20 or 5-20-20. Mixed grain (102 ha) and hay (39 ha) was fertilized with 112 kg/ha of N or 150 kg/ha of 5-20-20.

Most of the after planting fertilizer was applied in May or June except wheat, which was fertilized in March or April.

(iii) Trace elements. Borax (11% boron) was applied at 26.6 kg/ha as soil treatments to the turnips in the June-August period to control water core or brown heart (boron deficiency). The total application on 2 farms (35 ha) was 102.5 kg B.

## Limestone Use

No limestone was used on any crop land in 1975.

## Irrigation

There was no irrigation used in AG-3 during 1975.

### Pesticide Use

Insecticides were applied in June to control root worm in corn and root maggot in turnip. Mean application rate of insecticides was: 0.8 kg/ha carbofuran, 1.5 kg/ha chlordane, 0.8 kg/ha chlorfenvinphos, 0.7 kg/ha parathion and 0.9 kg/ha metalkamate on corn; and, 25 kg/ha fensulfothion and 2.7 kg/ha carbofuran on turnips.

Herbicides were applied to corn, white beans, cereals, hay, turnips, peas and fence rows to control weeds. Application was made in the May-June period as both pre- and post emergence treatments

Mean application rate of herbicides was: 1.6 kg/ha atrazine, 2.1 kg/ha cyanazine, 1.9 kg/ha alachlor, 0.6 kg/ha simazine, 0.4 kg/ha 2,4-D, 0.15 kg/ha dicamba and 0.1 kg/ha mecoprop on corn; 1.1 kg/ha metobromuron, 2.5 kg/ha EPTC, 1.3 kg/ha trifluralin and 1.1 kg/ha basogran on white beans; 0.5 kg/ha 2,4-D, 0.7 kg/ha MCPA, 1.7 kg/ha 2,4-DB, 1.3 kg/ha dicamba and 0.9 kg/ha mecoprop on cereals and hay; 0.9 kg/ha trifluralin on turnips; 0.7 kg/ha MCPA on peas; and 1 kg/ha of 2,4-D and 2,4,5-T as spot treatments on fence rows.

### Land Drainage

There is little natural drainage in the watershed, however, it is fairly well drained by open and municipal drains. About 50% of the watershed is tile drained in a systematic pattern with a general spacing of 15 m.

In general, farmers are satisfied with the drainage although a few feel that more drains would make municipal drains more efficient. A gravel pit in the watershed had excellent water quality which supported fish life; farmers, therefore, were against a proposal to allow municipal drains to enter the pit. The depletion of woodlots and lack of reforestation caused concern among farmers who observed loss of top soil in the runoff waters and by erosion and giving rise to murky creek water.

### Farm Residences

There were 94 farm residences located in the watershed. All the residences had septic tanks for sewage disposal.

### NON-AGRICULTURAL ACTIVITIES

#### Municipal Drains and Ditches

AG-3 has poor natural drainage but the runoff is aided by municipal drains. In 1975, there was 33.5 km of municipal drains located in the watershed (see also comments on land drainage above).

#### Road Allowance

Provincial highway #23, township and county roads cover 137 ha in the watershed (2.5%). These roads were either paved or gravel surfaced.

In 1975, all 137 ha of roads were treated with 2,4-D and/or 2,4,5-T to control weeds. The provincial highway also had a soil sterilant (bromacil + 2,4-D) applied around the guide rail posts.  $\text{CaCl}_2$  is used in the winter on the roads.

#### Railway

There were no railroads located in the watershed.

#### Residential Homes

There were 52 non-farm residences located in the watershed. Most of these were located in the hamlets of Elimville and Winchelsea and occupied 13 ha. It was noted that several of these residences had large lots with uncontrolled weeds growing on them. All the homes have septic tanks for sewage disposal.

#### Industrial Sites

There were no industries located in the watershed but there was one gravel pit (6 ha) and 2 cemeteries (3 ha).

#### REFERENCES

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 3-1

## LAND USE IN AG-3, 1975

Crop	Area (hectares)	Farmland (%)	Farms		Area (hectares)	
			(#)	(%)	mean	range
Corn	1,776	32	72	77	16	2 - 255
Mixed grain	872	16	61	65	14	1 - 39
White beans	686	12	43	46	16	2 - 58
Hay & Alfalfa	558	10	49	52	11	1 - 53
Pasture	458	8	31	33	15	1 - 41
Barley	307	6	23	24	13	4 - 49
Fall Wheat	269	5	30	32	9	1 - 45
Peas	66	1	5	5	13	6 - 36
Oats	50	1	2	2	25	13 - 37
Turnips	41	1	3	3	14	4 - 30
Unimproved land	428	8	74	79	6	0.4 - 22
Agricultural total:	5,511	100	94	100	59	1 - 446
Non-agricultural total:	159					
Watershed total:	5,670					

TABLE 3-2 LIVESTOCK IN AG-3, 1975

Livestock	Farms (#)	Livestock (#)	Livestock (#)	
			mean	range
Dairy cows - milkers	16	391	24	6 - 55
- followers	15	285	19	2 - 70
Beef cows	11	82	7	1 - 20
Beef Feeders: 400-1100 lb.	44	2,764	63	5 - 230
400-750 lb.	10	545	55	2 - 120
750-1100 lb.	6	2,208	368	23 - 2000
Veal calves	1	6	6	-
Swine: sows and boars	23	543	24	1 - 60
weaners <sup>a</sup>	7	2,654	379	300 - 700
Feeder hogs	37	10,120	274	12 - 1400
Sheep, lambs & ewes	1	10	10	-
Horses	18	50	3	1 - 20
Laying hens	11	210	19	1 - 30
Broilers	2	153	77	3 - 150
Total:	80 <sup>b</sup>	c		

a/ 6-8 week old pig

b/ some farms maintained more than one type of livestock

c/ about 2,734 animal units (Reference 1)



TABLE 3-3

## MANURE APPLICATION TO LAND IN AG-3, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure total (tonnes)	mean (tonnes/ha)
Hay	397	41	71	13,512	34.0
Corn	327	45	18	8,454	25.9
Pasture	101	12	22	3,321	32.9
White Bean	119	16	17	2,009	16.9
Mixed grain	75	13	9	1,690	22.5
Barley	28	5	9	789	28.2
Wheat	25	4	9	551	22.0
Peas	6	1	9	113	18.8
Total:	1,078	72 <sup>a</sup>	20	30,439	28.2

a/

some farms applied manure to more than one crop

TABLE 3-4

PRE-PLANT AND PLANTING TIME APPLICATION  
OF FERTILIZER IN AG-3, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Nutrient (kg)		
				N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	1,705	70	96	93,529	111,528	85,648
White bean	655	41	95	17,786	37,777	23,711
Mixed grain	812	57	93	12,923	38,132	25,183
Barley	307	23	100	6,278	19,886	11,754
Wheat	262	28	97	5,463	13,880	7,738
Pasture	153	8	33	2,814	11,232	5,755
Hay	141	10	25	2,533	6,135	5,032
Peas	43	2	65	1,525	1,609	3,082
Oats	50	2	100	757	2,007	1,003
Turnip	35	2	85	320	1,282	1,111
Total:	4,174	84 <sup>a</sup>	76	143,928	243,468	167,037

a/ some farms applied fertilizer to more than one crop

BORON APPLICATION TO SOIL

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Boron (kg)
Turnip	35	2	100	102.5

TABLE 3-5

AFTER PLANTING APPLICATION OF FERTILIZER IN AG-3, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	730	29	41	39,952	1,542	868
Wheat	210	21	78	9,691	-	-
Barley	57	3	19	2,628	-	-
Mixed grain	102	7	12	1,613	1,796	1,796
White bean	53	2	8	1,443	4,319	2,500
Hay	39	2	7	938	682	455
Pasture	6	1	1	216	-	-
Total:	1,197	46 <sup>a</sup>	22	56,481	8,339	5,619

a/ some farms applied fertilizer to more than one crop

TABLE 3-6 PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-3, 1975

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)
<u>Corn:</u>	Root worm	carbofuran	598	16	484
		chlordan	234	10	350
		chlorfenvinphos	89	2	72
		parathion	77	1	52
		metalkamate	11	1	10
	Weeds	atrazine	1,229	53	1,951 <sup>a</sup>
		cyanazine	496	14	1,041
		alachlor	359	10	677
		simazine	201	15	306.5
		2,4-D	290	16	124
		dicamba	162	7	24
		mecoprop	162	7	16
	<u>White bean:</u>	Weeds	metobromuron	545	36
EPTC			152	11	373
trifluralin			109	6	141
basogran			38	2	43
<u>Cereals:</u> (wheat, oats, barley, grain, etc)	Weeds	2,4-D	596	35	299
		MCPA	338	23	246
		2,4-DB	18	1	31
		dicamba	14	1	18
		mecoprop	14	1	12
<u>Turnip:</u>	Root maggot	fensulfothion	35	2	86
		carbofuran	30	1	82
	Weeds	trifluralin	35	2	31
<u>Peas:</u>	Weeds	MCPA	36	1	26
<u>Fence Rows :</u>	Weeds	2,4-D	1	1	1
		2,4,5-T	1	1	1
<u>Agricultural totals:</u>		Insecticides			1,136
		Herbicides			5,961.5
		Fungicides			931

TABLE 3-6 (continued.....)

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)
Road Allowance	Weeds	2,4-D	137		118
		2,4,5-T	124		28
		bromacil	13		0.5

a/ atrazine was applied on 96 ha of corn on 3 farms with 1,041 L of oil.



# 4 AG-4 CANAGAGIGUE CREEK

## GENERAL INFORMATION

### Location

AG-4 represents the watershed that drains Canagagigue Creek, a tributary of the Grand River which flows into Lake Erie. The watershed is located in Peel Township, Wellington County, about 22 km north of Kitchener-Waterloo. The topography of the area is flat to gently undulating with a slight slope to the outlet in the south. The main soil type is loam with small areas of muck and river bottom flat lands. Most of the land drainage is through natural runoff, however, a small area is tile drained. There are about 19 km of municipal drains, ditches and streams in the watershed.

### Size

The total area of the watershed is 2,477 ha and is occupied by 81 farms, 12 residences and 1 school. In 1975, 98% of the land (2,428 ha) was devoted to agricultural production. County and township roads accounted for 1.3% of the area (33 ha), residences and the school accounted for 0.3% of the area (6 ha), and municipal drains and ditches accounted for 0.5% of the area (10 ha).

The main agricultural activity in AG-4 is mixed farming with predominantly dairy and lesser numbers of beef and swine operations; the main crops grown are corn for silage, small grains and hay. There are few hectares devoted to cash crop production as most crops are grown for livestock feed.

### Historical

Many of the farmers in the watershed are Traditional Mennonites; however their agricultural practices are very modern. Dairy production and mixed farming has always been the main activity. In the last few years the number of dairy cattle has increased.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 81 farms located in the watershed ranging in size from 2 to 81 ha and having a mean area of 30 ha (Table 4-1). The agricultural land use in 1975 was 32% in mixed grain (779 ha), 32% in hay (767 ha), 19% in corn (462 ha), 6% in pasture (154 ha), 4% in wheat (96 ha), and 7% in

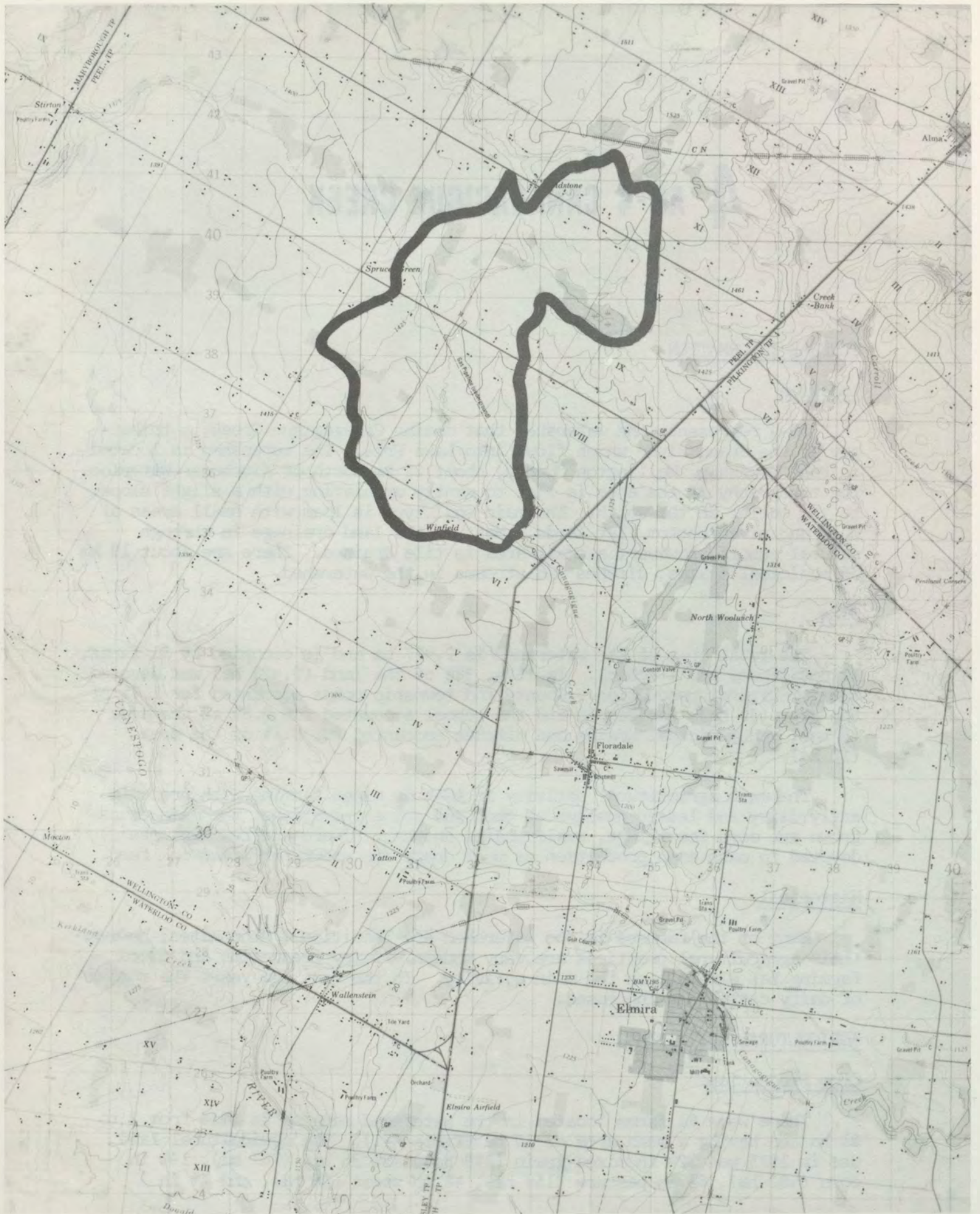


FIGURE 4-1: Location of AG-4, Canagigue Creek



unimproved land on farms (170 ha).

### Livestock Production

Livestock production was the major activity in AG-4 during 1975 with 55 farms (68%) maintaining some type of livestock operation (Table 4-2). Dairying was the main type of livestock operation; this was followed closely by beef and swine operations. Larger operations included 24 dairy herds, 33 beef herds, 34 swine herds, 16 flocks of laying hens and 1 flock of chicken broilers. Most farms maintained more than one type of livestock operation.

Sources of drinking water for livestock were 56 wells, 27 streams and ditches and 3 ponds.

### Land Preparation

The land preparation was very consistent throughout the watershed. All crop residue was removed from the field for farm use as livestock feed or litter. All crop land was prepared by plowing in October followed by 0-6 tillage operations in May.

### Manure Use

Seventy farms (86%) applied manure to 39% of the agricultural land. A total of 20,963 tonnes of manure was applied to 951 ha at a mean application rate of 22.0 tonnes/ha (Table 4-3). Generally, the manure was applied two times a year usually in April-May and July to November. Most of the manure was handled in the solid form after being stored in open piles unprotected from rain runoff. There were a few liquid manure tanks located in the watershed.

### Fertilizer Use

(i) Pre-planting or planting time fertilizer. Application of fertilizer for pre-planting or at planting time occurred on 70 farms (86%) or 58% of the agricultural land. Over 94% of the corn and mixed grain was treated whereas less than 35% of the hay, wheat and pasture was treated. The total application of fertilizer on 1,420 ha was 24,916 kg N, 57,246 kg P<sub>2</sub>O<sub>5</sub> and 52,920 kg K<sub>2</sub>O (Table 4-4).

Mean application rate on the different crops was: 432 ha of corn with 280 kg/ha of 12-16-14, 732 ha of mixed grain with 170 kg/ha of 7-26-16, 217 ha of hay with 160 kg/ha of 5-14-43, 34 ha of wheat 165 kg/ha of 6-16-15 and 5 ha of pasture with 225 kg/ha of 7-13-10. Most of the crop hectares were treated in May except hay, which was fertilized over the summer.

(ii) After planting. Six farms (7%) fertilized 4% of the agricultural land with after planting fertilizer. The total application on 99 ha was 5,653 kg N (Table 4-5). Twenty percent of the corn and 1% of the mixed grain was treated in May and June.

Mean application rate on the various crops was: 91 ha of corn with 173 kg/ha of Aeroprill (34% N) and 8 ha of mixed grain with 110 kg/ha of Aeroprill.

#### Limestone Use

There was no limestone applied in AG-4 in 1975.

#### Irrigation

No land was irrigated in AG-4 during 1975.

#### Pesticide Use

Herbicides were applied in May and June to control weeds in mixed grain and corn crops (Table 4-6). Mean application rate of herbicides was: 0.5 kg/ha of 2,4-D and 1.3 kg/ha of MCPA on 328 and 151 ha respectively of mixed grain; and 2.6 kg/ha of atrazine, 2.5 kg/ha of alachlor, 1.5 kg/ha of cyanazine and 1.1 kg/ha of cyprazine on 353, 13, 13 and 16 ha respectively of corn.

One small apple orchard (0.4 ha) was treated with 5 kg/ha of captan and 0.8 kg/ha of dodine to control diseases and 3.8 kg/ha of carbaryl and 1.3 kg/ha of phosalone to control insects. These pesticides were applied in the summer months.

#### Land Drainage

Most of the runoff and land drainage in the watershed occurs naturally; about 20% of the area being tile drained in a ratio of 50% random and 50% systematic.

#### Farm Residences

There were 81 farm residences located in the watershed. The farm homes have septic tanks with weeping tile for sewage disposal.

#### NON-AGRICULTURAL ACTIVITIES

##### Municipal Drains and Ditches

Municipal drains, ditches and streams cover approximately 0.4% (10 ha) of the watershed. The total length of such drains is about 19 km.

##### Road Allowance

Municipal and township roads, which were paved or gravel stabilized, cover 33 ha (1.3%) of the watershed. All the road allowance was treated with 2,4-D and 2,4,5-T for weed control.

##### Railroad

There were no railroads located in the watershed.

### Residential Homes

There were 12 residential homes and lots occupying 5 ha or 0.3% of the watershed. Most of the residences were located along the northern concession road. All the homes have septic tanks and weeping tiles for sewage disposal.

### Industrial Sites

There was a small gravel pit (0.5 ha) located in the watershed. An underground gas pipeline crosses the watershed in a NW-SE direction.

### Institutions

There was one school (1 ha) located in the watershed.

### REFERENCES

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 4-1      LAND USE IN AG-4, 1975

Crop	Area (hectares)	Farmland (%)	Farms		Area (hectares)	
			(#)	(%)	mean	range
Mixed grain	779	32	62	77	12.5	1.5 - 40
Hay	767	32	67	83	11.5	2 - 31
Corn	462	19	45	56	10	2 - 43
Pasture	154	6	27	33	6	1 - 14
Wheat	96	4	11	14	9	1 - 14
Unimproved land	170	7	31	38	5.5	1 - 16
Agricultural total: 2,428		100	81	100	30	2 - 81
Non-Agricultural total: 49						
Watershed total: 2,477						

TABLE 4-2

## LIVESTOCK IN AG-4, 1975

Livestock	Farms (#)	Livestock (#)	Livestock mean	Livestock (#) range
Dairy cows - milkers	33	578	18	1 - 43
- followers	24	520	22	1 - 60
Beef cows	10	177	18	4 - 36
Beef feeders: 400-1100 lb.	24	1,012	42	4 - 138
400-750 lb.	12	356	30	2 - 60
750-1100 lb.	13	402	31	5 - 120
Veal calves	8	81	10	1 - 30
Swine- sows and boars	19	286	15	1 - 53
Feeder hogs	33	3,461	105	6 - 500
Sheep, ewes	1	7	7	-
Horses	20	95	5	1 - 14
Laying hens	18	1,555	86	12 - 350
Broilers	2	301	151	1 - 300
Pullets	1	7	7	-
Geese	2	47	24	2 - 45
Ducks	1	9	9	-
Total:	55 <sup>a</sup>	b		

a/ some farms maintained more than one type of livestock  
b/ about 1,865 animal units (Reference 1)

TABLE 4-3

## MANURE APPLICATION TO LAND IN AG-4, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of total (tonnes)	Manure mean (tonnes/ha)
Corn	343	39	74	8,411	24.5
Hay	343	41	45	6,787	19.8
Mixed grain	151	22	19	3,313	21.9
Wheat	60	8	63	1,281	21.4
Pasture	54	12	35	1,171	21.7
Total:	951	70 <sup>a</sup>	39	20,963	22.0

a/ some farms applied manure to more than one crop

TABLE 4-4 PRE-PLANT AND PLANTING TIME APPLICATION OF FERTILIZER IN AG-4, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrients P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	432	42	94	14,107	19,334	16,915
Mixed grain	732	60	94	8,660	32,156	20,074
Hay	217	23	28	1,736	4,713	14,971
Wheat	34	4	35	335	897	848
Pasture	5	2	3	78	146	112
Total:	1,420	70 <sup>a</sup>	58	24,916	57,246	52,920

a/ some farms applied fertilizer to more than one crop

TABLE 4-5 AFTER PLANTING APPLICATION OF FERTILIZER IN AG-4, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	91	5	20	5,353	-	-
Mixed grain	8	2	1	300	-	-
Total:	99	6 <sup>a</sup>	4	5,653	-	-

a/ some farms applied fertilizer to more than one crop

TABLE 4-6

PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT OR  
ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-4, 1975.

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)	
<u>Mixed grain</u>	Weeds	2,4-D	328	28	157	
		MCPA	151	10	201	
<u>Corn</u>	Weeds	atrazine	353	37	932	
		alachlor	13	2	33	
		cyanazine	13	2	19	
		cyprazine	16	1	18	
<u>Apple Orchard</u>	Disease	captan	0.4	1	2	
		dodine	0.4	1	0.3	
	Insects	carbaryl	0.4	1	1.5	
		phosalone	0.4	1	0.5	
	Agricultural total:		Herbicides			1,360
			Fungicides			2.3
		Insecticides			2.0	
Road allowance						
	Weeds	2,4-D			17.5	
		2,4,5-T			17.5	



# 5 AG-5 HOLIDAY CREEK

## GENERAL INFORMATION

### Location

AG-5 represents the watershed that drains Holiday Creek, a tributary of the Upper Thames River which flows into Lake St. Clair. The watershed is located in Zorra Township, Oxford County, about 12 km east of London (Fig. 5-1). The topography of the watershed is gently rolling with the soils being mainly silt loam and loam with areas of muck and river bottom flat lands. Almost all the watershed is tile drained.

### Size

The total area of the watershed is 2,950 ha and is occupied by 52 farms. In 1976, 96% of the land (2,840 ha) was in agricultural use. The remaining 4% was occupied by road allowance (61 ha, 2%), municipal drains (40 ha, 1.5%), railroad (16 ha), 3 residences not on farms (1 ha) and one cemetery (2 ha).

About 20% of the land (595 ha) on 13 farms and 9 parcels of land was unaccounted for by the questionnaires and the land use for this area was therefore estimated from air photographs. Land use activities such as nutrient and pesticide use were calculated on a pro rated basis from known data on other farms in the watershed. The whole survey was carried out in 1976.

### Main Activities

The land use in AG-5 is characterized by a moderate density of dairy cattle (compared to the rest of Oxford County) and some corn is grown as a cash crop. A few farms produced small grains and hay which were primarily grown for livestock feed. Three farms in the SE corner grew mixed vegetables including beans, peppers, cabbage, brussel sprouts and potatoes.

### Historical

The agriculture practice within the watershed is not high intensity (compared to the rest of Oxford County) because of the poor natural drainage. In the last few years, farm grants have been used to install or improve municipal ditches and drains and thus the area of usable land for agriculture has increased. Livestock production has been a major activity in the area for the last 25 years or longer. Since 1970, the number of swine operations

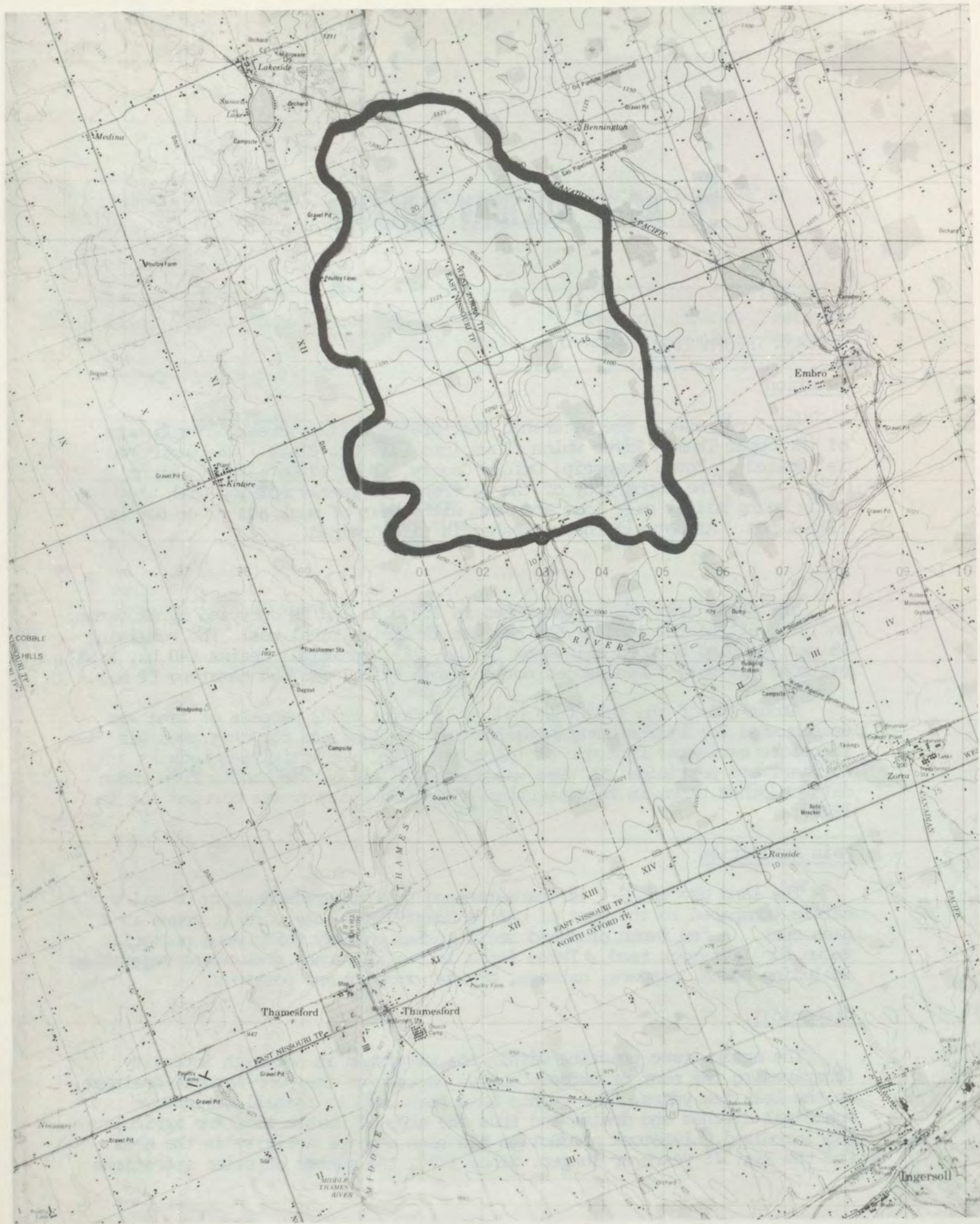


FIGURE 5-1: Location of AG-5, Holiday Creek

have decreased while the number of dairy herds have increased. In the last few years more corn has been grown as a cash crop.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 52 farms in the watershed that ranged in size from 6-162 ha with a mean area of 55 ha. The major crops grown were corn, hay and pasture, and some small grains (Table 5-1). Corn occupied 44% (1,249 ha) of the agricultural land, hay and pasture 21% (588 ha), mixed grains (oats and barley) 5% (152 ha), oats alone 4% (116 ha), barley alone 3% (75 ha), vegetables 4% (107 ha), alfalfa and hay 2.5% (84 ha), and wheat 0.5% (16 ha). Unimproved land on 39 farms accounted for 16% of the agricultural land (453 ha).

### Livestock Production

The livestock density in the watershed was large, consisting mainly of dairy, beef and swine productions. The dairy cattle density was lower than most of the surrounding areas of Oxford County. Among the livestock operations were 22 dairy herds (25 farms with followers), 17 beef herds, 6 swine herds, 1 flock of laying hens and 1 flock of chicken broilers. The large broiler operation was located beside the Creek. A total of 34 farms (65%) had some type of livestock on the property (Table 5-2).

All 34 farms used wells as their source of drinking water for the livestock.

### Land Preparation

Crop residue from corn, barley and vegetables was plowed down or removed for litter or feeding. The residue from mixed grain, oats, wheat and hay was removed for sale or farm use. Land in use for corn and mixed grain production was prepared by plowing in the spring (April-May) or in the fall (September-October). Barley and oat land was prepared by plowing followed by 2 tillage operations in April or May. Wheat was planted following plowing and tilling in August or September.

### Manure Use

Thirty farms applied manure to 18% of the agricultural land with a total application of 10,081 tonnes on 499 ha. Corn, hay and pasture, mixed grain, oats and barley alone, alfalfa and wheat crop land received manure at a mean rate of about 20.2 tonnes/ha (Table 5-3). Most of the manure was applied all year round rather than being stored for seasonal application. Some of the manure was sold to the tobacco areas (AG-2) south of the watershed.

Manure that was stored was piled in the open in the solid form and was unprotected from runoff by rain.

### Fertilizer Use

- (i) Pre-plant or planting fertilizer. Application of fertilizer for pre-

planting or at planting time occurred on 92% of the farms or 64% of the agricultural land. Over 90% of the corn, vegetables, mixed grain, barley and wheat and 31% of the alfalfa, hay and pasture and 65% of the oats received pre-planting fertilizer or were fertilized at planting time. The total application of commercial fertilizer on 1,816 ha was 104,311 kg N, 108,323 kg P<sub>2</sub>O<sub>5</sub> and 90,273 kg K<sub>2</sub>O (Table 5-4).

Mean application rate on the different crops was: 1,199 ha of corn treated with 200-300 kg/ha of a combination of N, K<sub>2</sub>O and a complete fertilizer; 205 ha of alfalfa, hay and pasture, 75 ha of barley and 75 ha of oats with 240 kg/ha of 6-21-21; 107 ha of vegetables with 730 kg/ha of 5-12-12; 139 ha of mixed grain with 320 kg/ha of 6-14-14; and 16 ha of wheat with 400 kg/ha of 6-12-12.

Most of this type of fertilizer was applied in April or May, except in the case of wheat where application was made in September and vegetables where application was made in May or June.

(ii) After planting. After planting fertilizer was applied to 566 ha or 16% of the agricultural land on 16 farms. The total application of fertilizer was 30,190 kg N, 5,150 kg P<sub>2</sub>O<sub>5</sub> and 15,864 kg K<sub>2</sub>O. Less than 40% of corn, alfalfa, hay and pasture, and barley land was treated at this time (Table 5-5).

Mean application rate on the different crops was: 475 ha of corn with mainly 62 kg/ha N (various forms) and some K<sub>2</sub>O and P<sub>2</sub>O<sub>5</sub>; 81 ha of alfalfa, hay and pasture with 200-400 kg/ha of various nutrients; and 10 ha of barley with 25 kg/ha of N. Corn and barley land was treated in June whereas the alfalfa, hay and pasture was fertilized in the April-August period.

One farm used sulphate of potash magnesia to raise the pH of the soil.

#### Limestone Use

No lime was used in AG-5 during 1976.

#### Irrigation

No crops were irrigated in 1976.

#### Pesticide Use

Mean application rate of insecticides on vegetables for foliar insect control during June was: 1.1 kg/ha of endosulfan and *B. thuringiensis*; and 0.6 kg/ha of diazinon. Mean application of insecticides for corn root borer control in May or June was: 0.7 kg/ha of carborufan; 0.6 kg/ha of phorate; and 0.9 kg/ha of metalkamate (Table 5-6).

Herbicides were used to control weeds in vegetables, corn and cereals. Mean application rate on the various crops was: 1.4 kg/ha of EPTC and metobromuron, 1.0 kg/ha of trifluralin and dinitramine, and 0.9 kg/ha of linuron on vegetables; 1.6 kg/ha of atrazine, 1.8 kg/ha of cyanazine, and 1.1 kg/ha of simazine on corn; and, 0.5 kg/ha a.e. of 2,4-D, 0.6 kg/ha a.e. of MCPA and 2,4-DB. Amitrole was

used as spot treatment to control weeds at 0.3 kg/ha before planting cereals. Herbicides were used as pre- or post emergence treatments in May or June.

### Land Drainage

The topography of the land is gently rolling with the soils being mainly a mixture of loam and silt loam with areas of muck and river bottom flat lands. Almost the whole watershed is tile drained. The tiles are located systematically and are generally spaced at 24 m. The tiles empty into municipal drains and ditches located throughout the watershed.

In the last few years, due to farm grants, the drainage in the watershed has been improved allowing more intensive agriculture.

### Farm Residences

There were 52 farm residences located in the watershed; all homes have septic tank systems which were installed in the last 10-15 years.

### NON-AGRICULTURAL ACTIVITIES

#### Municipal Drains and Ditches

Almost all the watershed is drained by municipal ditches and drains which are located throughout the area. Three new drains were installed and improvements to up-grade others were made in 1975-76. About 1.5% of the watershed area (40 ha) is taken by by municipal drains and ditches.

#### Road Allowance

The road allowance covers 61 ha or 2% of the watershed area. All concession roads were paved or gravel stabilized. In 1976, all the road allowance was sprayed with 2,4-D and 2,4,5-T.

#### Railroads

The CPR railroad passes in an EW direction across the top of the watershed occupying 16 ha.

#### Residential Homes

There were only 3 residences (about 1 ha) located at one intersection in the watershed. These homes have septic tanks for sewage disposal.

#### Industrial Sites

There were no non-agricultural activities located in the watershed.

### REFERENCES

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 5-1 LAND USE IN AG-5, 1976

Crop	Area (hectares)	Farmland (%)	Farms		Area (hectares)	
			(#)	(%)	mean	range
Corn	1,249	44	40	77	31	2 - 122
Hay and pasture	588	21	33	63	18	4 - 40
Mixed grain	152	5	13	25	12	4 - 20
Oats	116	4	7	13	17	6 - 40
Vegetables	107	4	3	6	36	12 - 51
Barley	75	3	7	13	11	7 - 18
Alfalfa	45	1.5	4	8	11	4 - 30
Hay	39	1	5	10	8	3 - 20
Wheat	16	0.5	5	10	3	2 - 6
Unimproved land <sup>a</sup>	453	16	39	75	22	0.5 - 30
Agricultural total:	2,840	100	52 <sup>b</sup>	100	55	6 - 162
Non-agricultural total:	110					
Watershed total:	2,950					

a/ includes river flats, forest, fence rows, unimproved land, etc.

b/ some farms grew more than one crop

TABLE 5-2

LIVESTOCK IN AG-5, 1976

Livestock	Farms (#)	Livestock (#)	Livestock (#) mean	Livestock (#) range
Dairy cows - milkers	22	747	34	15 - 60
- followers	25	878	35	2 - 130
Beef cows	3	41	14	10 - 21
Beef feeders: 400-1100 lb.	10	772	77	5 - 400
400-750 lb.	5	619	124	9 - 450
750-1100 lb.	4	297	74	5 - 250
Veal calves	2	30	15	10 - 20
Swine - sows and boars	4	104	164	5 - 550
Feeder hogs	5	2,515	503	40 - 1800
Laying hens	1	1,500	1,500	-
Chicken broilers	1	160,000	160,000	-
Horses	3	17	6	2 - 13
Total:	34 <sup>a</sup>	b		

a/ some farms maintained more than one type of livestock

b/ about 1,787 animal units (Reference 1)

TABLE 5-3 MANURE APPLICATION TO LAND IN AG-5, 1976

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure	
				total (tonnes)	mean (tonnes/ha)
Corn	366	25	37	7,461	20.4
Hay & pasture	61	8	15	1,188	19.5
Mixed grain	27.5	2	18	526	19.1
Barley	19	2	25	290	15.3
Alfalfa	9	2	20	290	32.2
Oats	8	2	7	181	22.6
Wheat	8.5	2	53	145	17.1
Total:	499	30 <sup>a</sup>	18	10,081	20.2

a/ some farms applied manure to more than one crop



TABLE 5-4

PRE-PLANT AND PLANTING TIME APPLICATION  
OF FERTILIZER IN AG-5, 1976

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	1,199	39	96	92,299	73,595	66,533
Vegetables	107	3	100	3,903	9,443	9,443
Alfalfa, hay and pasture	205	11	31	3,018	10,488	10,102
Mixed grain	139	12	91	2,614	6,428	6,301
Barley	75	7	100	1,125	3,825	3,539
Oats	75	6	65	972	3,741	3,741
Wheat	16	5	100	380	803	716
Total:	1,816	48 <sup>a</sup>	64	104,311	108,323	90,273

a/ some farms applied fertilizer to more than one crop

TABLE 5-5 AFTER PLANTING APPLICATION OF FERTILIZER IN AG-5, 1976

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Nutrient (kg)		
				N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	475	14	38	29,422	1,145	9,381
Alfalfa, hay and pasture	81	7	18	518	3,705	6,483
Barley	10	1	13	250	-	-
Total:	566	16 <sup>a</sup>	16	30,190	5,150	15,864

a/ some farms applied fertilizer to more than one crop

TABLE 5-6

PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT  
OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-5, 1976

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)
Vegetables: (beans, peppers, cabbage, potato, brussel sprouts)	Foliar Insects	endosulfan	28	3	32
		<i>B. thuringiensis</i>	8	3	9
		diazinon	10	3	6
	Weeds	EPTC	51	1	71
		metobromuron	51	1	71
		trifluralin	24	3	24
		dinitramine	16	2	16
		linuron	8	1	7
	Corn:	Corn root borer	carbofuran	159	3
phorate			164	5	105
metalkamate			8	1	7
Weeds		atrazine	964	42	1,939 <sup>a</sup>
		alachlor	535	15	1,072
		cyanazine	164	11	382
		simazine	16	1	18
Cereals: (oats, barley, mixed grain, hay)		Weeds	2,4-D	172	12
	MCPA		28	4	16
	2,4-DB		5	1	3
	amitrole		3	1	1
Agriculture Total:		Insecticides			276
		Herbicides			3,713
Road allowance					
	Weeds	2,4-D			101
		2,4,5-T			50.5

a/ 10 farms also treated 267 ha of corn with  
2,175 litres of oil.



# 6 AG-6 TRIBUTARY OF UPPER MAITLAND RIVER

## GENERAL INFORMATION

### Location

AG-6 represents the watershed that drains into the Upper Maitland River (2 km east of Gorrie) which then flows into Lake Huron. The watershed is located in Howick Township, Huron County and Minto Township, Wellington County about 13 km west of Mount Forest (Fig. 6-1). The watershed has gently rolling hills and has loam, silt loam and muck soils. The drainage in the watershed is imperfect and is aided by open ditches and municipal drains. About 25% of the land is randomly tile drained.

### Size

The total area of the watershed is 5,230 ha and is occupied by 111 farms, 38 non-farm residences, a trailer-campground, non-farm woodlots, a gravel pit and a township dump. In 1975, 96% of the land (5,026 ha) was in agricultural use. Provincial and township roads occupied 2% of the area (109 ha), non-farm woodlots occupied 1% (50 ha) and miscellaneous activities such as residences (20 ha), trailer park (15 ha), municipal dump (5 ha), a gravel pit (4 ha), and railroad (1 ha) accounted for the other 1% of the area.

### Main Activity

Land use in AG-6 is characterized by a livestock orientated agriculture, with most of the land supporting livestock and growing crops to support livestock operations. The main form of farming is the raising of beef cattle from beef cow-calf operations and the production of milk from dairy cow-calf herds fed on pasture in the summer and fed silage and hay in barns during the winter.

### Historical

The watershed has always supported a large density of livestock. The trend in this area seems to be toward more corn being grown and towards larger beef feedlots. The poultry production has always been on a small scale and is gradually diminishing. There are more and more part-time farmers moving into the area.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 111 farms located in the watershed that ranged in size from



FIGURE 6-1: Location of AG-6, Tributary of Upper Maitland River

0.4 to 182 ha and having a mean area of 45 ha. The agricultural land use during 1975 was 19% in mixed grain (936 ha), 19% in hay (933 ha), 16% in pasture (815 ha), 13% in corn (641 ha) and 4% in barley (228 ha). Ninety-six farms (86%) had some unimproved land (29%, 1,473 ha) on their farms (Table 6-1). Many of these farmers were small part-time operators working in urban centres outside the watershed.

### Livestock Production

Livestock production was the major agricultural activity in AG-6 during 1975, with 78 farms (70%) maintaining some type of livestock operation (Table 6-2). Major livestock operations included 33 dairy herds, 48 beef herds, 39 swine herds and 12 flocks of poultry. In the last few years there has been a trend towards larger beef operations consisting of feedlots with several operations changing from beef to dairy.

Sources of drinking water for the livestock were 71 wells, 23 streams and ditches, and 17 ponds.

### Land Preparation

Most of the crop residue from mixed grain, corn and barley was removed from the field for livestock silage or litter. A small hectareage of corn residue was incorporated into the soil during plow down. Land for mixed grain, corn and barley was prepared by plowing in September, October or May. Tillings (1-4 times) of land for the same crops took place in May.

### Manure Use

Manure was applied on 62 farms (56%) to 894 ha of agricultural land (18%). Crop land treated with manure included 371 ha of hay, 167 ha of corn, 181 ha of mixed grain, 131 ha of pasture, and 44 ha of barley (Table 6-3). A total of 23,164 tonnes of manure was applied to the land at a mean rate of 26 tonnes/ha. More than one half of the manure was applied in April, May, September and October, whereas the rest was applied year round. Most of the manure is handled in the solid form, in piles stored outside the barn unprotected from runoff by rain. There are a few liquid manure tanks in the watershed, and the manure is pumped out once or twice a year for spreading on the land.

One farm applied sludge to 32 ha of corn. The total application of sludge was 133 tonnes at a mean rate of 4.2 tonnes/ha. The source of this sludge was the sewage plant located in Harriston.

### Fertilizer Use

(i) Pre-plant or planting fertilizer. Application of fertilizer as pre-planting or at planting time occurred on 77 farms (69%) or 36% of the agricultural land. Most of the corn, mixed grain and barley was treated whereas only about 5% of the pasture and hay was treated in May. The total application of commercial fertilizer on 1,794 ha was 41,750 kg N, 63,415 kg P<sub>2</sub>O<sub>5</sub>, and 73,492 kg K<sub>2</sub>O (Table 6-4).

Mean application rate on the different crops was: 596 ha of corn with 255 kg/ha of 15-17-17, 887 ha of mixed grain with 325 kg/ha of 5-10-12, 217 ha of barley with 205 kg/ha of 10-15-14, 51 ha of pasture with 72 kg/ha of 10-27-60, and 43 ha of hay with 232 kg/ha potash (60% K<sub>2</sub>O).

(ii) After planting. After planting fertilizer was applied in June to 157 ha of corn (24%) on 8 farms. The total application was 17,480 kg N and the mean application was 326 kg/ha Aeroprill (34% N).

#### Limestone

Two farms applied lime on 57 ha at a mean rate of 225 kg/ha. The total application on corn, mixed grain and hay was 12,802 kg.

#### Irrigation

There was no irrigation of any crop in 1975.

#### Pesticide Use

In 1975, only herbicides were used in AG-6 to eradicate weeds in mixed grain, corn, barley and trefoil. A total of 1,866 kg of herbicides were applied as pre and post-emergence treatments to the agricultural land (Table 6-6). Mean application on the crops was: 0.5 kg/ha of 2,4-D, 0.4 kg/ha of MCPA, 1.2 kg/ha of 2,4-DB, and 1.1 kg/ha of alachlor on mixed grain; 1.8 kg/ha of atrazine, 3.4 kg/ha of butylate and 1.0 kg/ha of cyanazine on corn; 1.4 kg/ha of diallate on barley; and 0.8 kg/ha of paraquat on trefoil.

#### Land Drainage

The topography of AG-6 is gently rolling hills with the soils being composed of loam, silt loam and muck. Although there is a fair amount of natural drainage, most of the runoff is through open ditches and municipal drains. About 25% of the land is tile drained with most of these tiles being randomly spaced.

#### Farm Residences

There were 111 farm residences located in the watershed. All the homes have septic tanks and weeping beds which are properly installed.

#### NON-AGRICULTURAL ACTIVITIES

##### Municipal Drains and Ditches

Although there is a fair amount of natural drainage in the area, the general drainage is through a number of open ditches and municipal drains. There was about 16 km of municipal drains and 4.5 km of municipal streams located in the watershed. In 1975, no new drains were installed or old ones cleaned.



### Road Allowance

Roads cover 109 ha or 2% of the watershed. These roads consisted of Highway 87 which was paved, and gravel surfaced township and county roads. In 1975, all 109 ha of roads were treated with 2,4-D and 2,4,5-T to control weeds.

### Railroads

The Canadian Pacific Railroad crosses a very small section in the extreme north part of the watershed occupying about 1 ha.

### Residential Homes

There were 38 non-farm residences located in the watershed and these occupy 20 ha. These homes have septic tanks and weeping beds which are properly installed.

A few farms in the watershed are being sold to city people for summer homes. Some of the new owners are digging ponds in spring water areas and stocking their ponds with fish. Most of these owners are renting the surrounding land as pasture to neighbouring farmers.

### Recreational Areas

There is a trailer park and camp ground covering 15 ha located in the NW corner of the watershed.

### Industrial Sites

There were no industrial sites located in the watershed in 1975. There was one gravel pit (4 ha) and the Howick Township dump (5 ha) which was located off Highway 87 in the south of the watershed.

### REFERENCES

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 6-1 LAND USE IN AG-6, 1975

Crop	Area (hectares)	Farmland (%)	Farms		Area (hectares)	
			#	%	mean	range
Mixed grain	936	19	71	64	13	1 - 35
Hay	933	19	73	66	13	0.5 - 47
Pasture	815	16	66	59	12	1.5 - 45
Corn	641	13	58	52	11	1.5 - 49
Barley	228	4	10	9	23	6.5 - 36
Unimproved land	1,473	29	96	86	15	1 - 85
Agricultural total:	5,026	100	111 <sup>a</sup>	100	45	0.4 - 182
Non-agricultural total:	204					
Watershed total:	5,230					

a/ some farms grew more than one crop

TABLE 6-2

## LIVESTOCK IN AG-6, 1975

Livestock	Farms (#)	Livestock (#)	Livestock (#) mean	Livestock (#) range
Dairy cows - milkers	36	917	26	2 - 69
- followers	31	618	21	1 - 75
Beef cows	24	579	24	1 - 126
Beef feeders: 400-1100 lb.	32	1,473	46	2 - 220
400-750 lb.	26	599	23	2 - 98
750 - 1100 lb.	8	383	48	7 - 130
Veal calves	1	5	5	-
Swine: sows and boars	34	646	19	1 - 73
Feeder hogs	20	5,024	251	10 - 1,000
Sheep, ewes, lambs	1	21	21	-
Horses	18	36	2	1 - 6
Laying hens	13	1,005	77	8 - 200
Broilers	1	20	20	-
Pullets	2	200	100	50 - 150
Total:	78 <sup>a</sup>	b	-	-

a/ some farms maintained more than one type of livestock

b/ about 2,685 animal units (Reference 1)

TABLE 6-3 MANURE APPLICATION TO LAND IN AG-6, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure	
				total (tonnes)	mean (tonnes/ha)
Hay	371	38	40	10,119	27.3
Corn	167	26	26	5,018	30.0
Mixed grain	181	23	19	4,520	25.0
Pasture	131	17	16	2,385	18.2
Barley	44	3	19	1,122	25.5
Total:	894	62 <sup>a</sup>	18	23,164	25.9

a/ some farms applied manure to more than one crop

<sup>a</sup> SLUDGE APPLICATION TO LAND IN AG-6, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Sludge	
				total (tonnes)	mean (tonnes/ha)
Corn	32	1	5	133	4.2

a/ probably from sewage plant in Harriston

TABLE 6-4 PRE-PLANT AND PLANTING TIME APPLICATION OF FERTILIZER IN AG-6, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient (kg)	
					P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	596	49	93	22,235	25,702	25,942
Mixed grain	887	60	95	14,432	29,240	33,315
Barley	217	9	95	4,605	6,654	6,064
Pasture	51	5	6	369	1,001	2,198
Hay	43	6	5	109	818	5,973
Total:	1,794	77 <sup>a</sup>	36	41,750	63,415	73,492

a/ some farms applied fertilizer to more than one crop

TABLE 6-5 AFTER PLANTING APPLICATION OF FERTILIZER IN AG-6, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient (kg)	
					P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	157	8	24	17,480	-	-
Total:	157	8	24	17,480	-	-

Two farms also applied agricultural gypsum (65 ha, 14,619 kg) and sulphur (28 ha, 480 kg)

TABLE 6-6

PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT  
OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-6, 1975

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)
<u>Mixed grain</u>	Weeds	2,4-D	515	36	260
		MCPA	372	24	162
		2,4-DB	74	6	90
		alachlor	10	1	11
<u>Corn</u>	Weeds	atrazine	543	44	1,001
		butylate	73	3	245
		cyanazine	6	1	6
<u>Barley</u>	Weeds	diallate	26	1	37
<u>Trefoil</u>	Weeds	paraquat	10	1	8
Agricultural total:		Herbicides			1,820
Road Allowance		2,4-D			44
		2,4,5-T			22

# 7 AG-7 SHELTER VALLEY CREEK

## GENERAL INFORMATION

### Location

AG-7 represents the watershed that drains Shelter Valley Creek which flows into Lake Ontario. The watershed is located in Haldimand Township, Northumberland County, about 32 km east of Trenton (Fig. 7-1). The watershed lies on undulating topography with soils being mainly sandy loam with areas of loam and sand. Almost all the watershed is naturally drained.

### Size

The total area of the watershed is 6,236 ha and is occupied by 75 farms, 127 homes and residential lots, recreational areas and Crown Land. In 1975, 77% of the land (4,810 ha) was in agricultural use. Provincial highways, county and township roads accounted for 2.5% of the area (155 ha), residential homes and lots accounted for 3% (190 ha), churches, cemeteries and parks accounted for 2.5% (154 ha), recreational areas accounted for 1% (47 ha), and Trans-Canada Pipeland Co. accounted for 0.5% (23.5 ha). Crown Land, forest and woodlots on 61 properties not on farm land accounted for 13.5% (856.5 ha).

### Main Activity

Land use in Shelter Valley Watershed is characterized by non-intensive general agriculture. Some individual farms, producing primarily tobacco and corn, are an exception to the general situation. A large hectarage is also covered by woodlands and swamp unsuitable for agriculture. The remainder of the land holdings are characterized by a livestock orientated agricultural activity.

More detailed information on the activities in the watershed may be found in "Resource Study of Shelter Valley Creek and its Tributaries, 1974" (1).

### Historical

Today a large portion of the land is being held by landowners not deriving a major income from agriculture. This group includes non-farm people using the area for recreation, part-time farmers with full-time jobs outside the watershed, and retired or semi-retired farmers operating on a reduced scale.

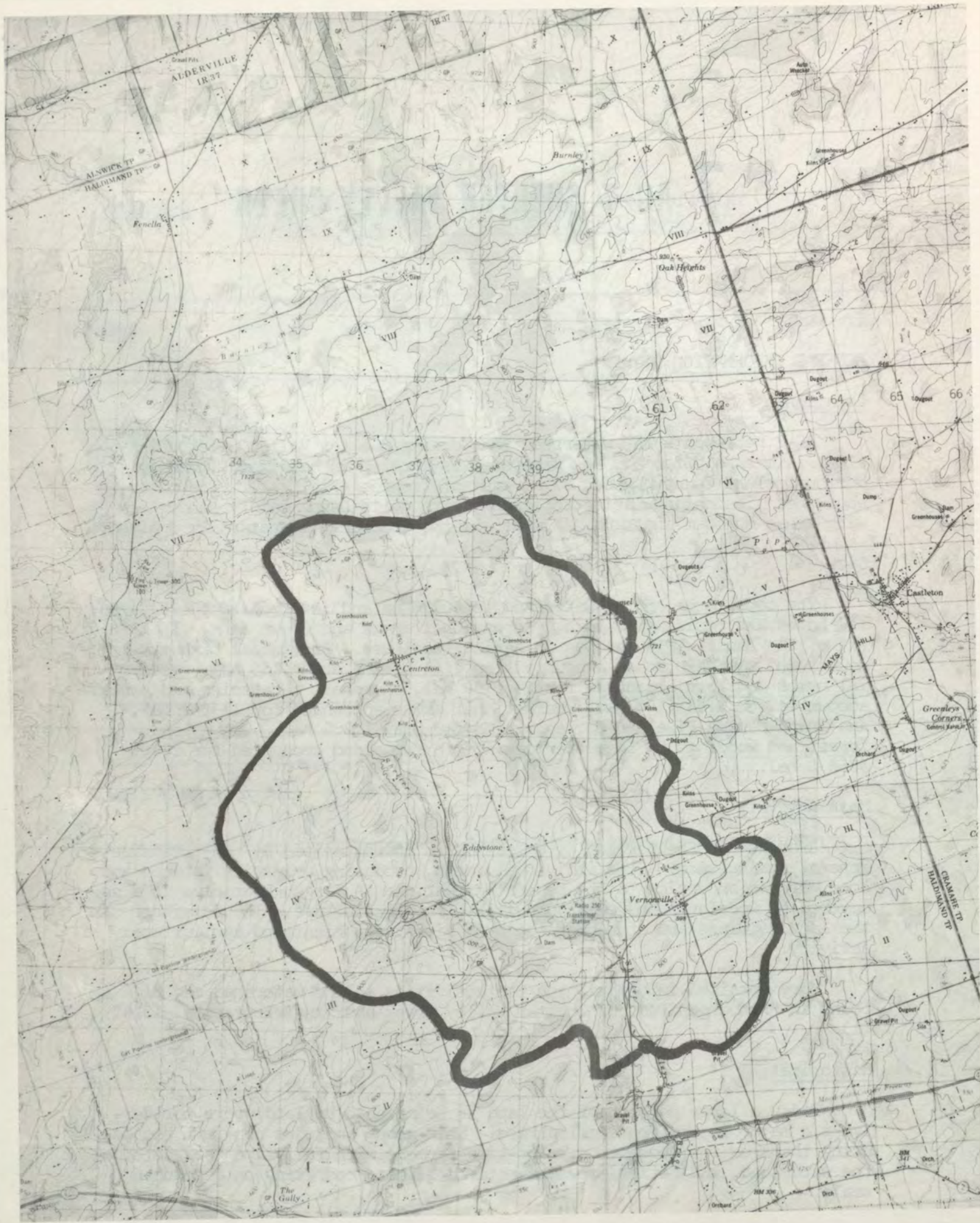


FIGURE 7-1: Location of AG-7, Shelter Valley Creek



Tobacco hectareage has tended to decline significantly from 1960, reflecting hectareage restrictions and shifting of production rights from this area to southwestern Ontario (see AG-2). Since 1970 the number of tobacco farms and tobacco rights has stabilized, but the actual hectareage has continued to decline.

The remainder of the land has remained as hobby farms, pasture and livestock units and a few cash crop units. Of the farmers surveyed, the farms are being used more for agriculture than in the past (see also Reference 1).

### AGRICULTURAL ACTIVITIES

#### Crop Production

There were 75 farms in the watershed varying in size from 4.5 - 371 ha and having a mean area of 64 ha. The agricultural land use during 1975 was 23% in pasture (1,094 ha), 14% in hay (681 ha), 13% in corn (649 ha), 5% in oats alone (249 ha), 4% in rye (177 ha), 3% in fallow land (134 ha), 3% in barley alone (130 ha), 2% in tobacco (95 ha), 1% in mixed grain (66 ha), 1% in wheat (45 ha), and 31% (1,486 ha) in unimproved land on farms (Table 7-1).

#### Livestock Production

Livestock production was a major activity during 1975, with 54 farms (72%) maintaining some type of livestock operation (Table 7-2). Many of these farms were small, home-use operations having less than 5 large animals. Larger livestock operations included 28 beef herds, 8 swine herds, 5 poultry flocks, 4 dairy herds and 3 sheep flocks. Production of beef was reduced during 1975 with several farms having more beef cows than feeder cattle. In the last few years, fewer farms have had livestock operations.

Sources of drinking water for livestock were 36 wells, 20 streams and ditches, and 8 ponds.

#### Land Preparation

Disposition of crop residue depended on the crop and the subsequent use of the land. Crop residue from corn, tobacco, wheat and hay was incorporated into the soil, whereas that from oats, grain and barley was removed for sale or farm use. Rye was grown over the winter and was plowed down as green manure mainly for tobacco.

Oats were planted after plowing mainly in September and tilling 2 - 3 times in April. Corn land was prepared by plowing in September or April followed by 1-4 tillage operations in April or May. Winter barley and wheat were planted after the land was plowed and tilled in September. Rye was planted after 1 tillage operation in September. The rye was plowed down in the spring and after 2-7 tillage operations in April and May, tobacco was planted.

### Manure Use

Thirty-three farms applied manure to 13% of the agricultural land. A total of 4,763 tonnes of manure applied to 613 ha at a mean application rate of only 7.8 tonnes/ha (Table 7-3). Most of the manure was applied in March to May. Manure application to wheat and oats was done in August or September.

Most of the manure was handled in the solid form except one large beef operation which used a liquid manure system.

### Fertilizer Use

(i) Pre-planting or planting fertilizer. Application of fertilizer as pre-planting or at planting time occurred on 47% of the farms or 30% of the agricultural land. Over 80% of the corn, mixed grain, tobacco, oats and wheat hectarage was treated, while less than 25% of the pasture, barley and rye hectarage was treated. The total application of fertilizer on 1,444 ha was 60,264 kg of N, 84,196 kg of  $P_2O_5$  and 108,736 kg of  $K_2O$  (Table 7-4).

Mean application rate on the various crop hectarages was: 638 ha of corn with 325 kg/ha of 18-18-18 (although about one-quarter of the farms applied part of their N as AeroPrill), 278 ha of hay with 383 kg/ha of 5-13-18, 203 ha of oats with 100 kg/ha of 9-15-15, 95 ha of tobacco with 1,200 kg/ha of 3-18-34, 73 ha of pasture with 247 kg/ha of 15-15-15, 63 ha of mixed grain with 720 kg/ha of 15-15-15, 37 ha of wheat and 29 ha of barley with 273 kg/ha of 12-15-15, and 28 ha of rye with 115 kg/ha of AeroPrill (34% N). Most crop hectarages were treated in April or May except wheat and rye hectarages which were fertilized in August.

(ii) After planting fertilizer. Eleven farms fertilized 7% of the agricultural land with after planting fertilizer. The total application on 331 ha was 31,184 kg of N, 1,565 kg of  $P_2O_5$  and 2,138 kg of  $K_2O$  (Table 7-5).

Mean application rate on the various crop hectarages was: 245 ha of corn with 356 kg/ha of AeroPrill, 53 ha of tobacco with 193 kg/ha of 3-14-19, 26 ha of rye with 114 kg/ha of AeroPrill, and 7 ha of pasture with 145 kg/ha of 15-15-15. Most land was fertilized in May.

Two tobacco farms applied magnesium to the soil while one farm used boron on corn.

### Limestone Use

No limestone was used on any crop land in 1975.

### Irrigation

Six farms irrigated 78 ha of tobacco at a mean application rate of 2.2 times. Ponds were the source of water.

### Pesticide Use

Insecticides were applied to tobacco to control a variety of pests (Table 7-6). Cutworms were controlled in May with chlorpyrifos (51 ha) on 4 farms at a mean rate of 0.82 kg/ha and leptophos (32 ha) on 2 farms at a mean rate of 0.75 kg/ha. Tobacco crops were protected in May against nematodes with 1,2-dichloropropane and 1,3-dichloropropene and related C3-hydrocarbons (70.5 ha, 7 farms) at a mean rate of 112 kg/ha and methyl isothiocyanate (38.5 ha, 4 farms) at a mean rate of 11 kg/ha. Foliar insects such as hornworms, aphids and beetles were controlled during the summer on 27 ha with 1.1 kg/ha of endosulfan. Fatty alcohols to control suckers were applied at a rate of 28 kg/ha in August to 27 ha on 2 farms. No herbicides were applied to tobacco fields.

Herbicides were applied in May and June to cereals (138 ha), and corn (638 ha). Mean application rate of herbicides was: 0.52 kg/ha of 2,4-D and 0.45 kg/ha of MCPA on cereals, and on corn 2.1 kg/ha of cyanazine, 3.0 kg/ha of butylate, 1.3 kg/ha of atrazine and 1.1 kg/ha of alachlor.

### Land Drainage

About 90% of the drainage in the watershed is by natural surface runoff or soil permeability. Of the remainder, at least two-thirds is natural drainage assisted by open ditching to eliminate small marsh areas. Only 250-325 ha is estimated to be tile drained.

### Farm Residences

There were 75 farm residences located in the watershed. All the farm residences have septic tanks.

### NON-AGRICULTURAL ACTIVITIES

#### Municipal Drains and Ditches

There were no municipal ditches or drains located in the watershed.

#### Road Allowance

Provincial highway 401 and township and county roads cover 155 ha in the watershed (2.5%). Highway 401, which covers 5.5 ha, was treated with 2 kg of picloram.

In 1975, major road construction and widening activities took place throughout the summer and fall as part of the rebuilding of Shelter Valley Road which runs directly beside Shelter Valley Creek for much of its length.

#### Railway

There were no railroads located in the watershed.

### Residential Homes

There were 127 homes and residential lots located in the watershed. Most of the residences were located in the towns of Centreton and Vernonville. All these homes have septic tanks.

### Industrial Sites

Trans Canada Pipeline Co. owned 23.5 ha (0.5%) which was used as a pumping station. This company was in the process during 1975 of constructing a pipeline on its right-of-way which crosses the watershed at its widest part. Herbicide was applied to the 23.5 ha in the amount of 224 kg 2,4-D.

### REFERENCES

- (1) Resource Study of Shelter Valley Creek and its Tributaries, submitted to Lower Trent Region Conservation Authority, September 1974.
- (2) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 7-1 LAND USE IN AG-7, 1975

Crop	Area (hectares)	Farmland (%)	Farms		Area (ha/crop)	
			#	%	mean	range
Pasture	1,094	23	43	57	25.5	2 - 162
Hay	681	14	44	59	15.5	2 - 61
Corn	649	13	22	29	29.5	0.2 - 109
Oats	249	5	24	32	10	2 - 81
Rye	177	4	7	9	25	19 - 41
Fallow	134	3	6	8	22	8 - 49
Barley	130	3	4	5	17.5	5 - 101
Tobacco	95	2	7	9	13.5	10 - 17
Mixed grain	66	1	5	7	13	3 - 20
Wheat	45	1	6	8	7.5	2 - 14
Fruit & Vegetables	4	-	5	7	0.7	0.4 - 1.2
Unimproved Land	1,486	31	65	87	23	0.8 - 117
Agricultural total:	4,810	100	75 <sup>a</sup>	100	64	4.5 - 371
Non-agricultural total:	1,426					
Watershed total:	6,236					

a/  
some farms grew more than one crop

TABLE 7-2 LIVESTOCK IN AG-7, 1975

Livestock	Farms (#)	Livestock (#)	Livestock (#) mean	Livestock (#) range
Dairy cows - milkers	7	188	27	1 - 72
- followers	4	230	58	25 - 100
Beef cows	32	724	23	1 - 140
Beef feeders: 400-1100 lb.	19	877	46	4 - 400
400-750 lb.	17	284	17	2 - 80
750-1100 lb.	5	97	19	3 - 50
Veal calves	1	5	5	-
Swine - sows & boars	8	349	44	1 - 200
Feeder hogs	9	1,840	204	1 - 650
Sheep, ewes, lambs	3	157	2	3 - 95
Horses	17	47	3	1 - 8
Goats	1	2	2	-
Laying Hens	5	70	14	10 - 20
Broilers	1	50	50	-
Pullets	2	33	17	8 - 25
Turkey Hens	1	8	8	-
Geese	2	8	4	-
Ducks	1	100	100	-
Total	54 <sup>a</sup>	b		

a/ some farms maintained more than one type of livestock  
b/ about 1744 animal units (Reference 2)

TABLE 7-3      MANURE APPLICATION TO LAND IN AG-7, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure	
				total (tonnes)	mean (tonnes/ha)
Corn	360	16	55	2,334	6.5
Hay	121	8	18	744	6.1
Oats	56	7	22	698	12.5
Tobacco	32	3	34	612	19.1
Rye	12	1	7	272	22.7
Wheat	21	2	47	73	3.5
Pasture	9	1	1	19	2.1
Fruit & Vegetables	2	2	50	11	5.5
Total:	613	33 <sup>a</sup>	13	4,763	7.8

a/ some farms applied manure to more than one crop

TABLE 7-4

PRE-PLANT AND PLANTING TIME APPLICATION OF  
FERTILIZER IN AG-7, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Nutrients (kg)		
				N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	638	18	98	37,771	30,537	39,741
Mixed Grain	63	4	95	6,420	6,783	6,783
Hay	278	8	41	4,812	18,015	25,139
Tobacco	95	7	100	3,402	20,411	28,623
Pasture	73	1	7	2,700	2,700	2,700
Oats	203	1	82	1,764	3,096	3,096
Wheat	37	4	82	1,167	1,508	1,508
Barley	29	3	22	1,146	1,146	1,146
Rye	28	1	17	1,082	-	-
Total:	1,444	35 <sup>a</sup>	30	60,264	84,196	108,736

a/ some farms applied fertilizer to more than one crop



TABLE 7-5

## AFTER PLANTING APPLICATION OF FERTILIZER IN AG-7, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Nutrients (kg)		
				N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	245	5	38	29,719	-	-
Rye	26	1	15	1,005	-	-
Tobacco	53	4	56	307	1,412	1,985
Pasture	7	1	0.6	153	153	153
Total:	331	11	7	31,184	1,565	2,138

TABLE 7-6

PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT  
OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-7, 1975

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)
<u>Tobacco:</u>	Cutworms	chlorpyrifos	51	4	42
		leptophos	32	2	24
	Nematodes	1,2-dichloropropane + 1,3-dichloropropene	70.5	7	7,902
		methyl isothio- cyanate	38.5	4	424
	Foliar Insects (hornworms, aphids, etc)	endosulfan	27	2	29
Sucker control	fatty alcohols (as n-decanol)	27	2	749	
<u>Cereals:</u>	Weeds	2,4-D	138	8	71.5
		MCPA	138	14	62
<u>Corn:</u>	Weeds	cyanazine	297	7	613
		butylate	204	4	611
		atrazine	370	14	475
		alachlor	145	6	163
<u>Agricultural Totals:</u>		Insecticides			95
		Herbicides			1,995.5
		Nematicides			8,326
		Sucker control			749
<u>Road Allowance:</u>					
	Weeds	picloram			2
<u>Industrial Site:</u>					
	Weeds	2,4-D			224

# 8 AG-10 NORTH CREEK

## GENERAL INFORMATION

### Location

AG-10 represents the watershed that drains North Creek, a tributary of Twenty Mile Creek that flows into Jordan Harbour and thus to Lake Ontario. North Creek is located in West Lincoln Township, the Regional Municipality of Niagara, approximately 13 km south of the town Grimsby and just west of the town of Smithville (Fig. 8-1).

### Size

The total area of the watershed is 2,980 ha on which 96 farms and 64 residential homes are located. The area is composed of agricultural land, 2,879 ha (96.5%); road allowance, 74.5 ha (2.5%); and, residential lots, 26.5 ha (1%).

### Main Activity

North Creek watershed represents an area of low intensity agriculture being mainly dairy farms with some intensive poultry and swine operations. Livestock manure is being returned to the soil. The soil is a Haldiman clay loam, with poor natural drainage and hence does not lend itself to intensive cash cropping. Most of the crops are fed to livestock, although some are sold as cash crops.

### Historical

The land use pattern in AG-10 has not changed significantly in the last few years. There are an increasing number of absentee land-owners which results in either idle land or land being rented to existing farm operators for crop production. Twenty-seven farms were purchased in the last 10 years with the mean purchase date being 1971. The number of livestock operations have increased in recent years. The use of fertilizer, manure and pesticide appears to have remained fairly constant over the past 20 years.

## AGRICULTURAL ACTIVITIES

### Crop Production

The main crops grown were for the support of livestock operations (Table 8-1). The mean area per farm was 30 ha, with 96 farms ranging in size from 2.5 to 164 ha. Thirty-three percent of the farm land (962 ha) was

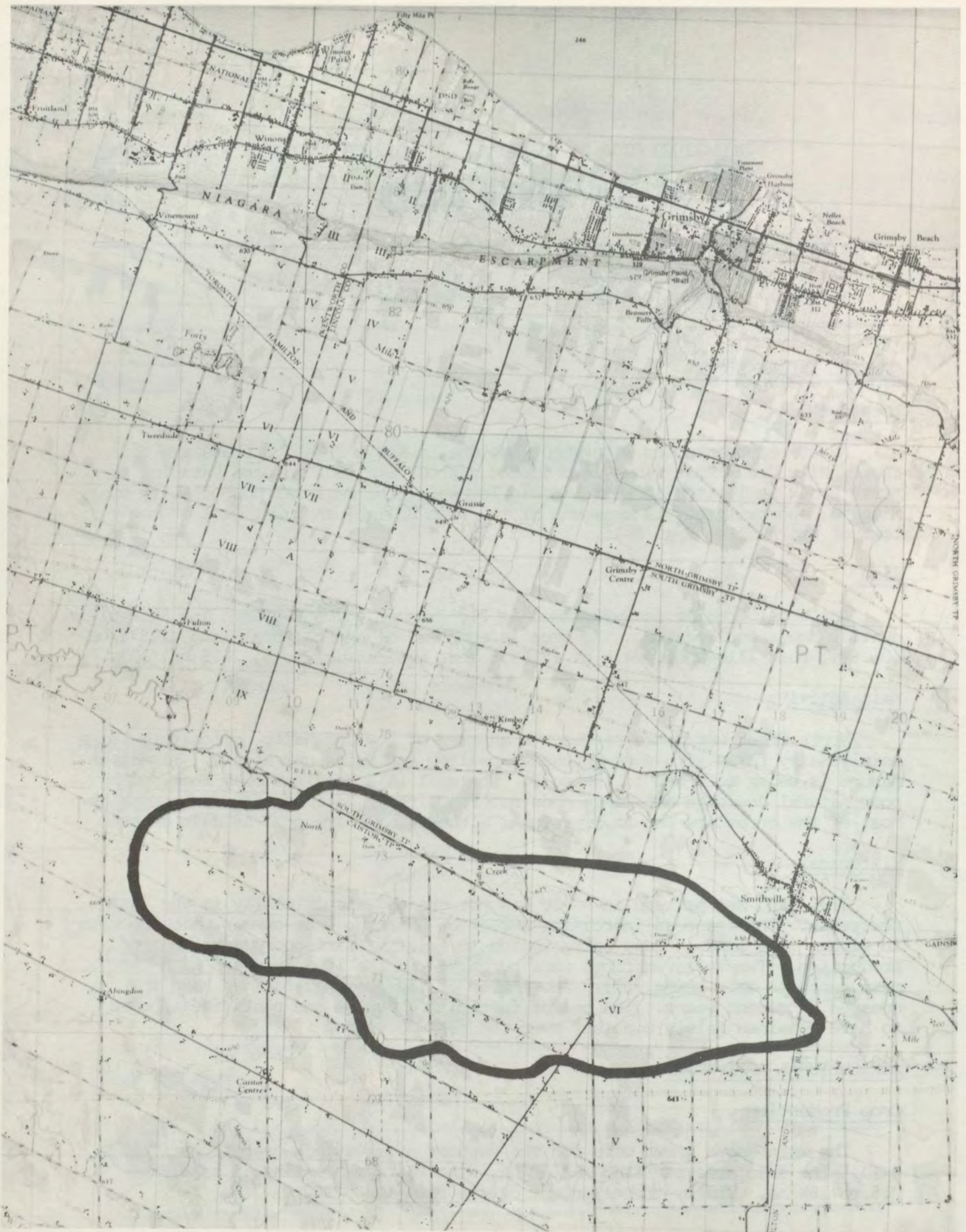


FIGURE 8-1: Location of AG-10, North Creek

in hay, 17% (484 ha) was in corn, 12.5% (355 ha) was pasture, and 10.5% (299 ha) was in oats. Wheat, fallow land, barley, mixed grain and grapes accounted for 250 ha (8%). Seventy-eight percent of the farms had some unimproved land that accounted for 529 ha (19% farm land).

### Livestock Production

Livestock units were the prime agricultural activity in AG-10 (Table 8-2). Twenty-six farms were in dairy, 18 farms were in poultry (6 major operations), 8 farms were in swine (5 major operations), and 6 farms were in beef. Seventy farms (73%) had some livestock during 1975. In general, the poultry operations turned their chicken broilers over 4 times whereas the feeder hogs were taken to market 3 times during 1975. There was one mink operation. The sources of drinking water for the livestock were wells (55 farms), ponds (12), cisterns (8), and streams or ditches (4).

Most of the livestock operations have been going on for the last 20 years. Many farmers reported that they have increased their number of livestock in the last 5 years, with several large operations beginning in that period.

### Land Preparation

All farms incorporated their crop residue from corn, wheat, oats and barley into the soil by plowing. Corn, oats and barley fields were fall plowed in October (1974) and were tilled 2-4 times in May in preparation for planting. Wheat fields were usually plowed in July. Land preparation for wheat involved 4-9 tillage operations in August and September before planting.

### Manure Use

Most of the manure from the livestock was returned to the land to supplement or replace commercial fertilizer, however, only 19% of the agricultural land was so treated (Table 8-3). Manure was applied to corn, pasture, hay, oats and wheat. A total of 13,489 tonnes of manure was applied to 536 ha on 44 farms at a mean rate of 25.2 tonnes/ha. The manure was applied to the land at various times of the year. Land for corn received one treatment, usually in the fall or spring, while land for wheat received one treatment in July or August. Hay, pasture, oats and barley usually received two treatments, usually once in March-April and once in August-November.

Manure from one large poultry and one large swine operation close to Smithville was sold outside the watershed. In the past, there have been problems with the odour arising from the application of manure to the land in the vicinity of the urban population (Smithville).

### Fertilizer Use

(i) Pre-planting or planting fertilizer. The use of fertilizer before or at planting occurred on 42 farms or 32% of the agricultural land. On 933 ha of farmland 26,348 tonnes N, 37,610 tonnes  $P_2O_5$ , and 17,217 tonnes  $K_2O$  were applied (Table 8-4).

Mean application rates on the different crops were: 62% of the corn at 350 kg/ha of 10-19-7 in May; 88% of the oats at 210 kg/ha of 10-15-9 in May; 26% of the pasture land at 125 kg/ha of 34-8-8 in the Spring; 18% of the hay at 115 kg/ha of 19-14-7 in the spring or fall; 61% of the wheat at 285 kg/ha of 9-19-7 in August; 82% of the barley at 280 kg/ha at 10-17-20 in May; and, 13% of the mixed grain at 225 kg/ha of 8-16-0 in May. An N-P-K fertilizer was the predominant form of nutrient applied during 1975.

(ii) After planting fertilizer. Only corn and wheat were side or top dressed with fertilizer after planting. Corn was treated at a rate of 218 kg/ha Aeroprill (34% N) on 36% of the crop during June, while 35% of the wheat was treated with 96 kg/ha of Aeroprill in March or April (Table 8-5).

#### Limestone Use

Three farms applied lime to their land. Two farms treated 17.5 ha of corn with 17 tonnes of lime. One farm (6 ha) treated oats with 99 tonnes of lime.

#### Irrigation

There was no irrigation used in AG-10 during 1975.

#### Pesticide Use

Herbicides were the only pesticides used in AG-10 during 1975. Corn, mixed grain and oats were treated mainly in June. Atrazine (497 kg) was applied on 12 farms to 258 ha corn (53%) at a rate of 1.9 kg/ha, while one farm (67 ha, 14%) applied 150 kg of butylate at a rate of 2.2 kg/ha. Eight farms treated 107 ha of oats or mixed grain (33%) at a rate of 0.5 kg/ha 2,4-D and 5 farms treated 60 ha of oats (20%) with 0.5 kg/ha of 2,4-DB (Table 8-6).

#### Land Drainage

Most of the runoff occurs through natural topographical drainage and a few private open ditches that feed into North Creek. There is no tile drainage. Private drains exist to drain some milk houses. Organic waste from milk rooms often form live gels that completely fill tiles and thus these wastes go directly to private ditches acting as disposal sites for wastes. Due to the impervious nature of the heavy clay soil vertical percolation of such wastes is very slow.

#### Farm Residences

There are 96 farm homes located in the watershed. Waste is disposed of in septic tanks.

#### NON-AGRICULTURAL ACTIVITIES

##### Municipal Drains and Ditches

There were no municipal ditches or drains.

### Road Allowance

No major highways pass through the watershed. The great majority were gravel surfaced township roads. Road allowances covered 2.5% (74.5 ha) of the watershed. No herbicides were used on these allowances during 1975. Many of the roads are arteries to the urban centres of Hamilton and St. Catharines as well as the Queen Elizabeth Highway. Salting of a few intersections occurred in the winter of 1975. These roads were sanded with gravel.

### Railways

The Toronto, Hamilton and Buffalo Railway traverses the east end of the watershed for 1 km.

### Residential Properties

There are 64 residential homes located in the watershed. Most are concentrated in the northern part of the watershed, increasing in density towards Hamilton in the west. About 50% of the residences have been built in the last 20 years. All the residences have a septic tank system and about 80% have dry wells.

### Industrial Sites

An underground oil pipeline traverses the entire width of the watershed in an East-West direction.

### REFERENCE

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 8-1 LAND USE IN AG-10, 1975

Crop	Area (hectares)	Farmland (%)	Farms		Area (ha/crop)	
			(#)	(%)	mean	range
Háy	962	33.5	57	59	17	1 - 63
Corn	484	17	28	29	17	3 - 67
Pasture	355	12.5	33	34	11	1.5 - 38
Oats	299	10.5	30	31	10	2 - 24
Wheat	120	4	17	18	7	2 - 16
Fallow	60	2	5	5	12	8 - 20
Barley	38	1	5	5	7.5	1.5 - 16
Mixed grain	30	1	3	3	10	8 - 12.5
Grapes	2	<1	1	1	2	-
Unimproved land	529	18.5	75	78	7	0.4 - 40
Agricultural total:	2,879	100	96 <sup>a</sup>	100	30	0.5 - 164
Non-agricultural total:	101					
Watershed total:	2,980					

a/ some farms had more than one crop



TABLE 8-2

## LIVESTOCK IN AG-10, 1975

Livestock annual basis (a) marketed basis (m)		Farms (#)	Livestock (#)	Livestock mean	(#) range
Dairy cows - milkers	(a)	26	721	28	1 - 100
- followers	(a)	26	737	28	1 - 100
Beef cows	(a)	17	500	29	1 - 70
Bulls	(a)	1	1	1	-
Beef feeders:400-1100 lb.	(m)	6	65	11	4 - 15
400-750 lb.	(m)	4	27	8	3 - 10
750-1100 lb.	(m)	6	44	7	4 - 12
Veal calves	(a)	3	206	69	2 - 200
	(m)	5	674	135	3 - 600
Swine - sows & boars	(a)	4	79	20	15 - 29
Feeder hogs	(a)	4	811	203	1 - 500
	(m)	6	3,170	528	130 -1500
Weaner pigs	(m)	2	600	300	-
Sheep - ewes & lambs	(a)	8	530	66	10 - 200
	(m)	2	115	58	45 - 70
Horses	(a)	18	120	7	2 - 60
Laying hens	(a)	18	15,377	854	3 -10,000
Chicken broilers	(a)	3	49,000	16,333	13,000 -20,000
	(m)	3	203,000	67,667	48,000 -80,000
Turkey - hens	(a)	1	21,000	21,000	-
- broilers	(m)	1	54,000	54,000	-
Geese	(a)	1	8	8	-
Ducks	(a)	4	31	8	4 - 15

Continued . . . . .

TABLE 8-2 (continued....)

Livestock annual basis (a) marketed basis (m)	Farms (#)	Livestock (#)	Livestock (#)	
			mean	range
Mink	(a) 1	1,000	1,000	-
	(m) 1	750	750	-
Total:		70 <sup>a</sup>	b	

a/ some farms had more than one type of livestock

b/ about 2,770 animal units (Reference 1)

TABLE 8-3

## MANURE APPLICATION TO LAND IN AG-10, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure total (tonnes)	Manure mean (tonnes/ha)
Corn	252	20	52	6,473	25.7
Pasture	94	14	26.5	2,935	31.2
Hay	113	16	11	2,393	21.2
Oats	41	8	8	869	21.2
Wheat	32	5	26.5	747	23.3
Barley	2	1	5	36	18.0
Grapes	2	1	100	36	18.0
Total:	536	44 <sup>a</sup>	18.5	13,489	25.2

a/ some farms applied manure to more than one crop

TABLE 8-4 PRE-PLANT AND PLANTING TIME APPLICATION OF FERTILIZER IN AG-10, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	300	22	62	10,383	20,107	7,480
Oats	264	26	88	5,536	8,523	5,026
Pasture	91	6	26	3,878	825	825
Hay	170	10	18	3,708	2,666	1,359
Wheat	73	10	61	1,899	3,906	1,467
Barley	31	4	82	871	1,438	1,060
Mixed grain	4	1	13	73	145	0
Total:	933	42 <sup>a</sup>	32	26,348	37,610	17,217

a/ some farms applied fertilizer to more than one crop

TABLE 8-5 AFTER PLANTING APPLICATION OF FERTILIZER IN AG-10, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	172	10	36	12,784	-	-
Wheat	42	4	35	1,375	-	-
Total:	214	14	7	14,159	-	-

TABLE 8-6

PESTICIDE APPLICATIONS EXPRESSED AS ACID EQUIVALENT OR  
ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-10, 1975

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)
Corn	Weeds	atrazine	258	12	497
		butylate	67	1	150
Mixed grain	Weeds	2,4-D	107	8	57
Oats	Weeds	2,4-DB	60	5	32.5
Total:		Herbicide	492	22 <sup>a</sup>	736.5

a/ some farms applied more than one pesticide



# 9 AG-11 SALT CREEK

## GENERAL INFORMATION

### Location

AG-11 represents the watershed that drains Salt Creek which flows via the West Humber River into the Humber River and then into Lake Ontario. The watershed is located in the Regional Municipality of Peel, about 6 km northeast of Brampton (Figure 9-1). The topography of the watershed is gently rolling hills with an area of river bottom land and a general slope from the north to the outlet in the south. The soils in the area are clay, clay loam, loam and river flats. Most of the land drainage is through natural runoff and only a small area is drained through tile drains. There are no municipal drains or ditches.

### Size

The total area of the watershed is 2,499 ha and is occupied by 85 farms and 110 residential homes. In 1975, 91% of the land (2,279 ha) was in agricultural use. Provincial and municipal roads accounted for 3% of the area (74 ha), residences accounted for 5% (121.5 ha) and an undeveloped golf course occupied 1% (24.5 ha).

### Main Activity

The agricultural land in the watershed is fairly intensively farmed, being occupied by both forage and cash crops. About one third of the farms maintained some livestock. In general, crop and livestock production is quite specialized.

### Historical

The area has always maintained a high degree of agricultural practice. Today, the area is becoming increasingly urbanized due to its proximity to the metropolitan Toronto area. Farming is more specialized today than it was five to ten years ago.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 85 farms located in the watershed ranging in size from 4-81 ha and having a mean area of 27 ha. The agricultural land use in 1975 was





28% in hay (632 ha), 19% in mixed grain (424 ha), 18% in pasture (401 ha), 12% in corn (282 ha), 11% in wheat (241 ha), 2% in soybean (52 ha), 1% in barley (30 ha) and 1% in oats (30 ha). One farm produced trees in a nursery and occupied 34 ha (1%). Unimproved land on 41 farms accounted for 153 ha or 7% of the agricultural land (Table 9-1).

### Livestock Production

Livestock was a minor activity during 1975 with 31 farms (36%) maintaining some type of livestock operation (Table 9-2). Many of the livestock operations were small and consisted of dairy-beef or beef-swine combinations. Larger operations included 18 beef herds, 13 dairy herds, 5 swine herds and 3 flocks of poultry.

Sources of drinking water for livestock were 27 wells, 11 ponds and 9 streams or ditches.

### Land Preparation

The crop residue from cereal and corn crops was removed from the field for feed or litter for livestock. A very consistent pattern of plowing and discing was evident in the watershed. Corn, mixed grain, barley and oat fields were prepared by plowing in October followed by 2-4 tillings in May. Wheat was planted following plowing over the summer and 3 discings in August.

### Manure Use

Thirty-three farms (39%) applied manure to 18% of the agricultural land. A total of 5,817 tonnes of manure was applied to 416 ha at a mean application rate of 14.0 tonnes/ha (Table 9-3). The manure was applied year round with the heaviest applications being made in March, May, August, September and October. Most of the manure was handled in the solid form after being stored in open piles unprotected from rain and runoff.

### Fertilizer Use

(i) Pre-planting or planting time fertilizer. Application of fertilizer for pre-planting or at planting time occurred on 61 farms (72%) or 41% of the agricultural land. Over 85% of the wheat, mixed grain (including barley and oats alone) and corn was treated at this time, whereas less than 10% of the soybean and hay was treated. The total application of fertilizer on 941 ha was 28,375 kg N, 45,296 kg  $P_2O_5$  and 28,080 kg  $K_2O$  (Table 9-4).

A wide variety of rates and type of N-P-K fertilizers were applied mainly in May. Wheat was treated in August. Mean application rate on the various crop hectares was: 270 ha of corn with 235 kg/ha of 8-24-15 and 90 kg/ha of Aeroprill (34% N); 414 ha of mixed grain (including oats and barley alone) with 275 kg/ha of 8-16-10; 241 ha of wheat with 180 kg/ha of 8-28-16 and 25 kg/ha Aeroprill; 8 ha of hay with 235 kg/ha of Aeroprill; and 4 ha of soybean with 100 kg/ha of 8-32-16.

(ii) After planting fertilizer. Seven farms (8%) fertilized 3% of the agricultural land with after planting fertilizer. The total application on 66 ha was 1,609 kg N, 2,619 kg P<sub>2</sub>O<sub>5</sub> and 2,092 kg K<sub>2</sub>O (Table 9-5). A low percentage of the crop hectarage in corn, hay and pasture was treated.

Mean application rate on the various crop hectarages was: 13 ha of corn with 340 kg/ha of Aeroprill (34% N), 36 ha of hay with 235 kg/ha of 0-22-16 and 17 ha of pasture with 45 kg/ha of active P and 44 kg/ha of active K.

#### Limestone Use

Limestone was applied on one farm to 10 ha of corn at a mean application rate of 4.6 tonnes/ha.

#### Irrigation

No land was irrigated in AG-11 during 1975.

#### Pesticide Use

Only herbicides were used in AG-11 during 1975. Various herbicides were applied in May or June to control weeds during pre- and post-emergence treatments (Table 9-6). Mean application rate of herbicides was: 0.5 kg/ha of 2,4-D on 255 ha and 1.7 kg/ha of 2,4-DB on 12 ha of various cereals; 1.4 kg/ha of atrazine on 222 ha and 3.5 kg/ha of butylate on 50 ha of corn; 3.9 kg/ha of alachlor on 61 ha and 1.0 kg/ha of linuron on 4 ha of soybeans; and, 1.1 kg/ha of paraquat on 24 ha of land in the tree nursery.

#### Land Drainage

Almost all the drainage is through natural topographical runoff. About 15% of the watershed is tile drained with about 95% of the tiles being randomly spaced.

#### Farm Residences

There were 85 farm residences located in the watershed. These farm homes have septic tanks for sewage disposal.

### NON-AGRICULTURAL ACTIVITIES

#### Municipal Drains and Ditches

There were no municipal ditches or drains located in the watershed.

#### Road Allowance

Paved and gravel surfaced regional roads occupied 74 ha of the watershed (3%). About 31 ha of road allowance was treated with 2,4-D and 2,4,5-T to eradicate and control roadside weeds and bush.

### Railroad

There were no railroads located in the watershed.

### Residential Homes

There were 110 residential homes and lots occupying 121.5 ha or 5% of the watershed. Most of the residences were located along the major roadways and in the hamlet of Sandhill. All the homes have septic tanks.

### Industrial Sites

There were no true industrial sites located in the watershed but there was an undeveloped golf course that occupied 1% of the area (24.5 ha). The golf course, which was part of another course (not in the watershed), has not been developed as a true golf course or a residential area.

### REFERENCE

- (1) Agriculture Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 9-1

## LAND USE IN AG-11, 1975

Crop	Area (hectares)	Farmland (%)	Farms		Area (hectares)	
			(#)	(%)	mean	range
Hay	632	28	46	54	14	1.5 - 38
Mixed Grain	424	19	46	54	9	2 - 38
Pasture	401	18	34	40	12	2 - 39
Corn	282	12	23	27	12	3 - 38
Wheat	241	11	24	28	10	1.5 - 36
Soybeans	52	2	5	6	10	3.5 - 20
Tree Nursery	34	1	1	1	34	-
Barley	30	1	3	4	10	4 - 20
Oats	30	1	3	4	10	8 - 12
Unimproved land	153	7	41	48	4	0.2 - 24
Agricultural total: 2,279		100	85 <sup>a</sup>	100	27	4 - 81
Non-agricultural total: 220						
Watershed total: 2,499						

a/ some farms grew more than one crop

TABLE 9-2

## LIVESTOCK IN AG-11, 1975

Livestock	Farms (#)	Livestock (#)	Livestock mean	Livestock (#) range
Dairy Cows - milkers	14	471	34	10 - 75
- followers	25	695	28	1 - 70
Beef cows	15	160	11	1 - 21
Beef feeders: 400-1100 lb.	9	102	11	3 - 21
400-750 lb.	6	81	14	6 - 25
750-1100 lb.	4	141	35	1 - 100
Veal calves	1	12	12	-
Swine - sows & boars	3	14	5	2 - 6
Feeder hogs	5	209	42	15 - 85
Sheep, ewes, lambs	1	4	4	-
Horses	6	23	4	1 - 7
Laying hens	3	1,356	452	6 - 1100
Broilers	1	50	50	-
Total:	31 <sup>a</sup>	b		

a/ some farms maintained more than one type of livestock  
b/ about 790 animal units (Reference 1)

TABLE 9-3 MANURE APPLICATION TO LAND IN AG-11, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of total (tonnes)	Manure mean (tonnes/ha)
Hay	243	20	38	3,006	12.4
Corn	94	12	33	1,805	19.2
Pasture	47	8	12	473	10.1
Mixed grain	26	5	6	392	15.1
Wheat	6	2	2	141	23.5
Total:	416	33 <sup>a</sup>	18	5,817	14.0

a/ some farms applied manure to more than one crop

TABLE 9-4 PRE-PLANTING AND PLANTING TIME APPLICATION OF FERTILIZER IN AG-11, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	270	22	96	13,194	15,091	9,626
Mixed grain (and oats & barley)	414	41	86	9,099	18,218	11,429
Wheat	241	24	100	5,408	11,856	6,960
Hay	8	1	5	641	-	-
Soybean	4	1	8	33	131	65
Total:	941	61 <sup>a</sup>	41	28,375	45,296	28,080

a/ some farms applied fertilizer to more than one crop

TABLE 9-5

AFTER PLANTING APPLICATION OF FERTILIZER IN AG-11, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	13	1	5	1,500	-	-
Hay	36	4	0.6	109	1,855	1,346
Pasture	17	3	4	-	764	746
Total:	66	7 <sup>a</sup>	3	1,609	2,619	2,092

a/ some farms applied fertilizer to more than one crop

TABLE 9-6

PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-11, 1975

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)
<u>Cereals</u> (mixed grains, oats, barley, etc.)	Weeds	2,4-D	255	22	119
		2,4-DB	12	3	20
<u>Corn</u>	Weeds	atrazine	222	14	318
		butylate	50	2	175
<u>Soybeans</u>	Weeds	alachlor	61	4	236
		linuron	4	1	4
<u>Others</u> (nursery)	Weeds	paraquat	24	1	27
Agricultural total:		Herbicide			899
Road allowance	Weeds	2,4-D	31		62.5
		2,4,5-T	31		42.5

Reference: 5-11-4-11  
 Date: 5-11-4-11  
 Page: 21

Department: 11  
 Division: 11

(Continued)  
 Name: 11  
 Address: 11

Proposed: 11  
 Remarks: 11

City: 11  
 State: 11

County: 11  
 District: 11

Group: 11  
 Description: 11

Value: 11  
 Assessment: 11

Notes: 11  
 Remarks: 11

Area: 11  
 Volume: 11

Depth: 11  
 Width: 11

Height: 11  
 Area: 11

Area: 11  
 Volume: 11

Area: 11  
 Volume: 11

Area: 11  
 Volume: 11

Area: 11  
 Volume: 11

Area: 11  
 Volume: 11

Area: 11  
 Volume: 11



# 10 AG-13 HILLMAN CREEK

## GENERAL INFORMATION

### Location

AG-13 represents the watershed that drains the upper reaches of the west branch of Hillman Creek which flows into Lake Erie. The watershed is located in Mersea Township, Essex County, about 1.5 km north of the town of Leamington (Fig. 10-1). The topography of the watershed is gently rolling with the soils being a mixture of sands or sandy loam (Berrien sandy loam) and some clay. Approximately 75% of the surface runoff and drainage water flows through municipal drains or private ditches. Almost the whole watershed is tile drained.

### Size

The total area of the watershed is 2,070 ha and is occupied by 100 farms, 171 residential homes, 11 industries and 7 institutions. In 1975, 83% of the land (1,720 ha) was devoted to agriculture. Of the remainder, 3.5% was residences (73 ha), 3% was woodlots not on farms (64 ha), 2.5% was road allowance (53 ha), 2% was municipal streams (40 ha), 1.5% was industry (27 ha), 1% was institutions (24 ha), 0.5% was railroad (10 ha), and 3% was unaccounted for land (59 ha).

### Main Activity

The main agricultural endeavour is fruit and vegetable production and cash crop units. Livestock production is a very minor activity. Thirteen percent of the watershed is in non-agricultural activity.

### Historical

Over the past 15-20 years, the watershed has remained an intensively farmed area. There has been a slight shift from early vegetables, tomatoes, tobacco and fruit in the past to a corresponding increase in field crops such as wheat, corn and soybean. The number of livestock in the watershed has always been low.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 100 farms in the watershed that ranged in size from 3 to

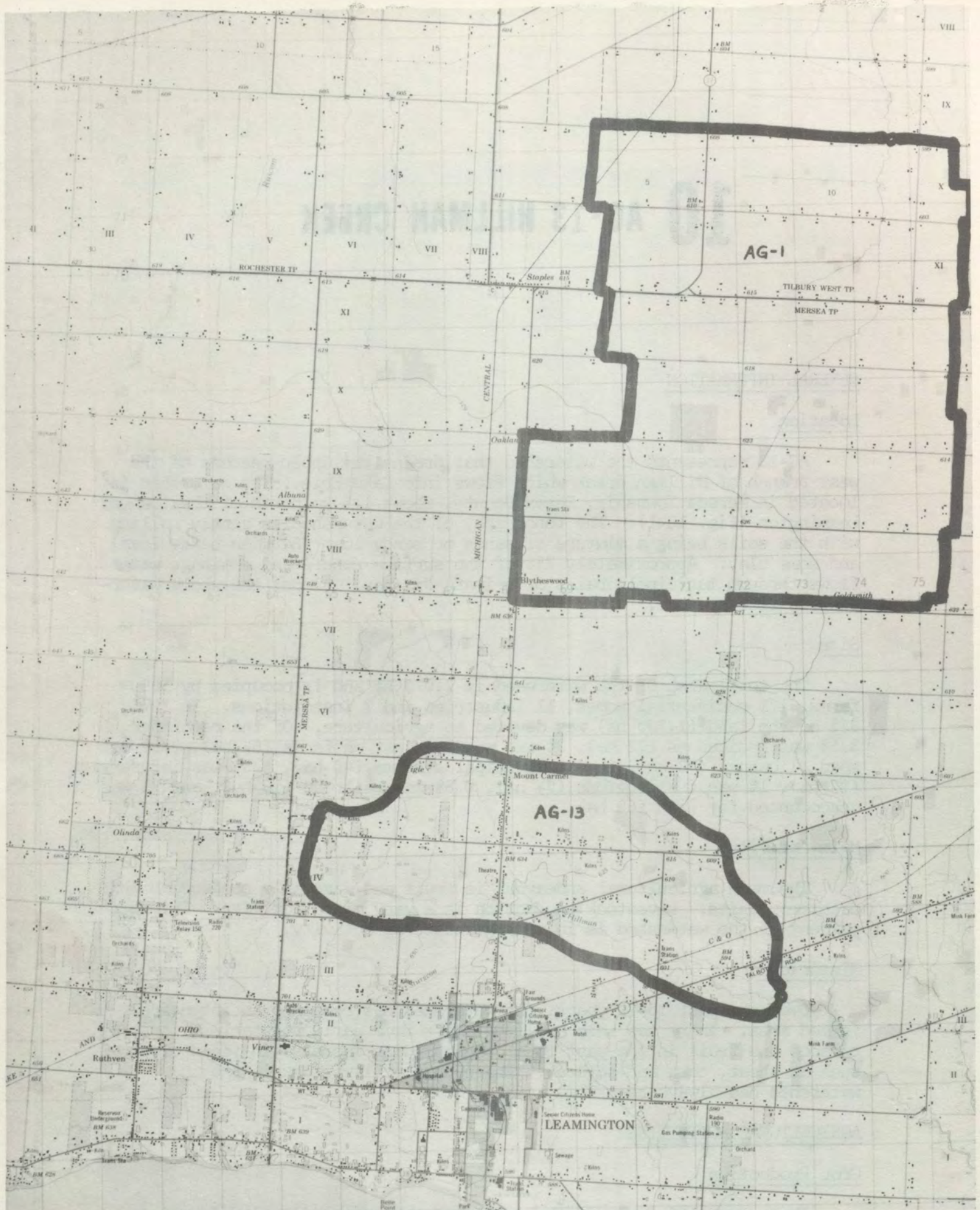


FIGURE 10-1: Location of AG-13, Hillman Creek

275 ha and had a mean area of 17 ha. There was considerable share-cropping and land leasing among farmers. Although the farms tended to be small units, a mixture of crops are produced or grown rather than specializing in one or two.

The major agricultural activity in 1975 was fruit and vegetable production and cash crop production (Table 10-1). Corn (field and sweet) occupied 27.5% (472 ha) of the agricultural land, potatoes 16% (280 ha), tomatoes 11% (183 ha), wheat 10.5% (176 ha), soybeans 9% (163 ha), other vegetables 7% (146 ha), tobacco 6% (104 ha) and cereals 1% (9 ha). There were 20 farms with orchards (4%, 78 ha) growing peaches, pears and apples; there were also some greenhouses and a mushroom farm. Unimproved land on 64 farms accounted for 8% of the agricultural land (144 ha).

#### Livestock Production

Livestock density in the watershed was extremely low and consisted of 1 dairy and 1 swine unit (Table 10-2). Wells were the only source of drinking water for these livestock.

#### Land Preparation

Crop residues from corn, soybean, potato and vegetables were plowed down into the soil. Wheat straw was mainly incorporated although some was removed or burnt in the field. The tobacco (mainly burley) was removed and then the old stalks returned later to be incorporated into the soil.

Most of the plowing and tilling of the crop land (except wheat) occurred in the spring, although about 20% of the land was disced in September. Generally, corn, soybean, vegetable and tobacco lands were plowed in April or May followed by three tillage operations in May before planting. Potatoes were planted following plowing and three tillings in April. Fall wheat was planted following 2-3 tillage operations in September.

#### Manure Use

A very light application of manure was applied to the land in 1975. Only 6 farms applied manure to 1% of the agricultural land (19 ha). The total application was 168 tonnes at a mean rate of 8.8 tonnes/ha to a variety of crops (Table 10-3). Most of the manure was applied in April.

Manure from the two livestock operations was stored in solid form in open piles not protected from runoff by rain.

#### Fertilizer Use

(i) Pre-planting or planting fertilizer. Application of fertilizer for pre-planting or at planting time occurred on 85% of farms or 74% of the agricultural land. Over 90% of the potato, corn, tomato, tobacco and vegetable hectareage received fertilizer at this time.

Orchard, bean, soybean, wheat and oat land was also fertilized in the

spring or at the time of planting. The total application of fertilizer on 1269 ha was 81,065 kg N, 186,648 kg P<sub>2</sub>O<sub>5</sub> and 200,594 kg K<sub>2</sub>O (Table 10-4).

Mean application rates on the different crops were: 1275 kg/ha of 10-18-21 on potato in April; 572 kg/ha of 8-17-14 on corn in May; 1140 kg/ha of 6-20-22 on tomato in May; 1240 kg/ha of 3-13-18 on tobacco in May; 980 kg/ha of 8-20-22 on vegetables in April and May; 515 kg/ha of 11-10-16 on orchard in April or May; 465 kg/ha of 6-20-20 on beans in May; 265 kg/ha of 8-26-9 on soybean in May; 205 kg/ha of 6-22-20 on wheat in September; and, 410 kg/ha of 5-20-20 on oats in April.

(ii) After-planting. After planting fertilizer was applied to 646 ha or 38% of the agricultural land. The total application of fertilizer was 57,605 kg of N, 5,310 kg of P<sub>2</sub>O<sub>5</sub> and 7,563 kg of K<sub>2</sub>O. Over 50% of the corn, wheat, tomato and vegetable hectareage received after-planting fertilizer treatments while a lesser percentage of tobacco, potato, orchard and oats was also treated (Table 10-5).

Mean application rates of Aeroprill (34% N) on the different crops were: 358 kg/ha on corn, 170 kg/ha on wheat, 238 kg/ha on vegetables, 132 kg/ha on potato, 122 kg/ha on orchard, and 132 kg/ha on oats. Tobacco was treated with 268 kg/ha of Aeroprill followed by 91 kg/ha of 2-10-16, while tomatoes were treated with either 218 kg/ha of Aeroprill or 335 kg/ha of 10-10-10. Treatment with after-planting fertilizer was carried out in May or June except wheat which was fertilized in April.

#### Limestone Use

Eight farms treated 44 ha of land with 185 tonnes of limestone. Limestone was applied on 26 ha of corn on 3 farms (118 tonnes), 5 ha of tobacco on 1 farm (11 tonnes), 4 ha of wheat on 1 farm (18 tonnes), 4 ha of vegetables on 2 farms (18 tonnes), 4 ha of potato on 1 farm (16 tonnes), and 1 ha of orchard on 1 farm (4 tonnes). The mean application rate of limestone was 4.2 tonnes/ha.

#### Irrigation

Twenty-one farms irrigated 117 ha of various crop land using water from farm ponds. Eight farms treated 46 ha of potato with a mean rate of 2.25 applications, 5 farms treated 35 ha of tobacco with a mean rate of 2.2 applications, 4 farms treated 26 ha of orchard with a mean rate of 1.5 applications, and 5 farms treated 10 ha of vegetables with a mean rate of 2.6 applications.

#### Pesticide Use

A large amount and a wide variety of insecticides, fungicides and herbicides were used to protect the various crops in AG-13 during 1975 (Table 10-6).

Herbicides were used on 100% of the soybeans (163 ha, 19 farms), 88% of the corn (417 ha, 30 farms), 86% of the tomatoes (157 ha, 20 farms), 76% of

the vegetables (85 ha, 21 farms), 56% of the orchard land (44 ha, 8 farms), 53% of the tobacco (55 ha, 9 farms) and 50% of the potato (141 ha, 12 farms). Some of the crop hectarages were treated with more than one herbicide. Most of the herbicides were applied in May.

Insecticides were applied to 100% of the orchards (78 ha, 19 farms), 93% of the potato (260 ha, 32 farms), 90% of the tobacco (94 ha, 15 farms), 77% of the tomatoes (140 ha, 17 farms), 29% of the vegetables (33 ha, 19 farms), and 3% of the corn (15 ha, 1 farm). The various crops were treated in the May to August period. Several crops received several consecutive treatments of the same insecticide as well as different insecticide treatments depending on the crop and the pest. It was determined that the mushroom farm periodically used diazinon indoors although the rate and time are not known.

Fungicides were applied to 84% of the tomatoes (155 ha, 20 farms), 81% of the orchards (63 ha, 17 farms), 72% of the potatoes (201 ha, 23 farms) and 11% of the vegetables (13 ha, 6 farms). The fungicides were generally applied 2-6 times between May and September.

As far as can be determined, farmers treated the crops at rates of application in accordance with O.M.A.F. publications (1-4) recommending pesticide use.

#### Land Drainage

The topography of the land is gently rolling with the soils being a mixture of sands, sandy loam and clay. The watershed is almost totally tile drained. Approximately 50% of the tile drains were designed for systematic drainage while the other 50% were laid for random drainage. The general spacing of the tiles in the systematic designs is about 12-15 m. The outlets of the drains empty into municipal ditches located throughout most of the watershed.

#### Farms Residences

There were 187 farm homes located on the 100 farms in the watershed. Most farm residences have septic tanks that can be pumped, however some of the older homes have weeping tiles.

#### NON-AGRICULTURAL ACTIVITIES

##### Municipal Drains and Ditches

Approximately 75% of the watershed is drained through municipal drains or ditches while the remainder of the drainage water runs off into natural drainage courses. Two percent of the watershed area (40 ha) is municipal streams. Dredging is carried out every 20-30 years.

##### Road Allowance

Roads cover 53 ha or 2.5% of the watershed. Highway 77 bisects one corner

of the watershed in a NS direction, and Highway 3 passes in a NE direction in the bottom section. Most other roads were gravel surfaced township roads. In 1975, 41% of the roads allowance was treated with 2,4-D.

### Railroads

The Michigan Central and the Chesapeake and Ohio Railroads run N and NE respectively from the town of Leamington through the watershed and occupy 10 ha or 0.5% of the watershed.

### Residential Homes

There were 171 residential homes occupying 73 ha (3.5% of watershed) located in the watershed in 1975. Most of the residences were distributed along the road allowance in the watershed with a high density along Highway 77. Almost all the homes have septic tanks.

### Industrial Sites

In 1975 there were 11 industries and 7 institutions located in the watershed. Industries occupied 27 ha (1.5%) and institutions occupied 24 ha (1%) and were located primarily on the major roadways. Schools and churches were the main institutions while industries included service stations, car and machinery dealers, and a drive-in theatre.

### REFERENCES

- (1) 1975 Field Crop Recommendations, Publication 296, O.M.A.F.
- (2) 1975 Tobacco Production Recommendations, Publication 298, O.M.A.F.
- (3) 1975 Fruit Production Recommendations, Publication 360, O.M.A.F.
- (4) 1975 Vegetable Production Recommendations, Publication 363, O.M.A.F.
- (5) Agricultural Code of Practice for Ontario, O.M.E. and O.M.A.F. 1976

TABLE 10-1 LAND USE IN AG-13, 1975

Crop	Area (hectares)	Farmland (%)	Farms		Area (ha/crop)	
			#	%	mean	range
Corn (field & sweet)	472	27.5	35	35	13.5	2.5 - 55
Potato	280	16	35	35	8	0.5 - 36
Tomato	183	11	27	27	6.5	0.4 - 30
Wheat	176	10.5	21	21	8	1 - 26
Soybean	163	9	19	19	8.5	2 - 32
Tobacco	104	6	25	25	4	0.4 - 20
Orchard (peach, pear, apple)	78	4	20	20	4	1 - 10
Bean (snap, green, etc.)	68	4	8	8	8.5	0.2 - 36
Vegetables (pepper, cucumber, cabbage, onion, berries, as- paragus, melon, grape)	44	3	24	24	2	0.2 - 4
Cereals (oats, rye, hay)	9	1	4	4	2	0.4 - 4
Unimproved land	144	8	64	64	2	0.1 - 11
Agricultural total:	1721	100	100 <sup>a</sup>	-	17	3 - 275
Non-agricultural total:	349					
Watershed total:	2070					

a/ some farms grew more than 1 crop

TABLE 10-2 LIVESTOCK IN AG-13, 1975

Livestock	Farms (#)	Livestock (#)	Livestock (#) mean	Livestock (#) range
Dairy cows - milkers	1	25	25	-
- followers	1	25	25	-
Feeder hogs	1	35	35	-
Total	2	a		

a/ about 27 animals units (Reference 5)

TABLE 10-3 MANURE APPLICATION TO LAND IN AG-13, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure Total (tonnes)	Mean (Tonnes/ha)
Tomato	2	1	1	45	22.5
Orchard	4	1	5	45	11.3
Potato	7	1	3	31	4.4
Corn	2	1	0.5	18	9.0
Strawberry	1	1	2	18	18.0
Tobacco	2	1	2	8	4.0
Asparagus	1	1	2	3	3.0
Total	19	6 <sup>a</sup>	1	168	8.8

a/ some farms applied manure to more than one crop



TABLE 10-4

PRE-PLANT AND PLANTING TIME APPLICATION  
OF FERTILIZER IN AG-13, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Nutrients (kg)		
				N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Potato	280	35	100	35,407	65,373	75,084
Corn	440	34	93	20,085	42,187	35,804
Tomato	173	26	95	11,871	39,697	43,186
Tobacco	104	25	100	3,877	16,729	23,225
Vegetables	44	24	100	3,467	8,505	9,623
Orchard	52	12	67	2,963	2,717	4,479
Beans	57	7	84	1,605	5,348	5,200
Soybean	44	5	27	924	2,968	1,062
Wheat	69	7	39	846	3,042	2,849
Oats	1	1	11	20	82	82
Total:	1269	85 <sup>a</sup>	74	81,065	186,648	200,594

a/ some farms applied fertilizer to more than one crop

TABLE 10-5 AFTER PLANTING APPLICATION OF FERTILIZER IN AG-13, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrients (kg)	
					P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn	348	25	74	42,307	-	-
Wheat	136	16	77	7,843	-	-
Tomato	92	8	50	2,997	5,192	7,374
Vegetables	27	13	61	2,185	-	-
Tobacco	17	11	16	1,118	118	118
Potato	22	6	8	986	-	-
Orchard	3	1	4	124	-	-
Oats	1	1	11	45	-	-
Total	646	49 <sup>a</sup>	38	57,605	5,310	7,563

a/ some farms applied fertilizer to more than one crop

TABLE 10-6

PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT  
OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-13, 1975

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)	
Tomato:	Disease (blight, anthracnose, spot, canker, burn, speck, wilt, rot, etc.)	fixed copper	159	15	1,220	
		EBDC <sup>a</sup>	161	19	1,161	
		captafol	161	17	632	
	Insects (beetles, aphids, horn- worm, fruit fly, loopers, etc.)	azinphos-methyl	158	16	125	
		methomyl	25	1	25	
		endosulfan	36	2	23	
		carbofuran	10	3	19	
		leptophos	10	1	11	
		<i>B. thuringiensis</i>	10	1	11	
	Weeds	malathion	5	1	2.5	
		trifluralin	162	17	200	
		chloramben	58	3	136	
		metribuzin	9	1	2.5	
	Potato:	Disease (rot, scab, decay, blight, etc)	EBDC <sup>a</sup>	101	12	202
			captafol	90	11	138
Nematodes		1,2-dichloropropane + 1,3-dichloropropene	46	8	1,212	
		methyl isothio- cyanate	46	8	295	
Insects (aphids, beetles, bugs, leaf- hoppers, etc)		carbofuran	200	22	250	
		azinphos-methyl	14	1	1.5	
		diazinon	3	1	1.5	
Weeds		linuron	63	6	82	
		metribuzin	40	4	45	
		monolinuron	36	1	41	
		butylate	15	1	22	
		EPTC	1	1	3	

Continued . . . . .

TABLE 10-6 (continued...)

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)
Vegetables: (cucumber, pepper, bean, aspar- agus, melon, onion, cabbage)	Disease (rot, scab, blight, wilt, etc.)	chlorothalonil	5	2	5.5
		fixed copper	2	1	2
	Insects (aphids, borers, bugs, beetles, loopers, leaf hoppers, maggots, etc.)	carbofuran	3	1	15
		methoxychlor	9	4	11
		carbaryl	11	6	11
		malathion	8	4	5.5
		demeton	4	3	3
		azinphos-methyl	3	2	2
		endosulfan	4	2	2
		dimethoate	2	2	2
		diazinon	2	1	1
		chlorpyrifos	1	1	1
		mevinphos	1	1	0.1
		Weeds	trifluralin	53	10
	simazine		6	5	14
	EPTC		5	1	12
	metobromuron		6	2	7
	chloramben		2	1	5.5
	monuron		1.5	1	5
	niclofen		2	1	3
linuron	2		1	2	
atrazine	1		1	1	
naptalam	2		1	0.7	
dinoseb	2	1	0.3		
Orchard: (apple, plum, peach, pear, grape, berry)	Disease (rot, blight, mite, mildew, leaf spot, scab, blotch, speck, curl, etc.)	oil <sup>b</sup>	39	6	8,096 <sup>b</sup>
		sulphur	16	5	1,425
		captan	37	11	1,409
		EBDC <sup>a</sup>	29	6	263
		benomyl	11	3	111
		dicofol	6	1	38
		dichloram	2	2	11
		captafol	3	1	5.5
		folpet	2	1	3.5

Continued . . . . .

TABLE 10-6 (continued....)

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)	
<u>Orchard:</u> continued..	Insects (moth, leafhopper, fruit flies, maggot, leaf roller, bugs, aphids, curculio, etc.)	azinphos-methyl	51	9	2,292	
		phosmet	15	3	664	
		carbaryl	52	13	629	
		phosalone	24	5	213	
		chlordimeform	8	1	45	
		endosulfan	32	5	45	
		cyhexatin	17	2	14	
		carbofuran	3	1	2	
		malathion	2	1	1	
		Weeds and grasses	metobromuron	8	1	218
			paraquat	39	7	146
	chlorthal		2	1	33	
	linuron		6	1	27	
	terbacil		5	2	14	
	<u>Tobacco:</u>	Nematodes	1,2-dichloropropane+ 1,3-dichloropropene	87	14	3,076
methyl isothiocyanate			87	14	748	
Cutworm		leptophos	30	3	23	
		chlorpyrifos	5	1	6	
Hornworm		<i>B. thuringiensis</i>	12	1	14	
Foliar Insects (aphids, beetles, grasshoppers, etc.)		malathion	2	1	2	
		mevinphos	5	1	0.7	
Weeds		diphenamid	32	1	145	
		pebulate	20	6	101	
		linuron	2	1	4	

Continued . . . . .

TABLE 10-6 (continued....)

Crop	Pest	Pesticide (common name)	Treated (ha)	Farms (#)	Use of Pesticide (kg a.i.)
Soybean	Weeds	trifluralin	56	8	117
		metobromuron	36	1	61
		linuron	32	1	55
		chloramben	36	6	39
		metribuzin	26	2	34
		basogran	14	3	15
Corn	Corn Borer	carbofuran	15	1	82
	Weeds	atrazine	438	31	594
		butylate	204	12	300
		alachlor	17	1	37
Agricultural Totals:		Insecticides	620		4,555.8
		Fungicides	432		6,626.5
		Herbicides	1062		2,587
		Nematicide	133		5,331
		Oils b/	39		8,096 b/
Road Allowance:					
	weeds	2,4-D	21		53

a/ ethylene bis dithiocarbamates and related dithiocarbamates

b/ L of dormant and/or superior oils (Reference 3)

# 11 AG-14 MILL CREEK

## GENERAL INFORMATION

### Location

AG-14 represents the watershed draining the head waters of the south branch of Mill Creek, a tributary of the Saugeen River that flows into Lake Huron. The watershed is located in Bruce Township, Bruce County, about 15 km south of Port Elgin and 10 km west of Paisley (Fig. 11-1). The watershed slopes gently downward from the south and has a sandy loam, clay loam, silt loam and silty clay loam soil profile. The watershed is almost totally drained naturally.

### Size

The total area of the watershed is 5,069 ha and is occupied by 61 farms, 3 residential homes and 1 industry. In 1975, 98% of the land (4,945 ha) was in agricultural use. Township roads accounted for 2% of the area (81.5 ha), and residential homes and the industry accounted for 5 ha and less than 1% of the area (37.5 ha) was unaccounted for by the survey.

### Main Activity

Land use in AG-14 is characterized by a livestock orientated agricultural practice, with most of the land supporting livestock and growing crops devoted to the maintenance of these animals.

### Historical

The watershed has always supported a large density of livestock. In the last decade, there has been a decline in the total number of livestock as well as decline in the number of operations. Correspondingly, there has been a significant increase in corn production in the last 5 years.

## AGRICULTURAL ACTIVITIES

### Crop Production

There were 61 farms in the watershed ranging in size from 6-234 ha and having a mean area of 81 ha. The agricultural land use during 1975 was 45% in pasture (2,219 ha), 23% in hay (1,153 ha), 10% in mixed grain (505 ha), 10% in corn (484 ha), 2% in barley, and less than 1% in oats. Forty-three farms had some unimproved land (10%) on farms (Table 11-1). Most of the crops grown were

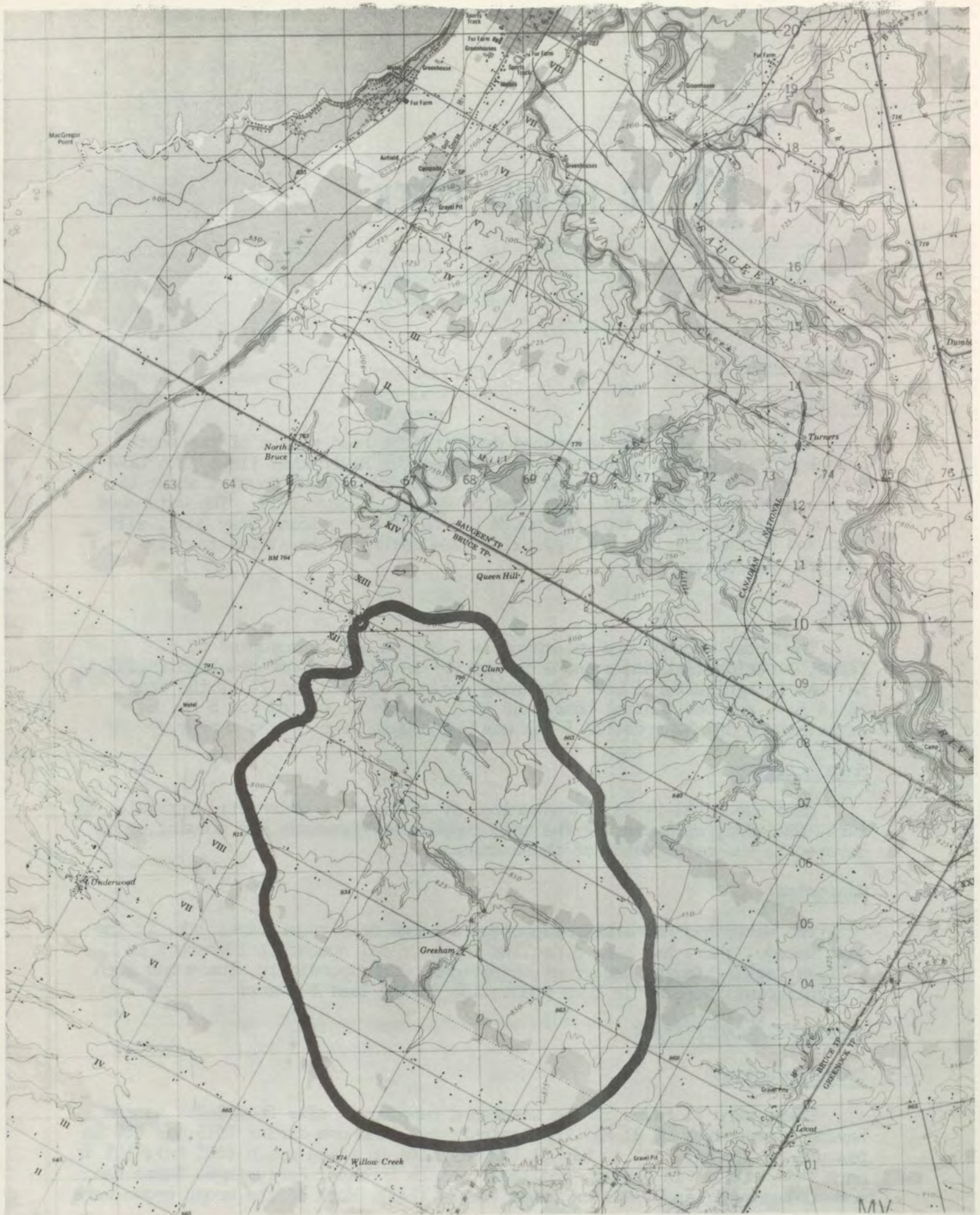


FIGURE 11-1: Location of AG-14, Mill Creek



for the maintenance of the livestock. Corn production has risen significantly in the last 5 years.

### Livestock Production

Livestock production was the major agricultural activity in AG-14 during 1975, with 57 farms (93%) maintaining some type of livestock operation (Table 11-2). Major livestock operations included 46 beef herds, 11 dairy herds, 8 swine herds, 2 flocks of poultry and 1 sheep herd. Most farms had more than one type of livestock operation. The last 10 years has shown a decrease in dairy (4 farms) and swine (1 farm) operations in favour of beef operations.

Sources of drinking water for the livestock were 54 wells, 18 streams and ditches and 2 ponds.

### Land Preparation

Crop residue from mixed grain and corn was incorporated into the soil during plow down. Hay was removed for farm use or sale. Land for corn and mixed grain was plowed in October or November, with some corn hectareage being re-plowed in May, and was tilled 2 to 4 times in April or May. No other land was reported to have been plowed or tilled.

### Manure Use

Manure was applied on 40 farms to 996 ha of agricultural land (20%). Crop land treated with manure was 393 ha of hay, 383 ha of pasture, 195 ha of corn and 25 ha of mixed grain (Table 11-3). The question regarding rate of application of manure was not answered on the questionnaire and thus no total application of manure is known. All the manure produced from the livestock (Table 11-2) in the watershed would have been applied to the land. The best estimate would be about 5-20 tonnes/ha applied mainly in May, although some land was treated in September.

One farm was reported to have cattle and manure in a stream that resulted in discolouration of the water (and possibly high bacti counts) and concern was raised by the farmers downstream.

All the manure was handled in the solid form and was stored in piles unprotected from runoff from rain until use.

### Fertilizer Use

(i) Pre-plant or planting fertilizer. Application of fertilizer as pre-planting or at planting time occurred on 41 farms (67%) or 23% of the agricultural land. Most of the corn and mixed grain land was fertilized while less than 10% of the pasture and hay was treated at this time. The total application of commercial fertilizer on 1,149 ha was 38,030 kg N, 52,107 kg P<sub>2</sub>O<sub>5</sub> and 39,005 kg K<sub>2</sub>O (Table 11-4).

Mean application rate on the different crops was: 472 ha of corn on 19 farms with 435 kg/ha of 15-24-18 followed by 200 kg/ha of Aeroprill (34% N), 549 ha of mixed grain (including oats and barley grown alone) on 35 farms with 200 kg/ha of 9-22-14, 37 ha of pasture on 3 farms with 224 kg/ha of 0-20-20, and 91 ha of hay on 6 farms with 125 kg/ha of 7-25-20. Most of the pre-plant or planting fertilizer was applied in May.

(ii) After planting. After planting fertilizer was applied to 140 ha of agricultural land (3%) on 7 farms. The total application of this type of fertilizer was 3,182 kg N, 5,009 kg P<sub>2</sub>O<sub>5</sub>, and 3,873 kg K<sub>2</sub>O (Table 11-5). Seventeen percent of the corn and 2% of pasture and hay land was treated.

Mean application rate on the various crops was: 82 ha of corn on 3 farms with 110 kg/ha of 0-20-20 or 100 kg/ha of Aeroprill (34% N), and 34 ha of pasture on 3 farms and 24 ha of hay on 3 farms with 215 kg/ha of 3-26-16. After planting fertilizer was applied in June or September.

The use of all types of fertilizer has generally increased in the last ten years.

#### Limestone

No lime was applied in AG-14 during 1975.

#### Irrigation

There was no irrigation of any crop in 1975.

#### Pesticide Use

In 1975, only herbicides were used in AG-14 to eradicate weeds in mixed grain and corn. A total of 1,204 kg of herbicides were applied to the agricultural land (Table 11-6). Mean application rate on the crops was: 255 ha of mixed grain with 0.5 kg/ha of 2,4-D or 2,4,5-T as the acid, 453 ha of corn with 2.0 kg/ha of atrazine, 67 ha of corn with 1.5 kg/ha of alachlor and 28 ha of corn with 1.5 kg/ha of cyanazine. Oil was used to apply atrazine in 38% of the corn (170 ha) with 6.9 L/ha. Most of the herbicides were applied as post-emergence treatments in June. The use of herbicides in AG-14 has increased in the last 10 years.

#### Land Drainage

The topography of the watershed is relatively flat with a slight downward slope to the north. The soils in the watershed are a variety of loams. About 10-15% of the drainage is through tiles which are both randomly and systematically located. Most of the newer tiles were laid systematically. Generally, the drainage is moderate and occurs through a number of small natural water courses and streams.

Mill Creek is probably a poor outlet because of lack of relative height difference between the surrounding land and the outlet. There is no large drop from the cultivated land to the creek course.

### Farm Residences

There were 61 farm residences located in the watershed. Most of these homes have septic tanks with weeping tile for household waste disposal.

### NON-AGRICULTURAL ACTIVITIES

#### Municipal Drains and Ditches

There were no municipal drains or ditches located in AG-14. Most of the runoff is through natural water courses or streams.

#### Road Allowance

Roads covered 81.5 ha or 2% of the watershed. All these roads were gravel surfaced township roads. About 45% of the road allowance (36.5 ha) was sprayed along the roadside with 2,4-D and 2,4,5-T to control weeds at 3.4 kg/ha as the acid.

#### Railroads

There were no railroads in AG-14.

#### Residential Homes

There were only 3 residential homes located in the watershed and these homes occupied 4.5 ha. These residences had septic tanks and weeping tile for waste disposal.

#### Industrial Sites

There was only one unspecified industrial site (0.5 ha) located in the watershed in 1975. A power transmission line passes in an EW direction through the southern part of the watershed but had no effect on the activities in AG-14.

### REFERENCE

- (1) Agricultural Code of Practice for Ontario, OME and O.M.A.F., 1976.

TABLE 11-1      LAND USE IN AG-14, 1975.

Crop	Area (hectares)	Farmland (%)	Farms		Area (hectares)	
			(#)	(%)	mean	range
Pasture	2,219	45	56	92	40	4 - 109
Hay	1,153	23	48	79	24	4 - 81
Mixed grain	505	10	31	51	16	4 - 40
Corn	484	10	20	33	24	3 - 122
Barley	87	2	5	8	17	6 - 36
Oats	22	<1	1	2	22	-
Unimproved land	475	10	43	70	11	2 - 43
Agricultural total:	4,945	100	61 <sup>a</sup>	100	81	6 - 324
Non-agricultural total:	124					
Watershed total:	5,069					

a/ some farms grew more than one crop

TABLE 11-2

## LIVESTOCK IN AG-14, 1975

Livestock	Farms (#)	Livestock (#)	Livestock mean	Livestock (#) range
Dairy cows - milkers	11	378	34	1 - 100
- followers	10	249	25	1 - 60
Beef cows	15	361	24	1 - 70
Beef feeders: 400-1100 lb.	17	2,285	134	6 - 250
400-750 lb.	24	2,239	93	9 - 250
750-1100 lb.	10	619	62	2 - 150
Swine - sows & boars	5	129	26	1 - 45
Feeder hogs	8	690	86	10 - 250
Sheep, ewes, lambs	2	144	72	2 - 110
Horses	8	36	5	1 - 17
Laying hens	5	108	22	6 - 50
Broilers	1	150	150	-
Total:	57 <sup>a</sup>	b		

a/ some farms maintained more than one type of livestock

b/ about 2,723 animal units (Reference 1)

TABLE 11-3

## MANURE APPLICATION TO LAND IN AG-14, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of Manure	
				total (tonnes)	mean (tonnes/ha)
Hay	393	29	34	b	b
Pasture	383	21	17		
Corn	195	11	40		
Mixed grain	25	5	5		
Total:	996	40 <sup>a</sup>	20		

a/ some farms applied manure to more than one crop

b/ Only a few farms replied to this question on the questionnaire. The best estimate would be 5-20 tonnes/ha of manure was applied to the crops. All the manure from livestock (Table 11-2) was applied to the land.

TABLE 11-4

PRE-PLANT AND PLANTING TIME APPLICATION OF  
FERTILIZER IN AG-14, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrient P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	472	19	98	27,135	22,765	18,726
Mixed grain <sup>a</sup>	549	35	89	10,115	24,068	15,433
Pasture	37	3	2	0	2,534	2,534
Hay	91	6	8	780	2,740	2,312
Total:	1,149	41 <sup>b</sup>	23	38,030	52,107	39,005

a/ includes oats and barley alone

b/ some farms applied fertilizer to more than one crop

TABLE 11-5

## AFTER PLANTING APPLICATION OF FERTILIZER IN AG-14, 1975

Crop	Treated (hectares)	Farms (#)	Crop (%)	Use of N	Nutrients P <sub>2</sub> O <sub>5</sub>	(kg) K <sub>2</sub> O
Corn	82	3	17	2,809	1,818	1,818
Pasture	34	3	2	282	1,918	782
Hay	24	3	2	91	1,273	1,273
Total:	140	7 <sup>a</sup>	3	3,182	5,009	3,873

a/ some farms applied fertilizer to more than one crop

TABLE 11-6

PESTICIDE APPLICATION EXPRESSED AS ACID EQUIVALENT  
OR ACTIVE INGREDIENT (a.i.) TO CROPS IN AG-14, 1975

Crop	Pest	Pesticide (common name)	Treated (hectares)	Farms (#)	Use of Pesticide (kg a.i.)
Mixed Grain:	Weeds	2,4-D	215	15	117
		2,4-DB	40	5	18
Corn:	Weeds	atrazine	453	17	922 <sup>a</sup>
		alachlor	67	2	104
		cyanazine	28	2	43
Agricultural total:		Herbicides			1,204
Road Allowance		2,4-D	36.5		61
		2,4,5-T	36.5		61

a/ atrazine was applied on 170 ha of corn on 5 farms with 1,173 L of oil.



APPENDIX "A"

Metric Equivalents

mile	= 1.609 km	kilometer	= 0.621 mile
acre	= 0.405 ha	hectare	= 2.471 acres
pound	= 453.592 g	kilogram	= 2.205 lb. avdp
ton	= 0.907 tonnes	tonne	= 1.102 short ton
imp. gal.	= 160 fl. oz.	U.S. gal.	= 0.8345 Imp. gal.
	= 1.2 U.S. gal.	litre	= 35.2 fl. oz.
	= 4.546 litres		
gal/acre	= 11.234 litres/ha	litre/ha	= 14.24 fl.oz./acre
lb/acre	= 1.120 kg/ha	kg/ha	= 14.5 oz avdp/acre
ton/acre	= 2.24 tonnes/ha	tonne/ha	= 0.446 ton/acre

kilogram = kg  
metre = m

hectare = ha  
litre = L

PROBING INTO THE FUTURE

IN THE

Year	Rate	Particulars	Notes	Balance
1950	150.00	(1950)		150.00
1951	100.00	100.00		50.00
1952	100.00	100.00		50.00
1953	100.00	100.00		50.00
1954	100.00	100.00		50.00
1955	100.00	100.00		50.00
1956	100.00	100.00		50.00
1957	100.00	100.00		50.00
1958	100.00	100.00		50.00
1959	100.00	100.00		50.00
1960	100.00	100.00		50.00

IN THE

APPENDIX "B"

Animal Units Determined From Livestock Numbers

<u>Type of Livestock or Poultry</u>	<u>Annual Basis (365 days)</u>
1 dairy cow (plus calf) . . . . .	1 animal unit
1 beef cow (plus calf) . . . . .	1 animal unit
1 bull . . . . .	1 animal unit
1 horse . . . . .	1 animal unit
4 sheep (plus lambs). . . . .	1 animal unit
4 sows (plus litter to weaning) . . . . .	1 animal unit
125 laying hens . . . . .	1 animal unit
100 female mink (plus associated males & kits). . . . .	1 animal unit

	<u>Market Basis (as marketed)</u>
2 beef feeders (gain 400-1100 lb). . . . .	1 animal unit
4 beef feeders (gain 400-750 lb) . . . . .	1 animal unit
4 beef feeders (gain 750-1100 lb) . . . . .	1 animal unit
15 hogs (gain 40-200 lb) . . . . .	1 animal unit
1,000 broiler chickens or roasters (4-5 lb) . . . . .	1 animal unit
300 turkey broilers (11-12 lb). . . . .	1 animal unit
150 heavy turkey hens (19-20 lb). . . . .	1 animal unit
100 heavy turkey toms (30-32 lb). . . . .	1 animal unit
40 veal calves (gain 90-300 lb) . . . . .	1 animal unit
1,000 pullets . . . . .	1 animal unit

Adapted from Agriculture Code of Practice for Ontario,  
OME and O.M.A.F., 1976.



APPENDIX "C"

Common Commercial Fertilizers

Nitrogen Materials	Form	% Nitrogen (N) *
Ammonium nitrate (Aeroprill)	Dry	33 to 34
Urea	Dry	45 to 46
Ammonium sulfate	Dry	20
Aqua ammonia	Liquid **	20
Ammonium nitrate-urea	Liquid	28
Ammonium nitrate-urea	Liquid	32
Ammonia-ammonium nitrate-urea	Liquid **	41
Ammonia-ammonium nitrate	Liquid **	41
Anhydrous ammonia	Liquid **	82

Phosphate Materials	% Phosphate (P <sub>2</sub> O <sub>5</sub> ) *
Superphosphate	18 to 20
Triple superphosphate	44 to 46
Monoammonium phosphate (12.5-50-0)	50
Diammonium phosphate (18-46-0)	46

Potash Materials	% Potash (K <sub>2</sub> O) *
Muriate of potash	60
Sulfate of potash	50
Sulfate of potash-magnesia (11% Mg)	22
Potassium nitrate (13-0-44)	44

\* Pounds of N, P<sub>2</sub>O<sub>5</sub>, or K<sub>2</sub>O supplied in 100 lb of material

\*\* Liquid under pressure

Adapted from Field Crop Recommendations, Publication 296, O.M.A.F., 1976.



APPENDIX "D"

Pesticides Used in the Various Watersheds

Type	Common Name	Trade or Brand Name
<u>Insecticides</u>	azinphos-methyl	Guthion
	<i>B. thuringiensis</i> Berliner	Dipel, Thuricide
	carbaryl	Sevin
	carbofuran	Furadan
	chinomethionate	Morestan
	chlordan	Chlordan
	chlordimeform	Galecron
	chlorfenvinphos	Birlane
	chlorpyrifos	Lorsban
	cyhexatin	Plictran
	demeton	Systox
	diazinon	Basudin
	dimethoate	Cygon, Roger
	endosulfan	Thiodan
	fensulfothion	Dasanit
	leptophos	Phosvel
	malathion	Malathion
	metalkamate	Bux
	methomyl	Lannate
	methoxychlor	Marlate
	mevinphos	Phosdrin
	parathion	Parathion
phorate	Thimet	
phosalone	Zolone	
phosmet	Imidan	
trichlorfon	Dylox	
<u>Herbicides</u>	alachlor	Lasso
	amitrole	Amino Triazole
	atrazine	AAtrex

Continued . . . . .

APPENDIX "D" ...continued

Type	Common Name	Trade or Brand Name
Herbicides (continued..)	basogran	Bentazon
	bromacil	Hyvar
	butylate	Sutan
	chloramben	Amiben
	chlorthal (dimethyl)	Dacthal, DCPA
	cyanazine	Bladex
	cyprazine	Outfox
	2,4-D	Weedex Weedone
	2,4-DB	Embutox, Butosone
	diallate	Avadex
	dicamba	Banvel
	dinitramine	Cobex
	dinoseb	Dinitro, Dynap, Sinox
	diphenamid	Enide, Dymid
	EPTC	Eptam
	linuron	Lorox, Afolan
	MCPA	Methoxone, Estamine
	mecoprop	Compitox
	metobromuron	Patoran
	metribuzin	Sencor, Lexone
	monolinuron	Afesin
	monuron	Telvar
	naptalam	Alanap, Dynap
	niclofen	Tok
	paraquat	Gramoxone
	pebulate	Tillam
	picloram	Tordon
simazine	Princep, Simazin	
	Continued . . . . .	



APPENDIX "D" ...continued

Type	Common Name	Trade or Brand Name
<u>Herbicides</u> (continued..)	2,4,5-T	Brushkill
	terbacil	Sinbar
	trifluralin	Treflan
<u>Fungicides</u>	benomyl	Benlate
	captafol	Difolatan
	captan	no common name
	chlorothalonil	Bravo
	copper (fixed)	various Trade Names
	dichloram	Botran
	dicofol	Kelthane
	dodine	Cyprex
	EBDC (ethylene bisdithio-) carbarnates & dithiocarbarnates)	Dikar, Dithane, Ferbam, Maneb, Manzate, Thiram, Zineb, etc.
	folpet	Phaltan
oils (dormant or superior)	various Trade Names	
sulphur	various Trade Names	
<u>Nematicides</u>	1,2-dichloropropane + 1,3-dichloropropene + related C-3 hydrocarbons	Vorlex, DD, Telone
	methyl isothiocyanate	Vorlex
<u>Sucker Control</u> (tobacco)	Fatty alcohols:n-octanol :n-decanol	Emtrol Antak, Contak, Delete, Emtrol, Fair-Tac
	:c-10 alcohols	Chiptac
<u>Fruit Ripening</u> (tomato)	ethephon	Ethrel

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Erigeron Erigeron

1-12 stems  
1-2 dm tall

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1-2 dm tall

APPENDIX "E"

Questionnaire on Land Use Activities

O.M.A.F. - I.J.C. QUESTIONNAIRE

Farmer's Name \_\_\_\_\_ Farm Number \_\_\_\_\_ Lot \_\_\_\_\_ Conc. \_\_\_\_\_ Township \_\_\_\_\_ County \_\_\_\_\_ Watershed AG- \_\_\_\_\_

Total Acres on Farm (In Watershed) \_\_\_\_\_

1. CROP AND PLANT FOOD INFORMATION

Crops Harvested (Include Woodlot & Pasture)		Crop Residue B,G,I,R	LAND PREPARATION				MUNICIPAL MANURE (M) & SLUDGE (S)			FALL AND/OR SPRING PRE-PLANT AND/OR PLANTING FERTILIZER				AFTER PLANTING TOP DRESSING SIDE DRESSING MINOR ELEMENTS, ETC.			
Name	Acres		Plowed Month (1-12)	Month (1-12)	# of times tilled	Quantity	Type (M or S)	Acres treated	Month (1-12)	Analysts	Product lb/A	Acres treated	Month (1-12)	Analysts	Product lb/A	Acres treated	Month (1-12)
1.																	
2.																	
3.																	
4.																	
5.																	
6.																	
7.																	
8.																	

Note on Month - 09/1974 to 08/1975

- B = Burned
- G = Green Manure
- I = Incorporated
- R = Removed

Limestone applied to \_\_\_\_\_ acres of \_\_\_\_\_ (crops) at \_\_\_\_\_ tons/A  
 Irrigation \_\_\_\_\_ acres crop \_\_\_\_\_ applications  
 (Source \_\_\_\_\_) \_\_\_\_\_ acres \_\_\_\_\_ crop \_\_\_\_\_ applications  
 \_\_\_\_\_ acres \_\_\_\_\_ crop \_\_\_\_\_ applications

2. CROP PEST CONTROL INFORMATION

A. INSECT & NEMATODE CONTROL

Trade or Common Name	Month	Formulation and Concentration	U.S. or Imp.	Rate of applic. lb. or Gal/A	Crops Sprayed (Including Soil Treatment) NAME ACRES
1.					
2.					
3.					
4.					

B. DISEASE CONTROL

Trade or Common Name	Month	Formulation and Concentration	U.S. or Imp.	Rate of applic. lb. or Gal/A	Crops Sprayed (Including Soil Treatment) NAME ACRES
1.					
2.					
3.					
4.					

C. WEED CONTROL

Trade or Common Name	Month	Formulation and Concentration	U.S. or Imp.	Rate of applic. lb. or Gal/A	Crops Sprayed (Including Soil Treatment on Fence Rows) NAME ACRES
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

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UNITED STATES DEPARTMENT OF AGRICULTURE  
OFFICE OF PLANT INDUSTRY  
WASHINGTON, D. C.

3. LIVESTOCK INFORMATION

Animals Housed on an Annual Basis, Average Number

Dairy cows, milkers \_\_\_\_\_ followers \_\_\_\_\_  
 Beef cows \_\_\_\_\_  
 Sheep (Ewes) \_\_\_\_\_  
 Laying hens \_\_\_\_\_  
 Horses \_\_\_\_\_  
 Swine - farrowing sows and boars \_\_\_\_\_

Market Animals, Number Marketed Annually (1975)

Beef feeders (gain 400 to 1100 lbs.) \_\_\_\_\_  
 Beef feeders (gain 400 to 750 lbs.) \_\_\_\_\_  
 Beef feeders (gain 750 to 1100 lbs.) \_\_\_\_\_  
 Feeder hogs \_\_\_\_\_  
 Chicken broilers or roasters \_\_\_\_\_  
 Turkey broilers \_\_\_\_\_  
 Heavy turkey hens \_\_\_\_\_  
 Heavy turkey toms \_\_\_\_\_  
 Veal calves \_\_\_\_\_  
 Pullets \_\_\_\_\_  
 Sheep (lambs) \_\_\_\_\_

4. WATER SUPPLY FOR LIVESTOCK

1. Stream or ditch \_\_\_\_\_
2. Pond \_\_\_\_\_
3. Well \_\_\_\_\_
4. Municipal \_\_\_\_\_
5. Comments on water supply system \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

5. PESTICIDE USE ON LIVESTOCK

Formulation (Name & Concentration)	Type Application	Number of Applic. per year
1.		
2.		
3.		
4.		

SPECIAL INFORMATION

A. HISTORY - Activity 1955-1975

<u>CROPS</u>	1955-1975	<u>LIVESTOCK</u>	1955-1975	<u>NUTRIENTS</u>	1955-1975
1. Arable - Cash Crops _____		1. Dairy _____		1. Fertilizers _____	
- Tobacco _____		2. Beef _____		2. Manures _____	
- Processing Crops _____		3. Swine _____		3. Sludge _____	
- Fresh Market Vegetables _____		4. Poultry _____		4. Herbicides _____	
2. Fruit _____		5. Others _____		5. Insecticides _____	
3. Pasture _____				6. Fungicides _____	
4. Others _____					

B. COMMENTS - \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

AG-13 Use of Triazines in 1973-74

	<u>1973</u>			<u>1974</u>		
	Crop	lb/A	Acres	Crop	lb/A	Acres
Atrazine (Aatrex)						
Metribuzin (Sencor)						
Prometryn (Gesagard)						
Cyanazine (Bladex)						
Simazine (Princep)						
Simazine - Atrazine (Ekko)						

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APPENDIX "F" : Non-Agricultural Land Use Questionnaire

INTERNATIONAL JOINT COMMISSION

PLUARG

Questionnaire on Watersheds

A questionnaire has been prepared on the agricultural area of the watershed. In order to complete the information for the total area in each watershed it is important to know the area of land devoted to non-agricultural uses.

NON AGRICULTURAL USES OF LAND IN WATERSHED - AG # \_\_\_\_\_ .

1. Public Utilities and Rights-of-Ways:

	<u>Miles X Width</u>	<u>Acres</u>	<u>Herbicides</u>	
	8.25	Sprayed	Name	Rate
	= acres	With		
		Herbicide		Acre
(a) Road allowances:				
(b) Railways				
(c) Hydro lines (uncropped)				
(d) Pipelines				
(e) Municipal Drains & Ditches (indicate area dredged in 1975)				
(f) Municipal Streams				

2. Urban Development:

	<u>Number</u>	<u>Total Acres</u>
(a) Residential - Homes, etc.	_____	_____
(b) Industrial - Power Stations, Factories, etc.	_____	_____

3. Wilderness:

(a) Recreational areas, e.g., golf courses, parks.	_____	_____
(b) Forest on Woodlands, not on farms	_____	_____

4. Any other land not in above uses

_____	_____	_____
_____	_____	_____

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INTERNATIONAL JOINT COMMISSION  
**GREAT LAKES REGIONAL OFFICE**

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