OPERATING SUMMARY

WATER SUPPLY SYSTEMS

1974

Ministry of the Environment

Hon. William G. Newman, Minister
Everett Biggs, Deputy Minister

WATER SUPPLY SYSTEMS

Operated by the Ministry of the Environment

prepared by
Technical Services Branch

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PROJECT	RAW WATER SOURCE	DESIGN CAPACITY in MIGD						
		PUMPS		Micro-strainer	Settling tank	Filter	@ gpm/ft²	Storage mil gal
		low-lift	high-lift					
Region I - Southwestern								
1. Amherstburg	Detroit River	9	10		4	4	1.7	
2. Blenheim	Lake Erie	2	2		1	1	2.9	
3. Dresden	Sydenham River	.86	.86		.5			.86
4. Elgin Area WSS	Lake Erie	10	10		10	10	3.2	6
5. Goderich	Lake Huron	2.6	2.8		3	3	3.6	.54
6. Harrow	Lake Erie		3.4	1.25				
7. Lake Huron WSS	Lake Huron	42	37			40	2.1	13.4
8. Lambton Area WSS	Lake Huron	Chlorination & Fluoridation						
9. Meaford	Nottawasaga Bay	6	3.7			2.9	1.6	.33
10. Southampton	Lake Huron	2[b]				1	1.7	.10
11. Union WSS	Lake Erie		23			16		
12. Watford Wyoming Plympton WSS		Pipeline Only						
Region II - West Central								
14. Dunnville	Lake Erie	24	58	20.5				.2
Region III - Central								
15. Brock Twp. (Beaverton)	Lake Simcoe	.8				.55	1.7	.10
16. Bobcaygeon	Big Bob River	.27				.2	.5	
17. Fenelon Falls	Cameron Lake	.24				.36	2.5	.008
18. Hastings	Rice Lake	Chlorination Only						
19. S. Peel-Lakeview	Lake Ontario	90	80		48	48		54
20. Warkworth	Mill Creek	.14	.22			.1	2	.11
Region IV - Southeastern								
21. Bancroft	Clark Lake	Gravity				Chlorination Only		
22. Chalk River	Corry Lake					Chlorination Only		
23. Eganville	Bonechere River					.18	1.6	
24. Marmora	Crow River	.22[a]				.5	2.6	.44
25. Rockland	Ottawa River	2	2.2		.8	.8	2.4	
Region V - Northeastern								
26. Cache Bay	Tanner Lake	Gravity				Chlorination Only		
27. Espanola	Apsey Lake	1.5			Chem. Add. Only			
28. Haileybury	Lake Timiskaming	2.6	3		1.5	1.5	2.3	.6
29. Michipicoten Twp.	Wawa Creek	Chlorination Only						
30. Moosonee	Store Creek	.14	.2		.15	.12	1.5	
31. Wahnapitae WSS	Wahnapitae Lake	4.2	5.2	2 Reactivators @ 6.25 ea.				
Region VI - Northwestern								
32. Ear Falls	English River	.14				Chlorination Only		
33. Emo Twp.	Rainy River	.08 Microfloc Pkg. Unit						
34. Geraldton	Reesor Lake	Chlorination Only						
35. Red Lake	Skookum Bay	.25			Chlorination Only			

a: Plus 100% standby
b: Plus 3 mgd diesel powered pump

GROUND WATER PROJECTS

PROJECT	Nominal Capacity MIGD	DESCRIPTION
Region I - Southwestern		
36. Hanover		Pumping only
37. Mitchell		Chlorination, aeration, filtration (iron removal)
38. Thedford		Chlorination
39. Van Astra		Chlorination
Region II - West Central		
40. Brantford Twp.		Chlorination
41. Orangeville		Pumping only
42. Shelburne		Chlorination
43. Woolwich Twp.		Chlorination, filtration (iron removal)
Region III - Central		
44. Anson Hindon & Minden		Chlorination
45. Bradford		Chlorination
46. Brock Twp.		Pumping only
47. Caledon (Bolton)		Chlorination
48. Caledon (Caledon E.)		Pumping only
49. Cookstown		Chlorination
50. Elmvale		Pumping only
51. Havelock		Chlorination (1 of 2 wells only)
52. King Twp. - Schomberg	.14	Zeolite softners, chlorination
53. Markham - Don Mills		Chlorination, sequestering
John Street		Chlorination, aeration, filtration (iron removal)
Steeles Ave.		Chlorination, aeration, filtration (iron removal)
Pharmacy		Chlorination, sequestering
54. Newcastle		Chlorination
55. Newcastle (Orono)		Pumping only
56. Oshawa (Whitby)	.16	Chlorination, aeration
57. Richmond Hill		Chlorination
58. Richmond Hill -Oak Ridges	.47	Chlorination, press filtration
59. Scugog Twp. -Port Perry		Chlorination
60. Stayner		Chlorination
61. Woodville Twp.		Chlorination
Region IV - Southwestern		
62. Alfred		Chlorination
63. Bourget		Chlorination
64. Chesterville	.5	Chlorination
65. Frankford	.54	Pumping only
66. Plantagenet		Pumping only
67. Vankleek Hill		Chlorination
68. Wellington		Chlorination
69. Westport		Chlorination
70. Winchester		Chlorination, sequestering
Region V-Northeastern		
71. Blezard Valley WSS		Chlorination
72. Blind River		Pumping only
73. Fauquier Twp.	.07	Chlorination, aeration, filtration (iron removal)
74. Black R. Matheson -Ramore		Pumping only
75. Warren (Ratter & Dunnett)		Pumping only

INTRODUCTION

Project Operations Branch of the Ministry of the Environment prepares annual operating summaries on staffed projects which have been in operation for at least one year. This report summarizes data from 74 water supply projects, not all of which provide treatment. In one case, Watford, Wyoming and Plympton, the project is a pipeline delivering water purchased from the Sarnia system.

During 1974 these projects supplied 39.8 billion gallons of water, 36.3 billion gallons from surface water sources and 3.5 billion gallons from ground water supplies.

This summary makes no attempt to delineate operating problems at individual plants. The nature of operating problems and unusual conditions, along with more detailed data, is contained in individual plant operating summaries.

OPERATING DATA

PLANT FLOWS

Table I summarizes flow data, including maximum rates where available. Design capacities listed for projects affording physical treatment (that is, microstraining, sedimentation and filtration) do not include reduction in potential output due to in-plant use of water for purposes such as backwashing of filters. Where no treatment, or chemical treatment only (usually chlorination) is provided, the maximum output is limited by pumping capacity.

A total of 39.8 billion gallons of water was produced: 36.3 billion gallons by surface water supplies and 3.5 billion gallons by ground water supplies. Two projects, the Lake Huron Water Supply System, and the South Peel Water Supply System accounted for more than half of the total.

TABLE I

PLANT FLOWS

SURFACE WATER SUPPLIES

PROJECT	DESIGN CAPACITY mgd	TOTAL OUTPUT million gal	AVERAGE DAY million gal	MAXIMUM DAY million gal	MAXIMUM RATE mgd
Region I - Southwestern					
Amherstburg	4.0	353	.97	1.5	2.5
Blenheim	1.0	142	.39	.62	1.4
Dresden	.5	113	.31	.59	.66
Elgin Area WSS	10	1495	4.1		
Goderich	3.0	373	1.0	2.0	2.8
Harrow		Not Available			
Lake Huron WSS	37	8804	24	35	38
Lambton Area WSS		4518	12	28	40
Meaford	2.9	320	.88	1.6	2.0
Southampton	1.0	124	.34	1.0	
Union WSS	16.0	1857	5.1	10.5	14.1
Watford, Wyoming, Plympton WSS		51	.14		
Region II - West Central					
Dunnville	20.0	3489	9.6	12.6	
Region III - Central					
Brock Twp. (Beaverton)	.55a	51.2	.34	.55	
Bobcaygeon	.2	26.5	.073	.14	
Fenelon Falls	.36	Not Available			
Hastings		21.8	.060	.21	
South Peel - Lakeview	48	12378	34	66	71
Warkworth - Percy Twp.	.10	17.6	.048	.13	
Region IV - Southeastern					
Bancroft		26.1	.072	.083	
Chalk River		15.9	.047	.90	
Eganville	.18	26.5	.070	.17	
Marmora	.23	45.9	.13	.41	
Rockland	.8	205	.56	.83	
Region V - Northeastern					
Cache Bay		14.7	.040	.086	
Espanola	1.5	189	.52	1.3	
Haileybury	1.5	164	.45	.65	
Michipicoten Twp. (Wawa)		Not Available			
Moosonee	.11	55.2	.15	.32	
Wahnapitae - Sudbury	6.25b	933	3.1	4.3	
Region VI - Northwestern					
Ear Falls	.14	39	.11	.18	
Emo Twp.	.08	16.2	.05	.11	
Geraldton		181	.50	.76	
Red Lake	.25	143	.39	.57	

a: Data for period Jan. 1 - June 30
b: Data for 300 days

GROUND WATER SUPPLIES

PROJECT	DESIGN CAPACITY mgd	TOTAL OUTPUT million gal	AVERAGE DAY million gal	MAXIMUM DAY million gal	MAXIMUM RATE mgd
Region I - Southwestern					
Hanover		108.2	.30		
Mitchell		169.9	.47	1.07	
Thedford		20.4*	.056	.12	
Van Astra		42.0*	.12	.16	
Region II - West Central					
Brantford Twp.		40.2*	.11	.39	
Cambridge (Preston)		Not Available			
Orangeville		341.6	.94		
Shelburne		76.7*	.21		
Woolwich Twp.		25.3	.069		
Region III - Central					
Anson, Hindon & Minden		18.0	.049	.10	
Bradford (Doane Well)		33.6*	.092	.40	
Brock Twp.		10.0a	.055	.09	
Caledon (Bolton)		114.0	.31	.64	
Caledon (Caledon East)		23.88	.065	.26	
Cookstown		155.6	.43	.78	
Elmvale		46.5	.13	.31	
Havelock		33.3	.091		
King Twp. - Schomberg	.14	16.5	.045	.13	
Markham - Don Mills		259.7	.81	1.35	1.5
German Mills #1		126.0	.55		
Steeles Ave.		28.7b	.31		
Pharmacy Ave.		214.3c	.84	1.28	.9
Sabiston		324.1d	.92	1.25	1.0
Total		952.8	2.6		
Newcastle		12.5e	.059	.11	
Newcastle (Orono)		10.6a	.058	.10	
Oshawa (Whitby)	.16	11.4f	.084	.12	
Richmond Hill		105.1*	.29	.63	
Richmond Hill (Oak Ridges)	.47	42.9	.12	.25	
Scugog Twp. (Port Perry)		28.1g	.23	.33	
Stayner		82.3	.23	-	
Woodville Twp.		3.6	.010		
Region IV - Southeastern					
Alfred		21.0	.060		
Bourget		Not Available			
Chesterville		28.5	.080	.159	.23
Frankford		48.3	.13	.38	
Plantagenet		Not Available			
Vankleek Hill		32.2	.09	.16	
Wellington		6.9e	.033	.94	
Westport		5.8h	.032	.080	
Winchester		70.3	.19	.31	
Region V - Northeastern					
Blezard Valley WSS		279.1	.77		
Blind River		51.7	.14	.27	
Fauquier Twp.	.07	16.9	.046	.082	
Black River Matheson Twp. (Playfair - Ramore)		Not Available			
Warren (Ratter - Dunnett)		13.1	.036	.081	

a: Six months data
b: 93 days flows
c: 254 days flows
d: 51 days flows
e: Seven months data
f: 136 days flows
g: Four months flows
h: 184 days flows

* Flows estimated in part

WATER QUALITY

Bacteriological Quality

Tables II and III are summaries of bacteriological sampling carried out during 1974. The indicator organisms used were total coliforms. The results for raw water are tabulated to provide an approximation of geometric means taking the logarithm of coliforms less than 4 as being 0, from 4 to 32 as 1, from 33 to 320 as 2 and coliforms greater than 320 to 3. The geometric mean of n samples is antilog $\frac{(\log x_1 + \log x_2 + \ldots \log xn)}{n}$

Samples of treated water are taken leaving the plant and in the distribution system up to the point of delivery of the water, which in some cases is the ultimate consumer and in others the municipal distribution system.

Chemical Quality

The results of chemical analysis are shown as arithmetic mean values in Tables IV and V for surface waters and ground waters respectively. Where no treatment is provided, or where treatment does not alter the parameter, the figure shown is of all analyses both raw and treated water. In many cases these averages are based on very few samples, and in some cases, the values shown have come from samples taken in investigating consumer complaints. The data tabulated may, therefore, not be entirely representative of the normal finished product.

Physical Characteristics

Turbidity, color and temperature data for surface water supplies and turbidity and color for ground water supplies is contained in Tables VI and VII. Where no facilities exist for the removal of turbidity and colour (coagulation and filtration), that is, where raw water with, perhaps, chemical addition is pumped directly into the distribution system, averages of all samples are shown as treated water. Ground water temperatures are assumed to be constant and equal to ground temperatures, therefore they are not recorded. It would appear from the limited data on turbidity and color that ground waters (Table VII) frequently exceed the desireable criteria of 1.0 F.T.U. turbidity and 5 units apparent color.

TABLE II BACTERIOLOGICAL QUALITY

SURFACE WATER SUPPLIES

PROJECT	AVG CHLORINE RESIDUAL mg/l	NUMBER OF SAMPLES HAVING TOTAL COLIFORMS (per 100 ml) OF:								
		0	1-3	4-32	33-320	>320	0	≥1	0	≥1
		RAW WATER					LEAVING PLANT		IN DISTRIB^n	SYSTEM
Region I-Southwestern										
Amherstburg	.6	0	0	0	4	32	34	0	112	4
Blenheim	.6	37	8	5	0	1	51	0	101	0
Dresden	1.0	0	0	0	5	23	37	1	0	0
Elgin Area WSS	.7	67	22	11	4	1	196	0	191	0
Goderich	1.0	16	10	11	14	1	52	1	209	0
Harrow		17	0	18	11	5	51	0	102	0
Lake Huron WSS	.5	150	0	0	0	0	150	0	791	0
Lambton Area WSS	.6	31	2	2	5	0	282	0	0	0
Meaford	.4	14	7	11	12	2	61	0	92	0
Southampton	.7	21	4	1	0	0	2	0	50	1
Union WSS	.5	3	0	13	18	3	37	0	348	0
Watford, Wyoming, Plympton WSS		6	0	0	0	0	0	0	15	3
Region II-West Central										
Dunnville	.5	0	0	0	7	21	28	0	0	0
Region III-Central										
Brock Twp. (Beaverton)	.5	2	1	2	3	0	8	0	15	0
Bobcaygeon	.5	0	4	9	19	9	40	0	153	0
Fenelon Falls		6	0	15	15	4	17	0	223	2
Hastings		0	0	0	0	0	0	0	214	23
South Peel-Lakeview	.4	2	6	18	21	6	52	2	407	4
Warkworth-Percy Twp.	.7	1	0	2	17	12	29	3	56	7
Region IV-Southeastern										
Bancroft	.9	17	10	11	4	2	37	0	286	4
Chalk River	.5	22	2	8	7	2	17	0	131	1
Eganville	.5	33	0	3	1	1	155	1	0	0
Marmora Rockland	.5	0	0	0	4	30	33	0	65	1
Region V-Northeastern										
Cache Bay	.6	11	5	3	4	0	25	0	0	0
Espanola	.8	12	5	1	4	1	35	1	138	7
Haileybury	.7	5	1	11	11	0	28	0	25	0
Michipicoten Twp. (Wawa)		1	0	0	2	0	0	0	14	0
Moosonee	.6	4	4	14	6	0	25	1	33	1
Wahnapitae WSS	.5	3	2	1	3	0	21	0	0	0
Region VI-Northwestern										
Ear Falls	.5	19	9	14	11	0	16	2	71	3
Emo Twp.	.7	3	0	0	4	37	83	1	170	0
Geraldton	1.0	27	11	10	3	0	51	0	236	6
Red Lake	.7	8	4	14	17	0	38	0	67	7

TABLE III

BACTERIOLOGICAL QUALITY

GROUND WATER SUPPLIES

PROJECT	AVG CHLORINE RESIDUAL mg/l	NUMBER OF SAMPLES HAVING TOTAL COLIFORMS (per 100 ml) OF: RAW WATER					LEAVING PLANT		IN DISTRIBN SYSTEM	
		0	1-3	4-32	33-320	>320	0	≥1	0	≥1
Region I - Southwestern										
Hanover		8		4	3	1	8			
Mitchell		31					19		39	
Thedford		18		1			20		40	
Van Astra	.2						5		10	
Region II - West Central										
Brantford Twp.	.3			Not Available						
Woolwich Twp.	.2	27	1				1		58	2
Region III - Central										
Anson, Hindon & Minden	.3								87	
Bradford	1.0	24								
Brock Twp.		3							9	
Caledon (Bolton)	.9									
Caledon (Caledon East)		7							8	3
Elmvale		41							118	8
Havelock		8		1					41	13
King Twp. - Schomberg		9					9		18	
Markham		80					41		195	2
Newcastle	.4						5		15	
Newcastle (Orono)		8							28	
Oshawa (Whitby)	.6	5					5		10	
Richmond Hill - Oak Ridges	.5									
Scugog Twp. (Port Perry)	1.0	9	1				10		23	1
Stayner									18	
Woodville Twp.	.4	1					1		1	
Region IV - Southeastern										
Alfred	.5	20	2	9	6	8	77	2	49	12
Chesterville	.5		1		1				14	2
Frankford	.1								142	24
Vankleek Hill	.4	45	4		4	1	55	1	79	
Wellington	1.3	12	1	2	6		22	1	91	5
Westport	.4	17	2	6	5	1	28	1	135	4
Winchester	.6	96		2	2				177	2
Region V - Northeastern										
Blezard Valley WSS		59							17	
Fauquier Twp.		21					21		42	3
Black River, Matheson Twp (Playfair - Ramore)		3							6	
Warren (Ratter-Dunnett Twp.)		6							49	

TABLE IV

CHEMICAL CHARACTERISTICS

SURFACE WATER SUPPLIES

NOTE Data shown as RAW/TREATED or as average of all samples (see text)

PROJECT	HARDNESS mg/l $CaCO_3$	ALKALINITY mg/l $CaCO_3$	IRON mg/l Fe	CHLORIDE mg/l Cl^-	pH pH units	FLUORIDE mg/l F^-	AMMONIA mg/l N	KJELDAHL NITROGEN mg/l N	NITRATE +NITRITE mg/l N	TOTAL PHOSPHORUS mg/l P	PHENOL µg/l C_6H_5OH	SULFATE mg/l SO_4^{-2}	ALUMINUM mg/l Al	COPPER mg/l Cu	CALCIUM mg/l Ca	CONDUCTIVITY micromhos per cubic centimeter
Region I-Southwestern																
Amherstburg	116/116	82/70	1.2/<.05	23/20	7.9	0.1/.8										
Blenheim	132/133	92/78	.6/<.05	22	8.0	0.1/.8										
Dresden	239/179	192/90	1.2/<.05	19/21	7.9/8.3											
Elgin Area WSS	137/139	98/89	.8/<.05	22	7.9	.1/.9	.04/.01	.36/.19	.07/.06	.04/.01						
Goderich	114/121	90/79	.9/<.05	8	8.0	.1/.9										
Harrow	126	82	.6	28	7.8											
Lake Huron WSS	105/107	79/76	.10/<.05	7	8.0	.1										
Lambton Area WSS	94	80	.11	7	8.0	.1										203
Meaford	90/92	72/70	.23/<.05	6	8.0											
Southampton	108/123	82/91	1.1/.12	7	8.1	.1			.2/.4			12/16				210/238
Union WSS	125/122	81/70	1.0/<.05	26/23	8.1											
Region II-West Central																
Dunnville	142	103	.56	24	7.9											
Region III-Central																
Bobcaygeon	77/80	65/60	.26/<.06	6/9	7.6											170/163
Fenelon Falls	50	71	.12	7	8.2											124
South Peel-Lakeview	132/140	98/93	.7/.1	30/32	7.7	.2/1.0	.1/<.1	.5/.3	.3							335/331
Warkworth-Percy Twp.	215/211	197/194	.21/.09	5	8.2											405/409
Region IV-Southeastern																
Bancroft	39	33	<.05	2	8.0											85
Chalk River	16	14	.30	2	7.7											.42
Eganville	50/52	36/38	.12/.25	6	7.4											115/114
Rockland	45/71	33/37	.76/<.05	<5	7.3/8.1		<.0/<.07	.43/.17	.22/.23						13/23	106/165
Region V-Northeastern																
Cache Bay	23	10	.15	2	7.6											62
Espanola	33	20/19	.09/.11	8	7.6/7.3	.16/.9										79/85
Haileybury	29/42	16/19	2.5/.3	2/4	7.7/8.2	.1/<.1							.56/.9			65/111
Michipicoten Twp. (Wawa)	75	44	.08	2	7.4											161
Moosonee	138/142	120/150	1.1/.15	114/117	7.6/7.8	.19/1.0										189/461
Wahnapitae WSS	43/49	17/18	.4/.05	12/11	7.4	.8					1.0		.27			85
Region VI-Northwestern																
Ear Falls	40/39	37	.38/.40	<1/1	7.1											75/83
Emo Township	32/33	30/48	.8/<.05	2/8	7.0											79/212
Geraldton	60/226	68/156	.20/.30	<1	7.6/7.4											116/287
Red Lake	29/29	24/20	.15/.12	1/2	6.9/6.6											60

TABLE V

CHEMICAL CHARACTERISTICS

GROUND WATER SUPPLIES

NOTE: Data shown as RAW/TREATED or as average of all samples (see text).

PROJECT	HARDNESS mg/l $CaCO_3$	ALKALINITY mg/l $CaCO_3$	IRON mg/l Fe	CHLORIDE mg/l Cl^-	pH pH units	FLUORIDE mg/l F^-	AMMONIA mg/l N	KJELDAHL NITROGEN mg/l N	NITRATE +NITRITE mg/l N	TOTAL PHOSPHORUS mg/l P	PHENOL µg/l C_6H_5OH	SULFATE mg/l SO_4^{-2}	ALUMINUM mg/l Al	COPPER mg/l Cu	CALCIUM mg/l Ca	CONDUCTIVITY micromhos per cubic centimeter
Region I-Southwestern																
Mitchell	267/249	199/203	.36/<.05	7	7.7											633/590
Thedford	106	206	.18	27	8.0	2.1										
Region II-West Central																
Woolwich Twp.	814/600	200/198	2.32/.05	3/12	7.5	.7	.42/.18		<.01/.90			633/570			228/135	1290/1197
Region III-Central																
Anson, Hindon & Minden			.13									0			41	
Elmvale	175	181	<.13	3	7.5											
King Twp.-Schomberg	242/220	329/327	1.8/2.3	3/7												
Markham (Don Mills)	304	266	.58	31	7.6											592
Newcastle (Orono)	318	249	<.05	40	7.4											680
Oshawa (Whitby)	270	228	.74/.13	7	7.6											463
Scugog Twp. (Port Perry)	215	222	.25	5	7.8											410
Woodville Twp.	363	298	1.95	31	7.3		.33	.60	7.4	.02						646
Region IV-Southeastern																
Alfred	233	184	.10	118	7.6		.07	.45	7.2						66	868
Bourget	55	114	2.0	15	7.5		.16	.50	<.22							243
Chesterville	407	305	.72	63	7.7											1042
Frankford	288	263	.12	50	7.8											727
Plantagenet	528/424	354/390	1.4/1.2	157/208	7.4/7.6		.29/.30	.44/.30	<.10						154/123	1265/1550
Wellington	318	284	.43	32	7.4		.2	.4	<.22							627
Westport	300	241	.10	39	7.7											609
Winchester	285/234	296/302	.15/.10	64/60	7.9/7.7											940/938
Region V-Northeastern																
Blezard Valley WSS	121	80	<.05	12	8.1											264
Blind River																
Fauquier Twp.	324	338	1.9/.6	8	7.6											623

TABLE VI

PHYSICAL CHARACTERISTICS

SURFACE WATER SUPPLIES

PROJECT	TURBIDITY					APPARENT COLOUR					TEMPERATURE	
	RAW WATER		TREATED WATER			RAW WATER		TREATED WATER			AVERAGE	MAXIMUM
	AVERAGE FTU	MAXIMUM FTU	AVERAGE FTU	MAXIMUM FTU	% of samples >1.0 FTU	AVERAGE units	MAXIMUM units	AVERAGE units	MAXIMUM units	% of samples > 5 units	°F	°F
Region I-Southwestern												
Amherstburg	17.0	89	.4	2.8	6	-	-	<5	<5	0	53	75
Blenheim	12	100	.7	2.9	22	9	100	<5	<5	0	50	74
Elgin Area WSS	30	197	.14	.76	0	6	10	<5	<5	0	51	72
Goderich	23	160	1.0	1.4	93	8	20	<5	<5	0	48	74
Harrow			11.5	30	100							
Lake Huron	11	70	.4	3.7	1	-	-	<5	<5	0	48	70
Lambton Area WSS	9	20	2.3	6.6	100						48	71
Meaford	1.7	20	.8	10.0	100	-	-	<5	<5	0	44	68
Southampton	2.6	80	2.1	10	100	13	50	<5	15	20	53	70
Union WSS	24	90	.9	4.9	34	9	30	<5	<5	0		
Region II-West Central												
Dunnville	25	150	2.0	144	100	3	10	<8	15	33	46	69
Region III-Central												
Bobcaygeon	3.1	6.4	.7	1.9	17	29	50	11	15	66		
Fenelon Falls	.9	1.4	.4	.5	0	15	15	<5	<5	0		
South Peel - Lakeview	8.8	84	.6	3.3	2	6	40	<5	<15			
Warkworth-Percy Twp.	2.2	3.0	1.7	7.7	50	21	50	10	25	38	51	73
Region IV-Southeastern												
Bancroft	.45	.80				.13	.40					
Chalk River	1.1	1.1				60	60					
Eganville	2.3	3.6	2.2	3.0	83	18	20	14	15	66	43	72
Rockland	3.3	16	.08	2.7	1	35	70	<5	5	0	47	73
Region V-Northeastern												
Cache Bay			.6	.6				30	30	100		
Espanola	1.2	3.0	1.2	2.9	55	12	20	11	20	65	-	
Haileybury	14.7	34	2.7	4.8	81	70	150	<6	20	60	47	71
Michipicoten Twp. (Wawa)	.45	.70				<5	<5					
Moosonee	7.9	70	4.8	9.0	70	126	235	17	90	100	40	60
Wahnapitae WSS	5.1	5.8	.4	1.0	1	24	40	6	10		55	72
Region VI-Northwestern												
Ear Falls	4.4	7.5	5.0	12	100	41	50	38	70	100		
Emo Twp.	5.1	49	.8	4.0	20	40	70	<5	10	8		
Geraldton	1.7	1.7	1.7	1.7	100	30	30	15	15	100		
Red Lake	1.0	2.5	.9	1.5	18	28	40	23	30	90		

TABLE VII

PHYSICAL CHARACTERISTICS

GROUND WATER SUPPLIES

PROJECT	TURBIDITY					APPARENT COLOUR				
	RAW WATER		TREATED WATER			RAW WATER		TREATED WATER		
	AVERAGE FTU	MAXIMUM FTU	AVERAGE FTU	MAXIMUM FTU	% of samples >1.0 FTU	AVERAGE units	MAXIMUM units	AVERAGE units	MAXIMUM units	% of samples >5 units
Region I - Southwestern										
Mitchell	2.9	2.9	.6	.6	0	10	10	5	5	0
Thedford	.8	.9			0	<5	<5			
Region II -West Central										
Woolwich Twp.										
Region III -Central										
King Twp.-Schomberg	6.0	11.0	2.4	6.5	33	16	30	7	10	33
Markham-Don Mills										
Oshawa (Whitby)			7	7	100			30	30	100
Region IV -Southeastern										
Alfred			2.0	3.9	66			10	15	66
Bourget			4.4	9.3	100			25	30	100
Chesterville			7.2	7.8	100			12	20	50
Frankford			.5	.9	0			<5	<5	0
Plantagenet	17	22	2.7	2.7	100	25	30	20	20	100
Wellington	.8	.8				<5	<5			
Westport	.7	2.0				<5	<5			
Winchester	.8	2.0	.4	.4		<5	5	<5	<5	0
Region V -Northeastern										
Fauquier Twp.	7.3	14.0	1.0	2.2	50			20	40	75

PROCESS DATA

The results of raw water algae enumeration are summarized in Table VIII tabulating weighted average monthly values of total algae.

The quantities of chemicals used in the treatment processes including disinfection are presented in Table X for both surface water and ground water projects. Sodium silicate is used as a flocculant aid in the surface water projects as 'activated silica'. Its use in ground water projects is for sequestering iron.

The data available on filter operation is summarized in Table XI. Since many of these plants are not staffed 24 hours per day, the filters are washed at regular intervals rather than on the basis of head loss.

Since there is a move to require treatment of process wastes rather than discharging these streams to the raw water source, data has been collected on volumes and chemical characteristics of filter wash water and of sludge from clarifiers and settling basins.

TABLE VIII

TOTAL ALGAE - RAW WATER

NOTE:

PROJECT	* AVERAGE ASU/ml	TOTAL ALGAE - in Areal Standard Units per milliliter											
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Region I - Southwestern													
Amherstburg	230	420	760	600	1200	1800	1100	610	130	610	400	370	500
Blenheim	740	640	390	670	600	450	-	1300	560	760	1500	390	600
Goderich		-	-	-	-	1000	900	780	730	80	-	-	-
Lake Huron	230	100	100	80	140	350	500	340	110	300	-	-	-
Union	3400	3200	2700	5200	3700	3800	3200	2700	2700	4500	3600	3400	2800
Region II - West Central													
Dunnville	900	690	570	1320	600	600	470	600	1500	1100	800	960	2000
Region III - Central													
South Peel - Lakeview	370	70	100	180	580	500	280	400	150	220	650	750	550

* Averages are weighted

TABLE IX

MICROSTRAINER PERFORMANCE

PROJECT	TOTAL			BLUE-GREEN			GREEN			FLAGELLATES			DIATOMS		
	ASU/ml		%	ASU/ml		%	ASU/ml		%	ASU/ml		%	ASU/ml		%
	applied	eff	red^n	applied	eff	red^n	applied	eff	red^n	applied	eff	red^n	applied	eff	red^n
Region I - Southwestern															
Union	3400	1447	57	130	182	-	624	249	60	125	80	36	2536	1051	59
Region II - West Central															
Dunnville	896	143	84	56	24	57	189	33	83	80	23	71	574	79	86

TABLE X

CHEMICALS USED

PROJECT	CHLORINE 10^3 lb	SODIUM HYPOCHLORITE gallons	ALUM LIQUID 10^3 gal	ALUM DRY 10^3 lb	SODIUM SILICATE 10^3 lb	SODIUM BICARBONATE 10^3 lb	POLYMER lb	LIME $Ca(OH)_2$ 10^3 lb	SODA ASH 10^3 lb	ACTIVATED CARBON 10^3 lb	SODIUM CHLORITE 10^3 gal	POT. PERMANG. lb	D. E. 10^3 lb	SODIUM CHLORIDE 10^3 lb	FLUORIDE H_2SiF_6 gallons	FLUORIDE Na_2SiF_6 10^3 lb
SURFACE WATER SUPPLIES																
Region I-Southwestern																
Amherstburg	12		18		14	.9									15.9	
Blenheim	3.0		8.8		11	2.2									1.8	
Dresden	3.7			53	32	8.0		106				655				
Elgin Area WSS	30			211												19.8
Goderich	5.8		10.8		.50	1.7										4.6
Lake Huron WSS	115.2		147													
Lambton Area WSS	38														73	
Meaford	3.5															
Southampton	1.8												21			
Union WSS	52		76		19	4.4				2.2						
Region II-West Central																
Dunnville	37															
Region III-Central																
Brock Twp. (Beaverton)	1.0															
Bobcaygeon	1.1												18			
Hastings	2.0															
South Peel-Lakeview	90		111								60					457
Warkworth-Percy Twp.		473		4.0												
Region IV-Southeastern																
Bancroft		730														
Chalk River	.91															
Eganville		784		2.2												
Marmora	1.0															
Rockland	9.2			8			865	40								
Region V-Northeastern																
Cache Bay		228														
Espanola	3.2															3.2
Haileybury	3.5		8.3	1.7	6.2	.32	20									
Michipicoten Twp. (Wawa)																
Moosonee		1660		34			472		23						2.9	
Wahnapitae WSS	44		44				3958	101	28							9.9
Region VI-Northwestern																
Ear Falls	1.5															
Emo Twp.	1.3		2.5				62		10							
Geraldton	5.2															
Red Lake	4.0															
GROUND WATER SUPPLIES																
Region I-Southwestern																
Hanover																
Mitchell																
Thedford																
Van Astra	.05															
Region II-West Central																
Brantford Twp.		143														
Woolwich Twp.		234														
Region III-Central																
Anson, Hindon & Minden		168														
Bradford		394														
Markham-Don Mills	3.2				58											
-German Mills	10.2															
-Steeles Ave.	.5															
-Pharmacy	3.3				33											
Newcastle	1.1															
Scugog Twp. (Port Perry)	.4															
Region IV-Southeastern																
Alfred		740														
Chesterville		456														
Frankford		102														
Vankleek Hill		473														
Wellington		20														
Westport		30														
Winchester		433														
Region V-Northeastern																
Blezard Valley WSS	1.3															

TABLE XI

FILTER OPERATION

PROJECT	TYPE OF FILTER	NUMBER and SIZE OF FILTERS n x sq. ft.	AVERAGE TURBIDITY FORMAZIN UNITS		FILTER RUN hours		FILTER WASH WATER USED
			APPLIED	FILTERED	AVERAGE	MINIMUM	% of output
SURFACE WATER PROJECTS							
Region I - Southwestern							
Amherstburg	Gravity, dual media	4 x 416	2.1	.4	69	48	5
Blenheim	Gravity, dual media	3 x 79	-	.7	12	5	5
Elgin Area W.S.S.	Gravity, dual media	2 x 1040	-	.1	62	24	4
Goderich	Gravity, dual media	4 x 144	3.2	1.0	43	12	2
Lake Huron W.S.S.	Gravity, dual media	12 x 1100	11.0	.4	42	4	6
Meaford	Gravity, anthracite	2 x 625	1.7	.8	24	23	3
Southampton	Pressure, D.E.	2 x 206	2.6	2.1			1
Union W.S.S.	Gravity, dual media	4 x 650	1.9	.9			1
Region III-Central							
Brock Twp. (Beaverton)	Pressure, sand	4 x 63	Not Available				
Bobcaygeon	Vacuum, D.E.	1 x 180	3.1	.7	81	24	2
Fenelon Falls	Pressure, sand	2 x 50	Not Available				
South Peel - Lakeview	Gravity, dual media	18 x 1000		.6	49	22	2
Warkworth - Percy Twp.	Gravity, sand	1 x 35	2.2	1.7			
Region IV - Southeastern							
Eganville	Pressure, sand	2 x 38			24	24	-
Marmora	Vacuum, D.E.	8 x 16	Not Available				
Rockland	Gravity, dual media	2 x 113		.1			
Region V - Northeastern							
Haileybury	Gravity, daul media	3 x 140		2.7	80		1
Moosonee	Gravity, sand	2 x 28		4.8	17	16	2
Region VI - Northwestern							
Emo Twp.	Gravity, multi-media	1 x 23		.8	5	3	10
GROUND WATER PROJECTS (IRON REMOVAL PLANTS)							
Region I - Southwestern							
Mitchell	Pressure, Anthracite	1 x 200	2.9	.6			
Region II - West Central							
Woolwich Twp.	Pressure	2 x 13			9	4	3
Region III - Central							
Markham - John Street	Pressure	2 x 78					
Steeles Avenue	Gravity, sand	1 x 182					
Oshawa (Whitby)	Pressure, sand	1 x 44	7.0	7.0			
Richmond Hill - Oak Ridges	Pressure, Anthracite	4 x 33	Not Available				
Region V - Northeastern							
Fauquier Twp.	Pressure, sand	2 x 13	7.3	1.0			

TABLE XII

WASTE STREAMS-CHARACTERISTICS

PROJECT	FILTER WASH WATER					SLUDGE FROM CLARIFIER/SETTLING BASIN				
	TOTAL VOLUME 10^3 gallons	BOD mg/l	S.S. mg/l	TOTAL PHOSPHORUS mg/l P	KJELDAHL NITROGEN mg/l N	TOTAL VOLUME 10^3 gallons	BOD mg/l	S.S. mg/l	TOTAL PHOSPHORUS mg/l P	KJELDAHL NITROGEN mg/l N
Region I - Southwestern										
Amherstburg	16.74	4.3	124	.13		4.58	8.3	5560	3.6	
Dresden							-	10240	1.0	
Goderich	8.58						119.0	66000	16.5	
Lake Huron WSS	547.0									
Union WSS	24.81	2.1	126	.43	1.0		5.9	1800	1.6	7.0
Region II - West Central										
Woolwich Twp.	.88	5.3	156	.45	-					
Region III - Central										
Bobcaygeon	.48	66.0	20500	7.0	7.1					
Oshawa - Whitby										
King Twp. - Schomberg		8	15	.47	3.8					
South Peel - Lakeview	261	19	370	.9	3.3					
Warkworth Twp.		2.7	85	.3	-					
Region IV - Southeastern										
Marmora	Not Available									
Rockland		4.1	670	1.7	9.9		9.7	3800	3.0	67
Region V - Northeastern										
Haileybury	2.57	4.3	880	1.2			7.9	3200	4.0	
Moosonee	.90									
Wahnapitae WSS	27.9									

PLANT STAFF

Of the twenty three projects listed in Table XIII as being Ministry staffed, Amherstburg, Dunnville, Elgin Area WSS., Goderich, Haileybury, Lake Huron, Lambton WSS., South Peel WSS., Union WSS., and Wahnapitae WSS., are supervised 24 hours per day. The others are supervised 8 hours per day or less. Chesterville, Ear Falls, Eganville, Emo Twp., Espanola, Frankford, Haileybury, Moosonee, Red Lake, Rockland, Southampton, Van Astra, Westport, Woolwich Twp., and Winchester are operated in conjunction with other projects in the municipality or area. Total staff complement charged to the project is shown as a function of plant size in Graph No. 1 for all staffed projects listed in Table XIII.

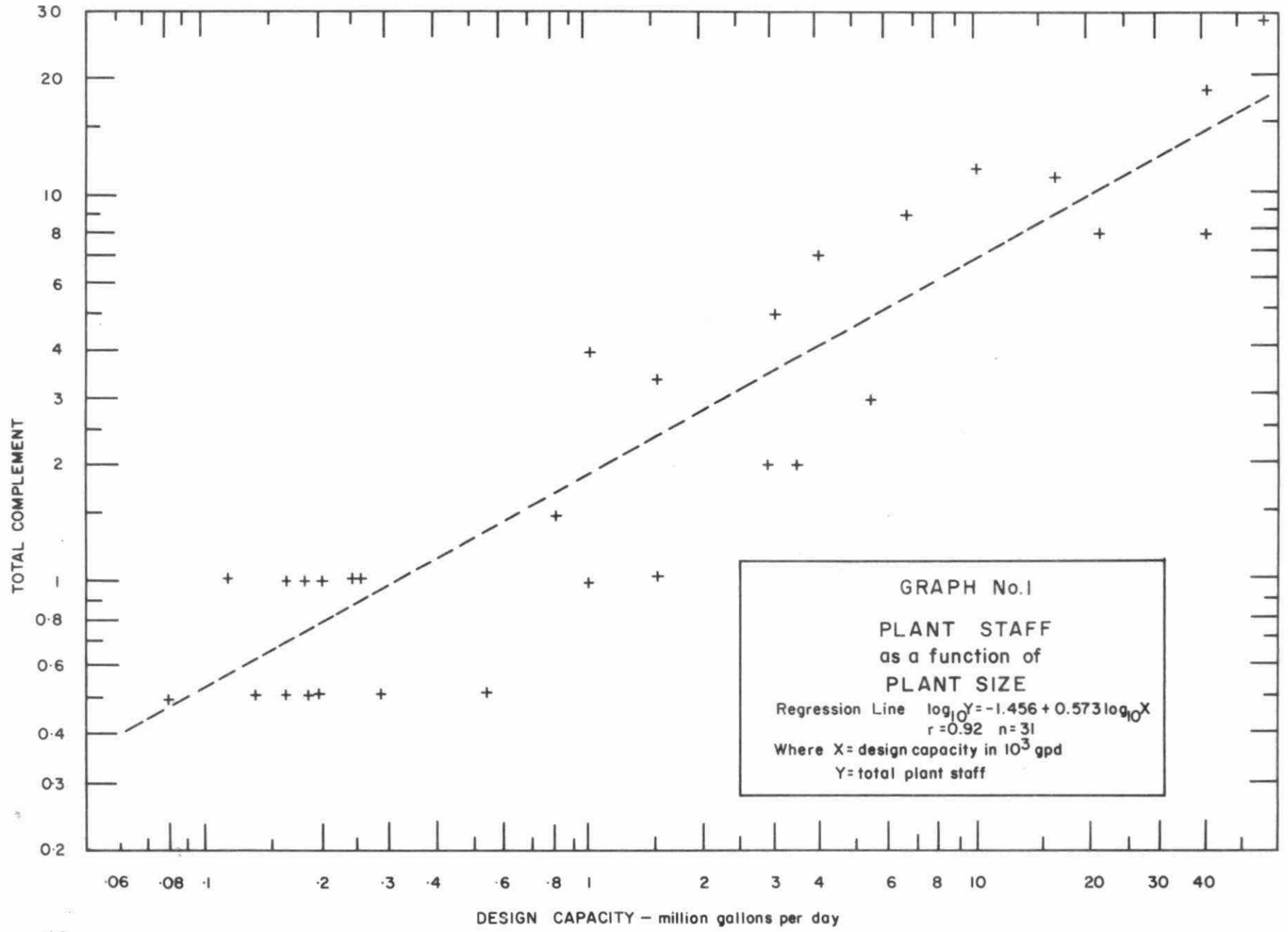

TOTAL COMPLEMENT
30
20
10
8
6
4
3
2
1
0·8
0·6
0·4
0·3
0·2
·06
·08
·1
·2
·3
·4
·6
·8
1
2
3
4
6
8
10
20
30
40
DESIGN CAPACITY — million gallons per day
GRAPH No.1
PLANT STAFF
as a function of
PLANT SIZE
Regression Line $\log_{10} Y = -1.456 + 0.573 \log_{10} X$
$r = 0.92$ $n = 31$
Where X = design capacity in 10^3 gpd
Y = total plant staff

TABLE XIII

PLANT STAFF

PROJECT	SUPERINTENDENT	ASSISTANT SUPERINTENDANT	CHIEF OPERATOR	MECHANIC	ELECTRICIAN	CONTROLS TECHNICIAN	LABORATORY TECHNICIAN	OPERATOR	GROUNDSMAN/ JANITOR	LABOURER	TOTAL
Amherstburg	1			1				5			7
Blenheim - Kent			1	1				2			4
Blezard Valley	0.2		1f		1						2
Bobcaygeon			1								1
Chesterville			0.5								0.5a
Dunnville	1			2				5			8
Ear Falls			0.5								0.5a
Eganville			0.5					0.5			1a
Elgin Area	1	1		1	1d	1		6		1	12
Emo Twp.			0.5								0.5a
Espanola			0.5					0.5			1a
Fenelon Falls			1								1
Frankford			0.5								0.5b
Goderich			1					4			5
Haileybury	0.67							2.67			3.3a
Lake Huron W.S.S.	1	1		3e	1	1	1	10	1		19
Lambton County W.S.S.	1	1						6			8
Markham			1					2			3
Meaford			1					1			2
Moosonee			0.5					0.5			1a
Red Lake			0.5					0.5			1a
Rockland			1					0.5			1.5a
Southampton			0.5					0.5			1.0a
South Peel W.S.S.	1		1	5c		2		16	2	2	29
Union W.S.S.	1	1		2				5	2		11
Vanastra			0.5					0.5			1.0a
Vankleek Hill			1					1			2
Wahnapitae (Sudbury)	0.8			1	1g			6			9
Westport			0.5								0.5a
Winchester			0.5								0.5a
Woolwich Twp.			0.5								0.5a

a Jointly operated with water pollution control plant
b Jointly operated with Trenton, Sidney Twp. and Frankford WPCP'S
c Includes Chief of Maintenance
d Electrician is Maintenance Foreman
e Mechanic is Maintenance Foreman. Maintenance assistants included in total
f Senior Operator
g Instrumentation Technician

OPERATING EXPENDITURES

The cost of operation of the water supply projects during 1973 are tabulated in Tables XIV and XV for surface water and ground water projects respectively. The cost of head office supervision, including travel, accounting, purchasing and inspection, is not charged against the projects.

An explanation of items included in each of the budget categories follows:

	EXPLANATION
SALARIES & WAGES	
Regular & Probationary	includes overtime, call-in, standby, etc.
Unclassified	includes casual, part-time
EMPLOYEE BENEFITS	includes employers share Canada Pension Plan, Superannuation, Unemployment Insurance, Workman's Compensation, etc.
TRANSPORTATION & COMMUNICATION	includes travel, telephone, telemetering, accommodation, etc.
SERVICES	includes easements, insurance, sludge haulage, maintenance and repair, leases.
SUPPLIES & EQUIPMENT	includes new vehicles, chemicals, power, fuel, water, treatment chemicals, small tools, petty cash.

ACQUISITION/CONSTRUCTION OF PHYSICAL ASSETS	includes new sewer or water connections.
TRANSFER PAYMENTS	includes grants in lieu of taxes (provincial).
OTHER TRANSACTIONS	includes municipal taxes.

Unit costs are shown in Tables XIV and XV only for those plants for which the entire cost of operation is charged to the project. Many of the smaller projects are operated by municipal staff whose salaries are not included in the cost shown here.

Graph no. 2 relates the total cost of operation to plant size, considering two separate groups of plants: those providing "complete treatment and those providing microstraining only, iron removal or chemical treatment only. Graph no. 3 displays the relation of unit, cost of operation to plant size for the same two groups of plants.

TABLE XIV

SURFACE WATER SUPPLIES

OPERATING EXPENDITURES

PROJECT	UNIT COST ¢/1000 gallons	GRAND TOTAL	Regular Staff	Casual (Unclassified) Staff	TOTAL SALARIES AND WAGES	TOTAL EMPLOYEE BENEFITS	TOTAL TRANSPORTATION AND COMMUNICATIONS	Insurance	Repairs and Maintenance
Region I - Southwestern									
Amherstburg	40	140917	77507	3588	81095	8227	1797	2013	190
Blenheim	55	78170	46817	7307	54124	5012	1548	92	9039
Dresden		6862					27	724	
Elgin Area WSS	20	299015	125886	11179	137065	14434	4594	7474	4578
Goderich	29	107773	56887	6497	63384	6217	1747	1941	840
Harrow		1079					145	684	250
Lake Huron	7	595396	196737	17836	214573	21537	4099	5764	4578
Lambton Area WSS		205788	103063		103063	12252	2082	2669	424
Meaford		25022		1195	1195	34		970	18364
Southampton	24	29215	9095		9095	760	179	614	5551
Union WSS	14	256304	119387		119387	11700	5349	6103	4071
Watford, Wyoming, Plympton WSS		46030	108		108	3	60	139	1703
Region II - West Central									
Dunnville	5	168831	85495		85495	9789	1324	4306	40
Region III - Central									
Brock Twp. (Beaverton)		227						227	
Bobcaygeon	89	23479	12258	1254	13512	1256	575	229	1225
Fenelon Falls		28353	14076	4609	18685	1396	811	263	159
Hastings		4042					257	184	99
South Peel - Lakeview	9	1112295	326735	6094	332829	38793	9976	20619	13024
Warkworth - Percy Twp.		6384	116	4063	4178	107	125	145	2
Region IV - Southeastern									
Bancroft		4654	4201		4201	233		174	
Chalk River		1596	1081		1081		218	165	
Eganville	67	17850	12673		12673		299	117	295
Marmora		1995	30		30		19	146	
Rockland	23	47140	20040		20040	2920	960	386	492
Region V - Northeastern									
Cache Bay		1294				3		45	
Espanola	6	10982		283	283		729	199	717
Haileybury	50	82479	31180	4605	35785	5600	2350	1064	1612
Michipicoten Twp.		263						69	
Moosonee		22559	1119		1119	36	1361	481	
Wahnapitae - Sudbury	25	237692	87266	6827	93093	6372	4654	930	1295
Region VI - Northwestern									
Ear Falls		10455					772	197	1421
Emo Twp.	136	22130	12246	1223	13469	1223	1157	223	395
Geraldton		3065	2610		2610		111	326	
Red Lake	17	24821	10907	570	11477	950	764	243	751

TABLE XIV

OPERATING EXPENDITURES

PROJECT	Other Services	TOTAL SERVICES	Machinery and Equipment	Chemicals	Utilities	Other Supplies and Equipment	TOTAL SUPPLIES AND EQUIPMENT	TOTAL AQUISITION/ CONSTRUCTION OF PHYSICAL ASSETS	TOTAL TRANSFER PAYMENTS	OTHER TRANSACTIONS
Region I - Southwestern										
Amherstburg	966	3169	584	9854	19067	7039	36544			10085
Blenheim	334	9465	1691	3501	1328	1501	8020			
Dresden	955	1679	3005	1548			4553			603
Elgin Area WSS	6260	18312	11262	15974	71060	22530	120826			3784
Goderich	345	3126	5630	4269	10190	2364	22453			10846
Harrow		934								
Lake Huron	987	11329	27027	48298	245404	21431	342160			1698
Lambton Area WSS	1423	4516	9419	9779	55496	9143	83837			38
Meaford	4417	23751				42	42			
Southampton	205	6370	3806	4109	3925	971	12811			
Union WSS	1545	11719	4790	31946	45970	10722	93428			14721
Watford, Wyoming, Plympton WSS	10	1852	406	95	43481	25	44007			
Region II - West Central										
Dunnville	(3764)	582	1468	10447	60108	(2541)	69482			2159
Region II - Central										
Brock Twp. (Beaverton)	227									
Bobcaygeon	235	2619	838	1778	1480	1285	5381			136
Fenelon Falls	389	811	1541	333	3271	1505	6650			
Hastings	115	398	610	639	1569	569	3387			
South Peel - Lakeview	31094	66113	18930	97902	460386	31638	608856			55728
Warkworth - Percy Twp.		147	319	350	842	316	1827			
Region IV - Southeastern										
Bancroft		174				22	22			24
Chalk River	20	185	112				112			
Eganville	2113	2525	947	1229		177	2353			
Marmora	176	322	29	1483			1512			112
Rockland	251	1129	1015	9827	9057	2192	22091			
Region V - Northeastern										
Cache Bay		45	1070	176			1246			
Espanola	3	919	199	2288	4701	1863	9051			
Haileybury	403	3079	4384	5558	14332	5198	29472			6193
Michipicoten Twp. (Wawa)	69	194					194			
Moosonee		481	147	8048	7389	3978	19562			
Wahnapitae - Sudbury	391	3070	6324	67657	43066	13456	130503			
Region VI - Northwestern										
Ear Falls	211	1829	671	1629	3292	2262	7854			
Emo Twp.	63	681	124	2346	287	2303	5060			540
Geraldton	12	338				6	6			
Red Lake	971	1965	237	670	4356	4402	9665			

TABLE XV
GROUND WATER SUPPLIES

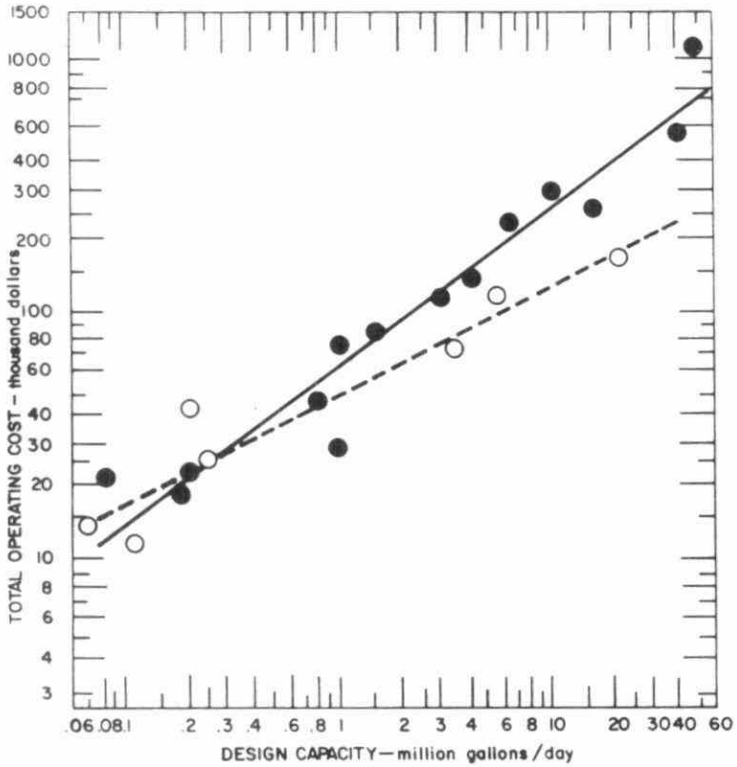
OPERATING EXPENDITURES

PROJECT	UNIT COST ¢/1000 gallons	GRAND TOTAL	Regular Staff	Casual (Unclassified) Staff	TOTAL SALARIES AND WAGES	TOTAL EMPLOYEE BENEFITS	TOTAL TRANSPORTATION AND COMMUNICATIONS	Insurance	Repairs and Maintenance
Region I - Southwestern									
Hanover		2121						52	
Mitchell		180						180	
Thedford		2465					102	138	158
Van Astra	100	41866	10574		10574	763	688	1	18545
Region II - West Central									
Brantford Twp.		2080	1723		1723		138	219	
Cambridge (Preston)		1416						437	
Orangeville								172	
Shelburne			Not Available						
Woolwich Twp.		9365	127	1966	2093		696	239	1372
Region II - Central									
Anson, Hindon & Minden		4360		2155	2155	68		56	
Bradford		7432	5055	939	5994	342		69	
Brock Twp.		895						29	
Caledon (Bolton)		3290						52	124
Caledon (Caledon East)		4382	104	1326	1430	11	19	80	
Cookstown		544					51	93	
Elmvale		3098						42	2988
Havelock		2814					37	139	280
King Twp. - Schomberg		7450	103	2463	2566	62	236	147	2
Markham	12	117234	37045		37045	3030	502	836	8183
Newcastle		1032						107	
Newcastle (Clarke)		1817					9	78	1470
Oshawa (Whitby)	36	4153	62	1090	1152	33	67	99	611
Richmond Hill		793						563	
Richmond Hill - Oak Ridges		4100				2		332	225
Scugog Twp. (Port Perry)		5709						145	1797
Stayner		182						104	57
Woodville Twp.		11181	10355	1024	11379	1168	554	129	(3328)
Region IV - Southeastern									
Alfred		4479	325		325		120	(13)	40
Bourget		476	184		184		51	13	
Chesterville		2631	2001		2001			240	
Frankford		9702	4645		4645				
Plantagenet		335	6	114	120		60	33	
Vankleek Hill		6740	19	3072	3199	80	369	265	72
Wellington		6088	462	3505	3967	160	20	153	88
Westport		11056		8510	8510		253	45	218
Winchester		10741	5045		5045		75	300	244
Region V - Northeastern									
Blezard Valley WSS	25	70601	38438	304	38742	3041	3281	1141	428
Blind River		1693						30	450
Fauquier Twp.		14268	8406	617	9023	585	592	107	
Black River Matheson Twp. (Playfair - Ramore)		2261	81		81		23	27	70
Warren (Ratter - Dunnett)		2758	52	1925	1977	36		50	

TABLE XV

OPERATING EXPENDITURES

PROJECT	Other Services	TOTAL SERVICES	Machinery and Equipment	Chemicals	Utilities	Other Supplies and Equipment	TOTAL SUPPLIES AND EQUIPMENT	TOTAL AQUISITION/ CONSTRUCTION OF PHYSICAL ASSETS	TOTAL TRANSFER PAYMENTS	OTHER TRANSACTIONS
Region I - Southwestern										
Hanover		52			2069					
Mitchell		180								
Thedford		296		102	1936	29	2067			
Van Astra	653	19199	4210		4239	2193	10642			
Region II - West Central										
Brantford Twp.		219								
Cambridge (Preston)	5	442		974			974			
Orangeville		172			2779		2779			
Shelburne										
Woolwich Twp.	32	1643	2115	113	174	2531	4933			
Region III - Central										
Anson, Hindon & Minden		56	(26)	124	1835	148	2081			
Bradford		69								1027
Brock Twp.		42			853		853			
Caledon (Bolton)		176		457	2620	37	3114			
Caledon (Caledon East)		80	266		2534	42	2842			
Cookstown		93		15	21		36			364
Elmvale		3030		56		12	68			
Havelock		419	1196	188	974		2358			
King Twp. - Schomberg		149	34	2744	1467	192	4437			
Markham	1517	10536	8831	5964	44166	5811	64772			
Newcastle				138	787		925			
Newcastle (Clarke)		1548			260		260			
Oshawa (Whitby)		710	65	402	1721	3	2191			
Richmond Hill	230	793								
Richmond Hill - Oak Ridges	171	728	75		3295		3370			
Scugog Twp. (Port Perry)		1942		657	2966	144	3767			
Stayner		161					21			
Woodville Twp.	36	(3163)	210		263	770	1243			
Region IV - Southeastern										
Alfred		27	1811	32	1852	312	4007			
Bourget		13	228				228			
Chesterville	114	354		276			276			
Frankford		398	1905	73	1311	1370	4659			
Plantagenet		33					122			
Vankleek Hill		337		408	2251	96	2755			
Wellington	114	355		394	1013	179	1586			
Westport	91	314			701		1979			
Winchester	490	1034		554	3840	193	4587			
Region V - Northeastern										
Blezard Valley WSS	2230	3799	4834	155	12370	4379	21738			
Blind River		1380		263	50		313			
Fauquier Twp.		107	256	863	2427	415	3961			
Black River Matheson Twp. (Playfair - Ramore)	21	118			1350	689	2039			
Warren (Ratter-Dunnett)		50			695		695			



GRAPH No. 2 (above)
TOTAL OPERATING COST vs PLANT SIZE

REGRESSION LINES

"Complete" Treatment
$\log_{10} Y = -0.093 + 0.628 (\log_{10} X)$
$r = 0.97$ $n = 14$

Iron removal, Microstraining or Chemical Treatment
$\log_{10} Y = 0.335 + 0.447 (\log_{10} X)$
$r = 0.95$ $n = 7$

Where X = design capacity in 10^3 gpd
Y = total operating cost in $/1000

GRAPH No. 3 (below)
UNIT OPERATING COST vs PLANT SIZE

REGRESSION LINES

"Complete" Treatment
$\log_{10} Y = 2.794 - 0.390 (\log_{10} X)$
$r = -0.92$ $n = 14$

Iron removal, Microstraining or Chemical Treatment
$\log_{10} Y = 3.102 - 0.540 (\log_{10} X)$
$r = -0.34$ $n = 7$

Where X = design capacity in 10^3 gpd
Y = unit operating cost in ¢ / 1000 gal.