APPENDIX A

CHESTERFIELD INLET : LABORATORY ANALYSIS OF SURFACE WATER EFFLUENT

JUNE TO SEPTEMBER 1994

94-2179-01

Sample I.D.	S1	S2	S3	S4	S5	S6	S7	S8	Date	Date	Date
ANALYTE	94-A9829	94-A9830	94-A9831	94-A9832	94-A9833	94-A9834	94-A9835	94-A9836	Sampled	Received	Analysed
Biochemical Oxygen Demand (mg/L)	33	<5	<5	<5	<5	<5	<5	<5	June 23/94	June 27/94	July 4/94
Residue - Non Filterable (mg/L)	25	6	24	5	<5	<5	11	<5	June 23/94	June 27/94	July 4/94
Ammonia (mg/L N)	26.5	14.8	5.28	0.141	0.037	0.02	0.282	1.74	June 23/94	June 27/94	July 4/94
Total Kjeldahl Nitrogen (mg/L N)	2.73	3.21	4.28	1.3	0.38	0.59	1.82	2.46	June 23/94	June 27/94	July 4/94
Total Coliform (CFU/100 mL)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	June 23/94	June 27/94	n/a
Fecal Coliform (CFU/100 mL)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	June 23/94	June 27/94	n/a

Sample I.D.	S1	S2	S3		S5		S6/S7	S8	Date	Date	Date
ANALYTE	94-A11176	94-A11177	94-A11178		94-A11179		94-A11180	94-A11181	Sampled	Received	Analysed
Biochemical Oxygen Demand (mg/L)	140	6.0	5.0		6.0		<5	<5	July 13/94	July 18/94	July 25/94
Residue - Non Filterable (mg/L)	330	12	15		200		95	52	July 13/94	July 18/94	July 25/94
Ammonia (mg/L N)	72.2	0.236	0.267		0.272		0.062	0.092	July 13/94	July 18/94	July 25/94
Total Kjeldahl Nitrogen (mg/L N)	96.7	2.46	2.61		1.74		0.41	0.62	July 13/94	July 18/94	July 25/94
Total Coliform (CFU/100 mL)	150000	0	0		0		0	0	July 13/94	July 13/94	July 15/94
Fecal Coliform (CFU/100 mL)	150000	0	0		0		0	0	July 13/94	July 13/94	July 15/94

Sample I.D.	S1	S2	S3			S6a	S6/S7	S8	Date	Date	Date
ANALYTE	94-A11465	94-A11466	94-A11467			94-A11468	94-A11469	94-A11470	Sampled	Received	Analysed
Biochemical Oxygen Demand (mg/L)	75	<5	<5			<5	<5	<5	July 18/94	July 21/94	July 26/94
Residue - Non Filterable (mg/L)	130	9	<5			7	48	n/a	July 18/94	July 21/94	July 27/94
Ammonia (mg/L N)	71.7	0.204	0.184			0.062	0.046	0.276	July 18/94	July 21/94	July 22/94
Total Kjeldahl Nitrogen (mg/L N)	73.7	2.36	2.52			0.43	0.54	2.22	July 18/94	July 21/94	July 22/94
Total Coliform (CFU/100 mL)	n/a	n/a	n/a			n/a	n/a	n/a	July 18/94	July 21/94	n/a
Fecal Coliform (CFU/100 mL)	n/a	n/a	n/a			n/a	n/a	n/a	July 18/94	July 21/94	n/a

Sample I.D.	S1	S2	S3		S5	S6a	S7	S8	Date	Date	Date
ANALYTE	94-A11643	94-A11644	94-A11645		94-A11646	94-A11647	94-A11648	94-A11649	Sampled	Received	Analysed
Biochemical Oxygen Demand (mg/L)	50	8	6		<5	<5	<5	18	July 25/94	July 27/94	Aug. 02/94
Residue - Non Filterable (mg/L)	46	17	19		7	8	5	77	July 25/94	July 27/94	July 29/94
Residue - Volatile NFR (mg/L)	38	11	19		7	8	8	64	July 25/94	July 27/94	Aug. 12/94
Ammonia (mg/L N)	76	0.554	0.519		0.026	0.026	0.031	1.45	July 25/94	July 27/94	July 28/94
Phosphorous - Total (mg/L P)	9.73	0.297	0.151		0.004	0.018	0.335	0.851	July 25/94	July 27/94	Aug. 08/94
Total Kjeldahl Nitrogen (mg/L N)	68.3	2.82	2.93		0.26	0.31	0.73	2.3	July 25/94	July 27/94	July 29/94
Total Coliform (CFU/100 mL)	1500+	9	0		23	15	4	0	July 25/94	July 25/94	July 27/94
Fecal Coliform (CFU/100 mL)	1500+	9	0		0	0	0	0	July 25/94	July 25/94	July 27/94

Sample I.D.	S1	S2	S3	S4a	S5		S7	S7a	Date	Date	Date
ANALYTE	94-A12485	94-A12486	94-A12487	94-A12488	94-A12489		94-A12490	94-A12491	Sampled	Received	Analysed
Biochemical Oxygen Demand (mg/L)	47	<5	<5	<5	<5		<5	<5	Aug. 08/94	Aug. 08/94	Aug. 08/94
Residue - Non Filterable (mg/L)	130	5	11	13	5		<5	<5	Aug. 08/94	Aug. 08/94	Aug. 08/94
Residue - Volatile NFR (mg/L)	110	5	11	13	5		<5	<5	Aug. 08/94	Aug. 08/94	Aug. 08/94
Ammonia (mg/L N)	67.7	0.468	0.595	0.979	0.071		0.025	<0.02	Aug. 08/94	Aug. 08/94	Aug. 08/94
Phosphorous - Total (mg/L P)	10.2	0.151	0.3	0.454	0.048		0.007	0.003	Aug. 08/94	Aug. 08/94	Aug. 08/94
Total Kjeldahl Nitrogen (mg/L N)	75.7	3.35	3.17	3.92	0.42		0.32	0.21	Aug. 08/94	Aug. 08/94	Aug. 08/94
Total Coliform (CFU/100 mL)	150000+	93	43	0	213		23	75	Aug. 08/94	Aug. 10/94	Aug. 15/94
Fecal Coliform (CFU/100 mL)	46000	93	15	0	0		0	0	Aug. 08/94	Aug. 10/94	Aug. 15/94

Sample I.D.	S1	S2	S3	S4a	S4b	S5	S7a	S7b	Date	Date	Date
ANALYTE	94-A14330	94-A14331	94-A14332	94-A14333	94-A14335	94-A14334	94-A14336	94-A14337	Sampled	Received	Analysed
Biochemical Oxygen Demand (mg/L)	20	<5	8	<5	<5	<5	<5	<5	Aug. 29/94	Aug. 31/94	Sept. 04/94
Residue - Non Filterable (mg/L)	130	14	15	14	<5	<5	<5	<5	Aug. 29/94	Aug. 31/94	Sept. 07/94
Residue - Volatile NFR (mg/L)	44	5	15	14	<5	12	<5	<5	Aug. 29/94	Aug. 31/94	Sept. 08/94
Ammonia (mg/L N)	33.9	0.496	0.713	18.8	<0.02	5.92	<0.02	<0.02	Aug. 29/94	Aug. 31/94	Sept. 01/94
Phosphorous - Total (mg/L P)	3.26	0.097	0.153	0.482	0.008	0.153	0.004	0.009	Aug. 29/94	Aug. 31/94	Sept. 08/94
Total Kjeldahl Nitrogen (mg/L N)	38	1.99	3.48	25.7	0.27	6.47	0.35	0.53	Aug. 29/94	Aug. 31/94	Sept. 01/94
Total Coliform (CFU/100 mL)	150000+	4300	4	150000+	2300	15	4	43	Aug. 29/94	Aug. 30/94	Aug. 31/94
Fecal Coliform (CFU/100 mL)	150000+	93	0	2300	43	0	0	9	Aug. 29/94	Aug. 30/94	Aug. 31/94
Oil & Grease/T.Recoverable (mg/L)	<10					<10		<10	Aug. 29/94	Aug. 31/94	Sept. 08/94

CHESTERFIELD INLET : LABORATORY ANALYSIS OF SEDIMENT

Sample I.D.	S1			S4a					Date	Date	Date
ANALYTE	94-A14345			94-A14346					Sampled	Received	Analysed
pH	6.9			7.2					Aug. 29/94	Aug. 31/94	Aug. 31/94
Total Solids (%)	9.96			5.4					Aug. 29/94	Aug. 31/94	Sept. 07/94
Total Volatile Solids (% of T.S.)	71.6			50.0					Aug. 29/94	Aug. 31/94	Sept. 07/94

TABLE A
RETENTION TIME AND LOADING RATES ON WETLAND

Year	Annual Trucked Sewage Volume (m^3)	Hydraulic Retention Time in Pond 1[1] (days)	Wetland Loading Rates	
			Hydraulic[2] m^3/ha/d	Organic[3] kg BOD_5/ha/d
1994	10,900	22 to 47	21.1	7.9
1995	11,800	21 to 45	21.9	8.5
2000	14,800	18 to 40	24.6	10.7
2005	16,800	17 to 37	26.5	12.2
2010	19,300	16 to 34	28.7	14.0
2015	22,000	15 to 32	31.1	15.9

1. Hydraulic retention times:

Calculated based on pond volume of 1380 m^3 and 3000 m^3; and runoff and precipitation into P1 of 12 450 m^3 annually

2. Hydraulic loading rate:

$$\frac{(10\,900\ m^3/yr. + 12\,450\ m^3/yr.)}{16.5\ ha} \div 67\ days = 21.1\ m^3/ha/d$$

3. Organic loading rate:

$$\frac{(10\,900\ m^3/yr. \times 800\ BOD_5\ mg/L \times 1000 L/m^3 \times 1\ kg/10^6 mg)}{16.5\ ha} \div 67\ days = 7.9\ kg\ BOD_5/ha/d$$

Several apparent sample anomalies are noted. The July 13, 1994 sample "N" and "O" had relatively higher solids levels. This may be attributed to the sampling procedure and the low water levels in these depressional areas. The August 29, 1994 sample "N" had an elevated ammonia level. This may be a result of plant decay. Further monitoring is necessary to confirm this.

3.2 Results and Discussion

The Chesterfield Wellands Treatment System is defined as the area extending from the truck sewage discharge point to the effluent discharge location at Finger Bay; confined by the north, south, and east by the bedrock ridges.

For ease of discussion and evaluation, the wastewater treatment system has been broken down into three areas (definitions of these treatment terms are found in Glossary of Terms). Sampling locations have been grouped to reflect these three areas:

- Primary treatment - wastewater exiting P1 (Column B, Table 1).

- Secondary treatment - wastewater exiting P2 and P3 (Columns C, D, F, G, H - Table 1).

- Tertiary treatment - wastewater entering Finger Bay (Columns K, L, M, N, O - Table 1).

Graphical representations of the removal of BOD_5, ammonia, TSS, and fecal coliforms are included in Appendix A.

Wastewater Influent

Raw sewage characterization, typical of holding tanks, is developed based on available published information (Metcalf & Eddy, 1979, Heinke, Smith & Finch, 1988 and Doku and Heinke, 1993). The following estimates are used in order to evaluate treatment system efficiencies.

- BOD_5 - 800 mg/L
- Total Suspended Solids - 500 mg/L
- Ammonia - 100 mg/L
- Phosphorous - 30 mg/L
- Fecal Coliform - <500 000 CFU/100 ml

CHESTERFIELD INLET SEWAGE DISPOSAL FACILITY SITE CHARACTERIZATION AND MONITORING STUDY

FOR

MUNICIPAL AND COMMUNITY AFFAIRS

GOVERNMENT OF NORTHWEST TERRITORIES
RANKIN INLET, NWT

M. M. DILLON LIMITED
CONSULTING ENGINEERS, PLANNERS, AND ENVIRONMENTAL SCIENTISTS

January 1995
94-2179-01

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Consulting Engineers • Planners
Environmental Scientists

Our File: 94-2179-01

January 6, 1995

Municipal and Community Affairs
Government of Northwest Territories
P.O. Bag 002
RANKIN INLET, NWT X0C 0G0

Attention: Mr. Don Forsyth

Chesterfield Inlet Sewage Disposal Facility
Characterization and Monitoring

Dear Mr. Forsyth:

The final reporting on the Chesterfield Inlet wetlands sewage treatment area 1994 work program is attached. This report fulfils the monitoring requirements of the operating license. Additional investigations, which may be considered to provide a better understanding of the treatment mechanisms, are also identified.

Yours truly,

M. M. DILLON LIMITED

Gary Strong, P. Eng.
Project Manager

GS:kse

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2.1.3 Geology and Terrain

Chesterfield Inlet is situated on the Canadian shield. Local geology consists predominantly of precambrian granite and gneiss, archean in age. The gneiss is foliated with pegmatitic dykes and veins.

The study area slopes downward in a northwest direction from the dumping area. The area is confined to the north, south and east by bedrock ridges. The sloping valley contains a block field, composed of angular, frost-weathered stone blocks. The depressional area opens to a rocky beach on the shore of Finger Bay (Figure 1).

Chesterfield Inlet is located in the zone of continuous permafrost. Thawing of the active layer in late summer creates unstable surface and subsurface conditions. The depth of the active layer ranges from zero to one metre and is dependent on subsurface composition.

2.1.4 Hydrology

The presence of permafrost, bedrock and rolling topography have created numerous small ponds in the region. Some of these smaller ponds are intermittent, storing water in the spring and drying up over the summer. In the valley of the study area there are three main ponds which, for discussion purposes, have been labelled P1, P2 and P3 (Figure 1). Estimated surface areas are 2000 m^2, 1000 m^2 and 11,500 m^2, respectively. There are a number of smaller ponds in the study area, including one near Finger Bay which appears to collect runoff from surrounding areas prior to discharging into the Bay. This pond has been labelled P4.

A series of calculations, relating to flows, were developed previously in the Design and Operations Concept Report (Dillon, 1994). The catchment areas downstream of P1 was estimated as 35 ha. The catchment area flowing to P1 was estimated as 5 ha. Using annual rainfall data, discussed previously, the annual runoff was estimated as 12,450 m^3/year. Spring runoff was estimated as 5,650 m^3. During the spring and early summer, water from P1 flows downgradient towards P2 or P3. During these higher early season flows, water passes through P3 and travels north towards Finger Bay. Water between P2 and P3, in the central and lower portion of the valley, is stored in numerous depression areas and appears to flow amongst the boulder field with no clearly defined channels.

Later in the year, when flows are lower (August/September), the water passes through more well-defined channels. At this time, flow passing from P1 splits approximately 40 m downstream into the channels. The northern channel passes through P2 and meanders along the northern side of the valley until reaching P4. The southern channel passes along the southern side of the valley until reaching P3. From P3, the water appeared to be flowing in the form of seepage northward. The majority of flow appears to collect in P4, prior to passing along a single channel into the Bay.

2.1.5 Soils

The local geology of the site consists of Precambrian bedrock. This, in conjunction with the northern climate, has resulted in poor soil development in most upland areas. Most upland areas, in the ridges surrounding the valley (Figure 1) consist of exposed rock outcrops.

The presence of the dumping area has facilitated or enhanced the development of soils in the valley. The area between P1, P2 and P3 contain black organic soil, approximately 13 cm thick, overlying either bedrock or permafrost. Soil surrounding P1 consists of black organic debris with some clay over permafrost. The permafrost is a black, frozen organic soil. Soils closest to P2 and P3 have slightly deeper soil (15 cm) with some clay and rock fragments or pebbles, over gneiss bedrock. Greatest soil depths around the ponds are, as expected, on the upstream ends, where they receive out flow from P1. Soil on the northern shore of P3 is only 10 cm thick, while further west of P3, soils are only 2 to 5 cm thick. Further downstream, in the blockfield, soil development is confined to the spaces between the stone blocks, and generally consists of 8 to 10 cm of sand and pebbles with some organic debris. In the channel flowing from P2, as well as several other isolated areas, there are smaller ponds or wetter low lying areas. These have better developed soils consisting of 2 to 13 cm of black organic debris over gneiss bedrock. As the blockfield approaches the Shore of Finger Bay, the soil is 5 to 8 cm thick, consisting of black organic debris with abundant pebbles over bedrock. The shoreline of Finger Bay consists of a 1 m wide strip of sand, pebbles and shells.

2.1.6 Vegetation

Vegetation for the site has been characterized in Figure 1. Vegetation in the upper drier areas of the site consists of various species of lichen and mosses typical for the region. In more sheltered sites in the upland area, occasional arctic willows, grasses and mountain cranberry can be found.

The presence of the dumping area has facilitated the development of a wetland area containing an abundance and diversity of vegetation not typical for the region. As shown in Figure 1, the area between P1, P2 and P3 contains abundant vegetation growth in the summer. A species of sedge (possibly <u>Carex capillasis</u> or <u>C. physocarpa</u>) grows much more abundantly in this area than in any of the surrounding areas. In addition, a species of water milfoil (possibly marestail), an aquatic emergent, also grows in abundance in this area on the fringes of P1 and P2, and in the channels between P1, P2 and P3 (Plate 1). These two

3.0 MONITORING PROGRAM

3.1 Methodology

Surface water at the Chesterfield Inlet natural wetlands treatment facility is being monitored in order to assess the organic and nutrient removal efficiency and overall performance of the system. The following parameters were monitored during the 1994 monitoring program and compared with established guidelines:

- Biochemical Oxygen Demand (BOD_5)
- Total Suspended Solids (TSS)
- Volatile Suspended Solids (VSS)
- Total Coliform
- Fecal Coliform
- Total Phosphorous
- Total Ammonia Nitrogen
- Total Kjeldahl Nitrogen
- Oil and Grease (two reference samples only)

The two benchmarks used to evaluate effluent quality include: NWT Water Board "License for Chesterfield Inlet License No. N6L4-1538," and Canadian Council of Ministers of the Environment (CCME) "Canadian Water Quality Guideline, 1987" for Freshwater Aquatic Life.

The monitoring locations were established in the spring of 1994 in order to provide sufficient data to assess seasonal system performance. Some sampling locations were dry later during the summer resulting in the establishment of additional sampling locations. The sampling locations are shown on Figure 1. An attempt was made to retrieve eight sample sets during each sampling visit to the site. Water samples were taken by Dillon staff. Sample containers were provided by the lab, Environmental Sciences Centre, Winnipeg, Manitoba. All samples were shipped by air directly to the lab.

Sampling of the wastewater treatment system occurred six times in 1994 by Dillon. Sampling in 1994 occurred from June 23 to August 29, 1994. The results of the sampling program are presented in Table 1. For comparative purposes, two sets of monitoring data undertaken by MACA in 1993 is also included, as well as the NWT Water Board License requirements and CCME guidelines.

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Page No.

1.0 INTRODUCTION

1.1 General

The Department of Public Works was retained in 1989 by the Department of Municipal and Community Affairs (MACA) to complete a Design and Operation Report for a new sewage and solid waste facility in Chesterfield Inlet, NWT. The initial concept developed involved the construction of an annual storage sewage lagoon by construction of a berm between two rock ridges at the existing sewage disposal area, and discharging every September. This concept was not accepted by MACA.

In August 1993, M. M. Dillon Limited (Dillon) was retained by MACA to develop the Design and Operation Concept for Sewage Treatment based on a wetlands system. During this project, Dillon developed design parameters, site design concepts and operational requirements for the treatment facility. The report also recommended that further investigations were required to evaluate the performance of the wetland system.

In June 1994, Dillon was retained to undertake further investigation of the wetland to assess the following:

- Nutrient uptake and filtration effects
- Seasonal performance

These were assessed by completion of a field program from June to September 1994. The field program involved gathering information on the following parameters:

- Water quality (BOD_5, Suspended Solids, Volatile Solids, Ammonia, Phosphorus, Total Kjeldahl Nitrogen, Total Coliform, Fecal Coliform, and Oil and Grease)
- Soil (depth, profile, pH)
- Vegetation characterization
- Wildlife (subjective observations on species present)

This report documents the results of the 1994 field season and incorporates information from the 1994 Sewage Disposal Improvements Design and Operations Concept report.

2.0 SITE SETTING

2.1 Environmental Setting

2.1.1 General

The Community of Chesterfield Inlet is located along the Shore of Hudson Bay at the northern end of Sparrel Harbour. The geographical setting is approximately latitude 63°20'N, longitude 90°42'W.

The existing sewage disposal area is located 2.5 kilometres west of the community and 1.0 kilometres south of the airstrip. The sewage disposal facility is adjacent to the solid waste facility.

The area is contained by ridges which surround a valley receiving runoff/effluent from the dumping area. The study area therefore extends from the dumping area to the shoreline of Finger Bay (tidal water inlet connected to Hudson's Bay).

2.1.2 Climate

Climate data, consisting of temperature, precipitation and wind, was obtained from the Environment Canada Publication entitled "Canadian Climate Normals."

Chesterfield Inlet receives an average of 259 mm of equivalent precipitation annually, with 56 percent (146 mm) falling as rain and the remainder (1125 mm or 112.5 mm water equivalent) as snow. The majority (40.6 mm) of rainfall occurs during July, with most snow (24.3 mm water equivalent) falling in October.

Mean daily temperatures range from -33.0°C in January to 11.0°C in July. Daily maximum temperatures can range from as low as -36.4°C in January to +16.8°C in July. Soil temperature at a depth of 10 cm ranges from -24.6°C in January to 10.1°C in July. Based on an examination of degree days above 5°C (generally accepted for plant growth), the growing season at Chesterfield occurs between June and August, with most growth in July and August.

The prevailing wind at Chesterfield Inlet is from the northwest at an average speed of 22.3 km/hr.

Several apparent sample anomalies are noted. The July 13, 1994 sample "N" and "O" had relatively higher solids levels. This may be attributed to the sampling procedure and the low water levels in these depressional areas. The August 29, 1994 sample "N" had an elevated ammonia level. This may be a result of plant decay. Further monitoring is necessary to confirm this.

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Graphical representations of the removal of BOD_5, ammonia, TSS, and fecal coliforms are included in Appendix A.

Wastewater Influent

Raw sewage characterization, typical of holding tanks, is developed based on available published information (Metcalf & Eddy, 1979, Heinke, Smith & Finch, 1988 and Doku and Heinke, 1993). The following estimates are used in order to evaluate treatment system efficiencies.

- BOD_5 - 800 mg/L
- Total Suspended Solids - 500 mg/L
- Ammonia - 100 mg/L
- Phosphorous - 30 mg/L
- Fecal Coliform - <500 000 CFU/100 ml

Primary Treatment

Primary treatment occurs in pond P1. The pond is reported to have a volume of 3000 m^3, based on digitized mapping provided by MACA (Dillon, 1994). Recent surveys carried out of this area in early September 1994 indicate Pond 1 to have a surface area of 2300 m^2 and an estimated volume of 1380 m^3. The hydraulic retention of P1; based on the above P1 volume estimates, current flow rates, and runoff is estimated to range from 22 to 47 days. Design hydraulic retention time is estimated to range from 15 to 32 days. A range of hydraulic retention times have been tabulated and included in Appendix A.

Based on the above-mentioned influent characteristics, the average removal efficiencies range from 42 to 92 percent, as shown in Table 2. The effluent quality at this point is typical of primary effluents for most parameters. BOD_5 removal is well above the 60 percent average primary treatment efficiencies.

TABLE 2: PRIMARY TREATMENT

Analyte	Average Concentration	Concentration Range	Average Removal
BOD_5 (mg/L)	61	20 to 140	92%
TSS (mg/L)	132	25 to 330	74%
Ammonia (mg/L)	58	33.9 to 76	42%
Phosphorous (mg/L)	8	3.26 to 10.2	73%
Fecal Coliform (CFU/100 ml)	150 000+	3.26 to 10.2	70%
Wastewater effluent exiting P1 (Column B - Table 1)			

Secondary Treatment

Secondary treatment occurs as the wastewater effluent flows over the rocks towards P2 and P3, as evidenced by the slime build-up on the rock. This stage appears to be acting as a conventional trickling filter. Further treatment occurs in the ponds of P2 and P3 through microbial and vegetative nutrient uptake, as evidenced by the lush growth of sedges and aquatic emergents. Again, based upon the influent characteristics, the combined primary and secondary removal efficiencies exceed 97 percent (Table 3).

PHOTOGRAPHS

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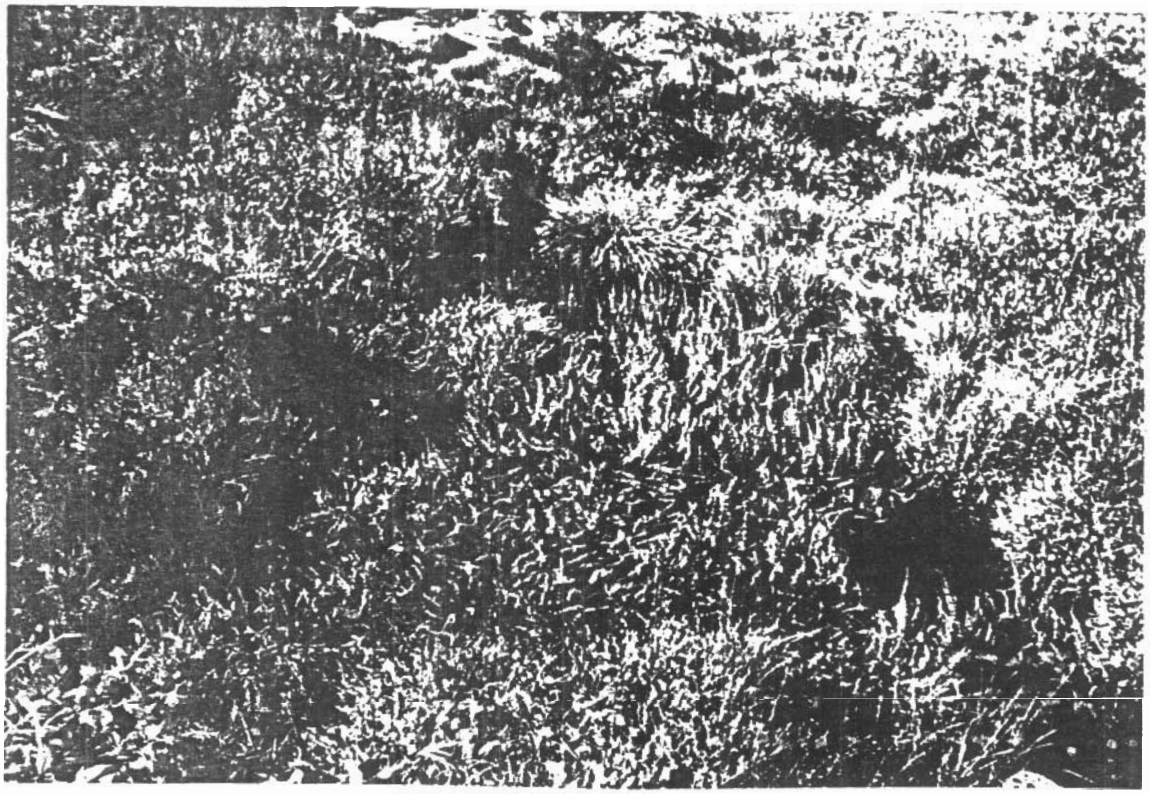
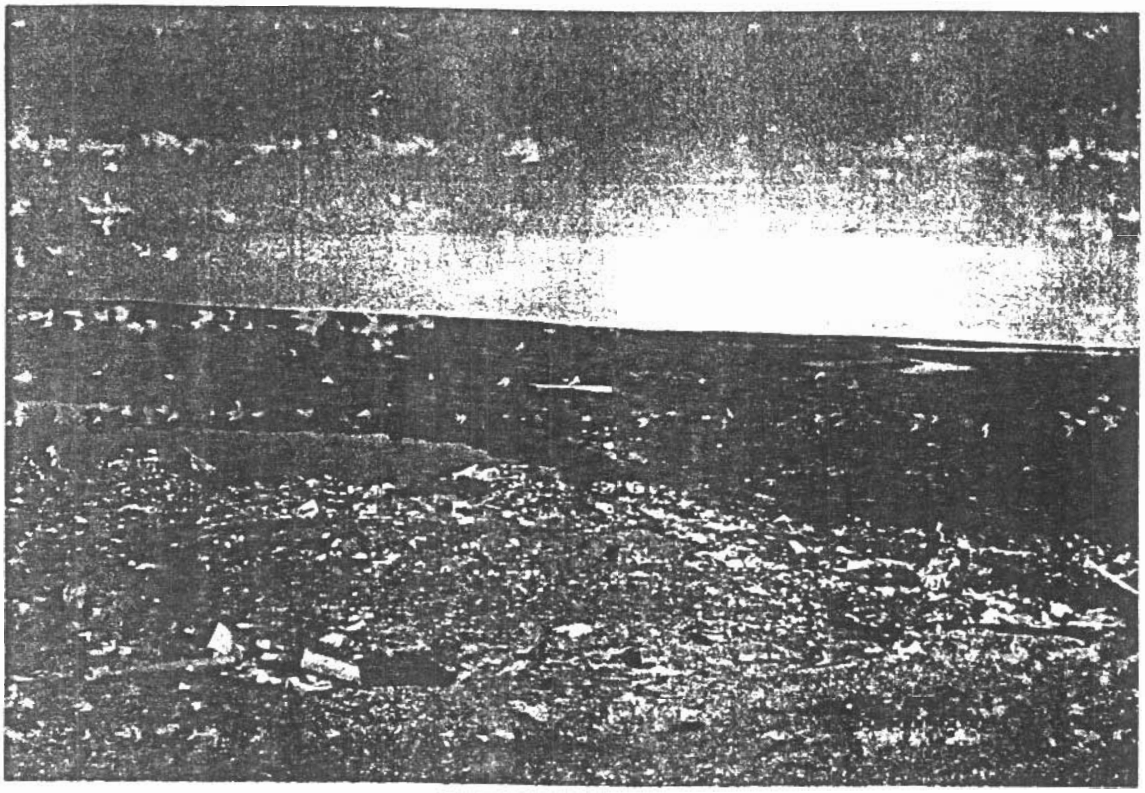


Plate 1: Chesterfield Inlet Wetland Vegetation

(Upper Photo) Species of Sedge Surrounding Aquatic Emergent in Open Water
(Lower Photo) Close-up of Aquatic Emergent Vegetation (Possibly Marestail or Water Milfoil)



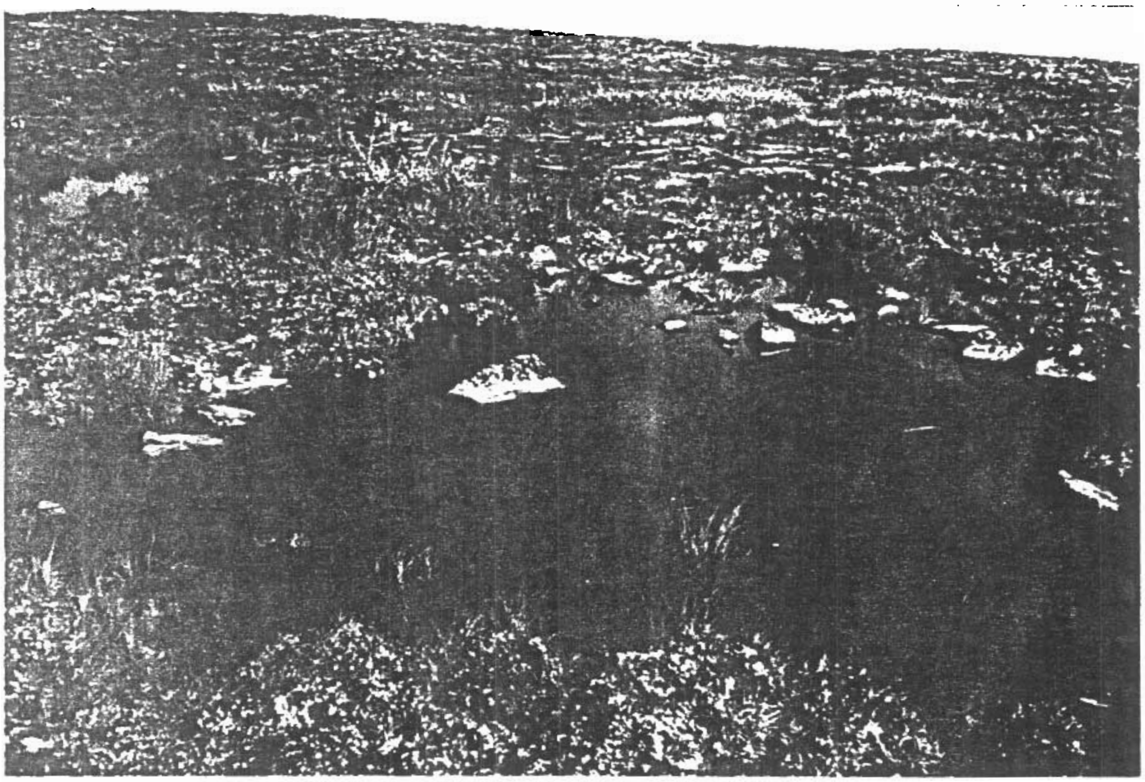
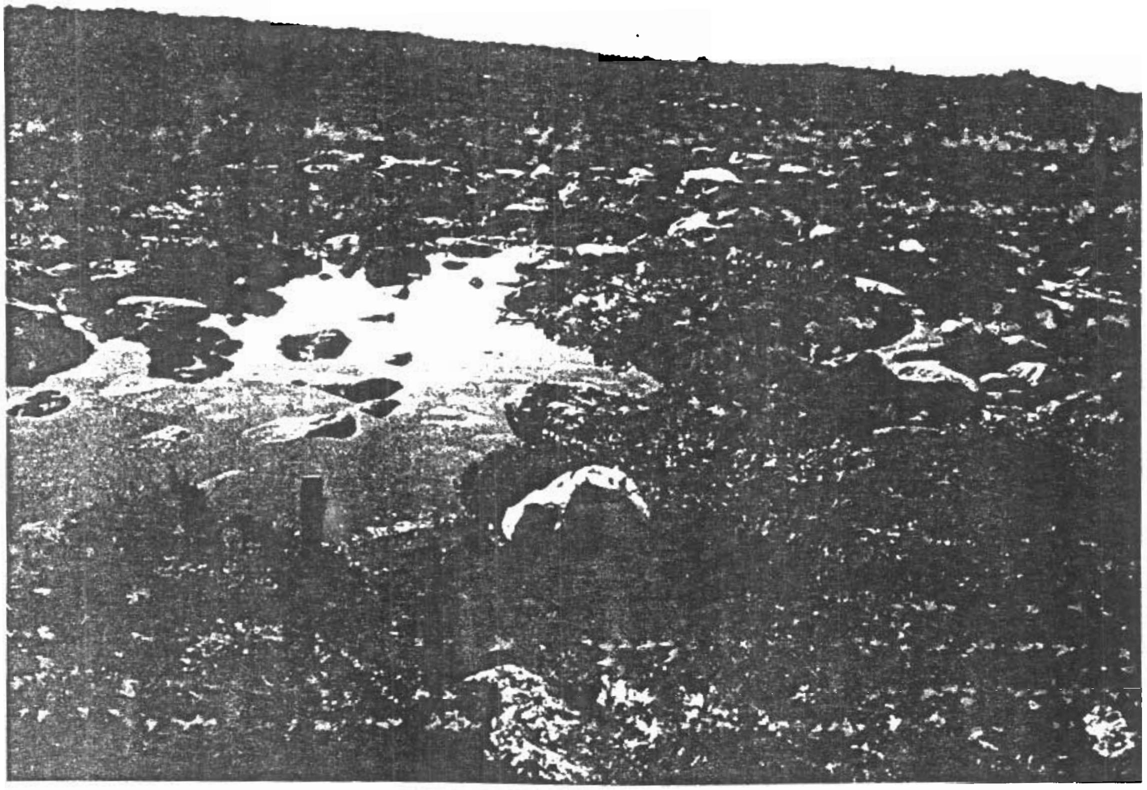


Plate 2: Chesterfield Inlet Wetland Ponds

(Upper Photo) Pond P1 in Foreground, Finger Bay in Background
(Lower Photo) Intermittent Small Ponds



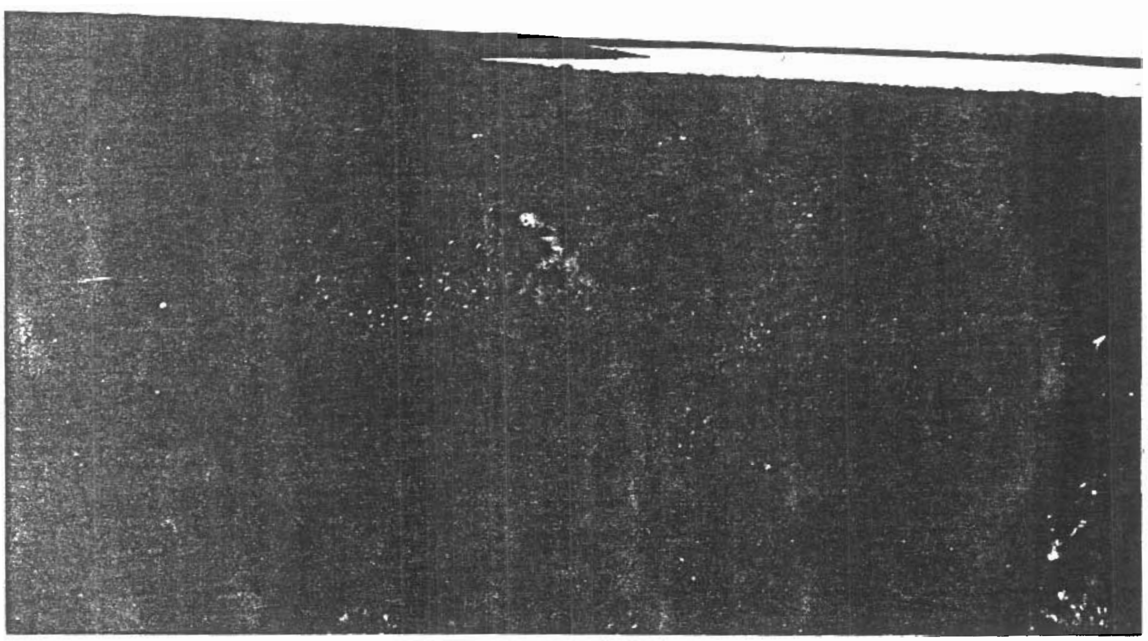


Plate 3: Chesterfield Inlet Wetland Lower Reach

(Upper Photo) Scattered Ponds North of Pond P3 Ridge
(Lower Photo) Defined Stream Channel North of Pond P2 During August

GLOSSARY OF TERMS

Primary Treatment - consists of solids removal from the wastewater, through such methods as grinding, screening, and sedimentation. Primary treatment systems typically remove approximately one-half of the incoming wastewater suspended solids and about 30 percent of the BOD associated with these solids (Peavy, 1985).

Secondary Treatment - usually consists of biological conversion of dissolved and colloidal organics into biomass that can subsequently be removed by sedimentation (Peavy, 1985).

Tertiary Treatment - most often involves further removal of suspended solids and the removal of nutrients. Solids removal may be accomplished by filtration, and phosphorous and nitrogen compounds may be removed by combinations of physical, chemical, and biological processes (Peavy, 1985).