Maine Center for Disease Control and Prevention
An Office of the Department of Health and Human Services

John E. Baldacci, Governor Brenda M. Harvey, Commissioner

Department of Health and Human Services
Maine Center for Disease Control and Prevention
286 Water Street
11 State House Station
Augusta, Maine 04333-0011
Tel: (207) 287-5674
Fax: (207) 287-5672; TTY: 1-800-606-0215

June 14, 2010

Wastewater Management
Attn.: Harold White
P. O. Box 122
Georgetown, ME 045478

Subject: Revised Product Registration, Cromaglass Wastewater Treatment Systems, Models CA-5, CA-12, CA-15, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120, CA-150

Dear Mr. White:

The Division of Environmental Health has completed a review of a registration revision you submitted on behalf of Cromaglass Wastewater Treatment Systems. This information was submitted pursuant to Section 1802 of the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules (Rules), for code registration, for use in Maine.

The Cromaglass Wastewater Treatment System consists of fiberglass-tank sequencing batch reactors, with rated treatment capacities ranging from 500 to 200,000 gallons per day. The Cromaglass Wastewater Treatment System has been certified by the National Sanitation Foundation (NSF)pursuant to ANSI/NSF Standard 40 for residential wastewater treatment systems, and was approved for use in Maine on that basis.

You have requested that the Cromaglass Wastewater Treatment System approval be modified to allow a 50 percent reduction to the vertical separation from the seasonal high groundwater table, "restricted layer", and bedrock on the basis of effluent quality below a combined BOD_5 and TSS of 30 mg/l.

The Division does not approve an across the board reduction in vertical separation from the seasonal high groundwater table, in particular the standard 12 inch separation for most soil profiles and drainage conditions. The Division does approve the following separation reductions based upon soil profiles and drainage conditions as specified in the Maine Subsurface Wastewater Disposal Rules, CMR 241:

Limiting Feature	Profile and Condition	Standard Vertical Separation	Allowed Vertical Separation
Seasonal high groundwater table	5 & 6 Profile; E Condition	24 inches	12 inches
Bedrock	All Profiles and Conditions	24 inches	12 inches

Because installation and owner maintenance has a significant effect on the working order of onsite sewage disposal systems, including their components, the Division makes no representation or guarantee as to the efficiency and/or operation of the Cromaglass Wastewater Treatment System. Further, registration of this product for use in the State of Maine does not represent Division preference or recommendation for this product over similar or competing products.

If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen

James A. Jacobsen
Project Manager, Webmaster
Division of Environmental Health
Drinking Water Program
Subsurface Wastewater Unit
e-mail: james.jacobsen@state.me.us

/jaj

xc: Product File
Cromaglass Corporation
P.O. Box 3215
2902 N. Reach Rd.
Williamsport, PA 17701

Wastewater Management
P.O. Box 122
Georgetown, ME 04548

James Jacobsen
DEH
11 State House Station
Augusta, ME 04333

June 7, 2010

Re: Cromoglass, Requested Reduction in Separation Distance to Seasonal High Groundwater Table, Restricted Layer and/or Bedrock

Dear Mr. Jacobsen:

Cromoglass respectfully requests the ability to be considered for a 50% reduction in the separation distance to the seasonal high groundwater table, restricted layer, and/or bedrock when needed by Licensed Site Evaluators in special considerations.

Cromoglass residential treatment units provide a combined BOD_5+ TSS to be below 30 mg/l.

We understand that other manufacturers of AWT units in Maine that provide treatment to the above level have requested, and were granted, a special reduction. We would like to offer the same opportunity to designers considering Cromoglass, since they can provide equivalent treatment capabilities.

Please contact me if you have any questions or additional matters for discussion.

Respectfully,

Harold L White

Harold White

HW/nd

Maine Department of Health and Human Services

Maine Center for Disease Control and Prevention
286 Water Street, 3rd Floor
11 State House Station
Augusta, ME 04333-0011

John Elias Baldacci
Governor

John R. Nicholas
Commissioner
Dora Anne Mills, MD, MPH
Public Health Director

January 17, 2006

Chromaglass Corporation
Attn.: Ashley L. Bogart
P. O. Box 3215
Williamsport, PA 17701

Subject: Product Registration, Chromaglass Wastewater Treatment Systems, Models CA 5/12/15/25/30/50/60/100/120/150

Dear Ms. Bogart:

The Division of Health Engineering has completed a review of a registration application for your company's product. This information was submitted pursuant to Section 1802 of the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules (Rules), for code registration, for use in Maine.

Product Description

The Chromaglass Wastewater Treatment Systems consist of fiberglass-tank sequencing batch reactors, with rated treatment capacities ranging from 500 to 200,000 gallons per day.

Claim

According to the information you provided, the Chromaglass Wastewater Treatment Systems have received National Sanitation Foundation Standard 40 approval.

Determination

On the basis of the information submitted, the Division has determined that Chromaglass Wastewater Treatment Systems are acceptable for use in the State of Maine, provided that they are installed, operated, and maintained in conformance with the manufacturer's directions.

Because installation and owner maintenance has a significant effect on the working order of onsite sewage disposal systems, including their components, the Division makes no representation or guarantee as to the efficiency and/or operation of Chromaglass Wastewater Treatment Systems. Further, registration of this product for use in the State of Maine does not represent Division preference or recommendation for this product over similar products.

If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen

James A. Jacobsen, Environmental Specialist IV
Wastewater and Plumbing Control Program
Division of Health Engineering
e-mail: james.jacobsen@maine.gov

/jaj

xc: Product File

Cromaglass® CORPORATION
Wastewater Treatment Systems
Box 3215 • Williamsport, PA 17701
Phone (570) 326-3396 • FAX (570) 326-6426
Website: www.cromaglass.com • Email: mailinfo@cromaglass.com

December 31, 2005

State of Maine
Department of Human Services
Division of Health of Engineering
ATTN: Russ Martin
11 State House Station #10
Augusta, ME 04333-0011

Dear Mr. Martin:

Please accept our submission for the onsite wastewater treatment approvals. Included in this packet is our NSF Standard 40 equivalency report. This was conducted under similar conditions to the NSF Standard 40 testing criteria with results superior to requirements. Presently, we are updating our certification to the current Standard 40 certification. Our system is in the preparatory phase at the Massachusetts Testing Center on Buzzard's Bay, MA with expected completion in 2006.

Our performance data booklet is also included to show field data from actual working systems. In addition, we are including approval letters from other states and references from our various installations around the world. This list includes secondary treatment systems in addition to our more advanced nutrient removal systems.

Our representative, Mr. Harold White of Wastewater Management, Inc., Georgetown, Maine, has an extensive history of installing Cromaglass systems in Maine. The systems that he installed continually operate within the limits required of onsite wastewater treatment systems. The combination of Mr. White's integrity and the success rate of Cromaglass Wastewater Treatments Systems form evidence of Cromaglass viability and effectiveness warranting approvals for Cromaglass systems in the state of Maine.

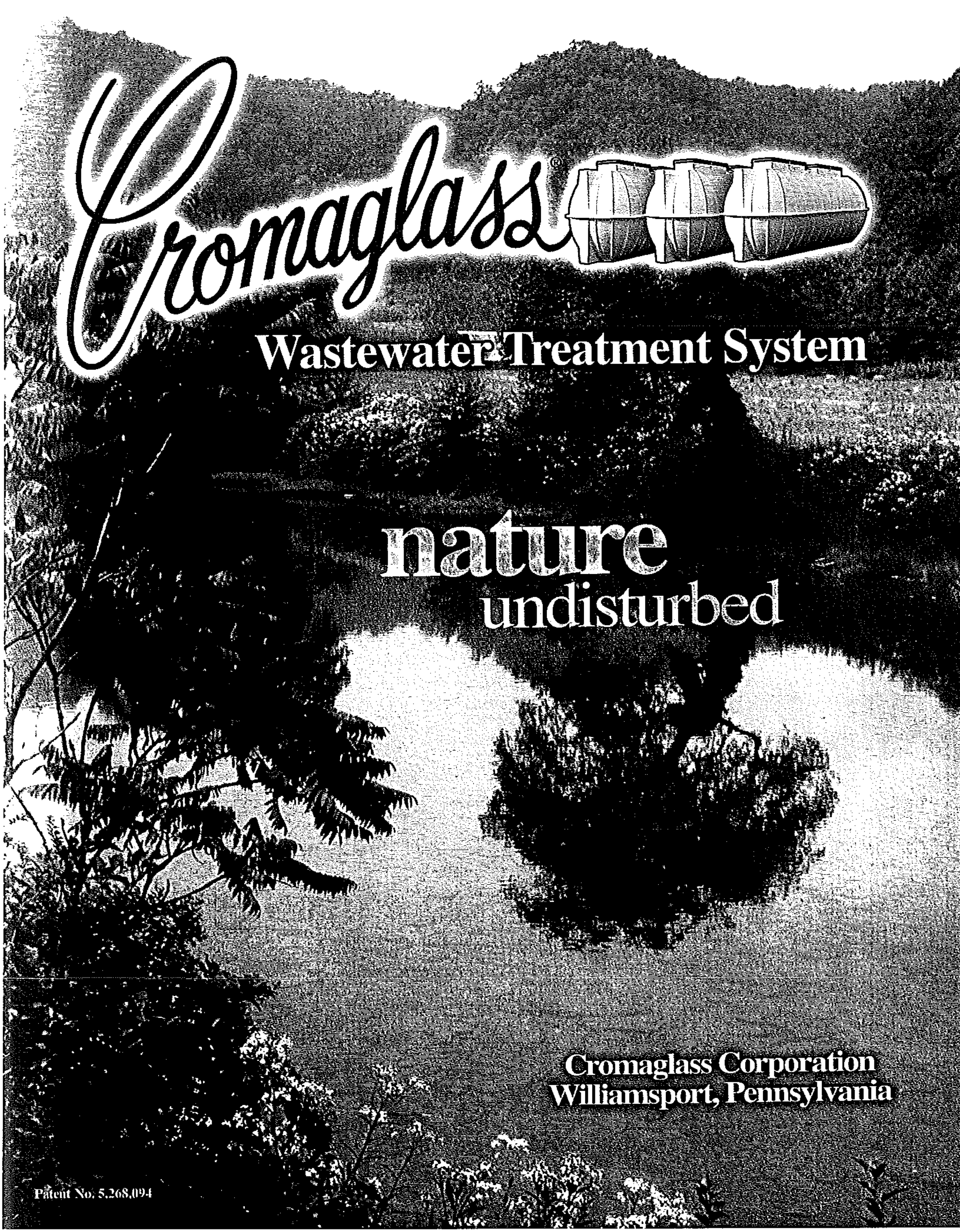
Please contact either Cromaglass Corp. or Mr. Harold White with your questions and concerns.

Thank you for this opportunity to submit this packet of information for your review.

Sincerely,
Ashley L. Bogart
Ashley L. Bogart
Markting

Cc: Mr. Harold White, Wastewater Management, Inc.

Enc: NSF Standard 40 Equivalency test
State Approval Letters
Cromaglass references
Cromaglass Catalog
Engineer's Report



Cromaglass®

Wastewater Treatment System

nature undisturbed

Cromaglass Corporation
Williamsport, Pennsylvania

Patent No. 5,268,094

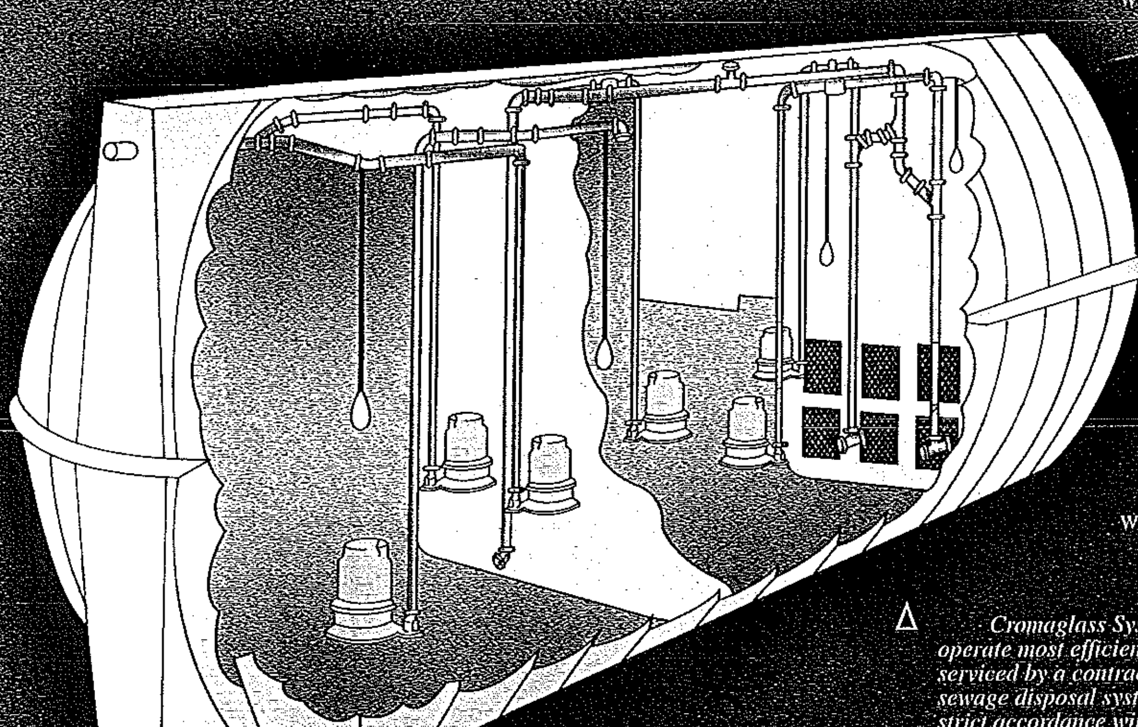
Cromaglass® Who We Are

Since 1965 Cromaglass Corporation has been providing cost-effective, environmentally friendly wastewater treatment solutions around the world. The innovative sequencing batch reactor technology employed by Cromaglass system coupled with the systems unique modular design provides an effective and efficient alternative to conventional sewerage.

Cromaglass Corporation is based in Williamsport, Pennsylvania. More than 10,000 Cromaglass systems have been installed worldwide. The Cromaglass Wastewater Treatment System is the ideal solution for single-family homes, small communities, hotels, schools, cluster developments, mobile home parks, resort areas and natural habitat preserves.

Our industry leading wastewater treatment system has positioned Cromaglass at the forefront of the wastewater treatment industry. The Cromaglass system has been recognized and approved by health and regulatory agencies throughout the U.S. and international markets for over 35 years. The treated wastewater from a Cromaglass system is consistently less than U.S. EPA secondary treatment standards of 30mg/L BOD and 30mg/L TSS.

With more than 35 years experience in the wastewater treatment business, it's no wonder more and more engineers and land developers are turning to Cromaglass to provide wastewater solutions.



Δ *Cromaglass Systems have been designed to operate most efficiently if installed, operated, and serviced by a contractor experienced in the field of sewage disposal systems. Installation must be made in strict accordance with regulations of local, state, or federal standards. Contractor must have applied for and been issued a permit for operation of the system.*

What We Do

Cromaglass Corporation manufactures a variety of wastewater treatment systems, which are designed as Sequencing Batch Reactor (SBR) systems. Cromaglass offers more than ten treatment models that enable effective treatment of wastewater flows ranging from 500 GPD (1.9 M3) to 200,000 GPD (758 cubic meters).

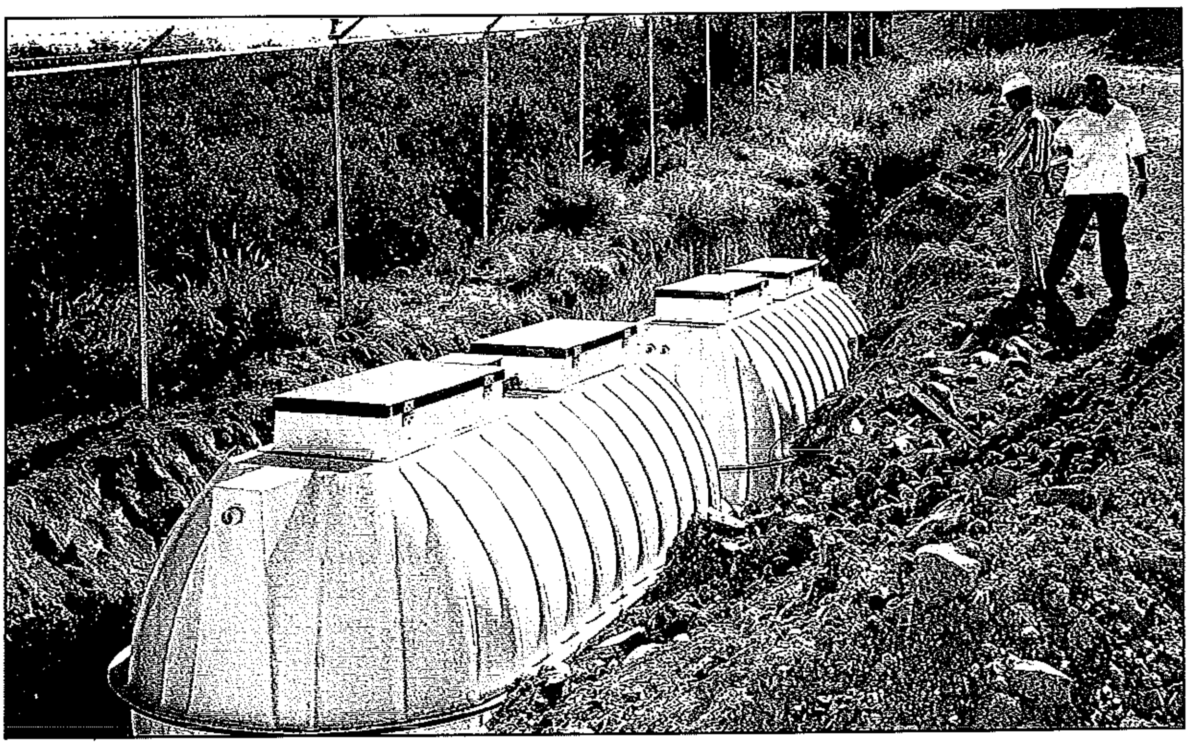
The Cromaglass Waste Water Treatment systems provide a strong, lightweight, corrosion-resistent fiberglass tank. The innovative design utilizes submersible pumps for aeration, mixing and effluent discharge – providing an effective wastewater treatment solution.

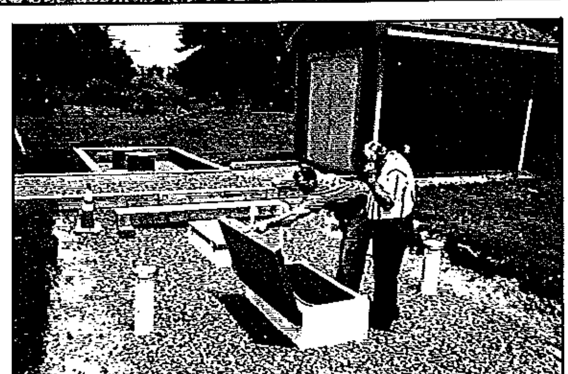
Cromaglass technology can also provide solutions for failed septic systems, and allow development of land where conventional sewage systems cannot be used. These systems enable land developers to proceed with construction even when central sewers are several miles away, or years in future development.

Cromaglass systems can also be designed for denitrification (biological nutrient removal) and recycling for irrigation and toilet flushing. In addition, Cromaglass is setting the industry standard with a state-of-the-art remote monitoring system.

Cromaglass not only manufactures wastewater treatment systems, but also Chlorine Contact Equipment, Equalization Equipment, and Sludge Processing Equipment.

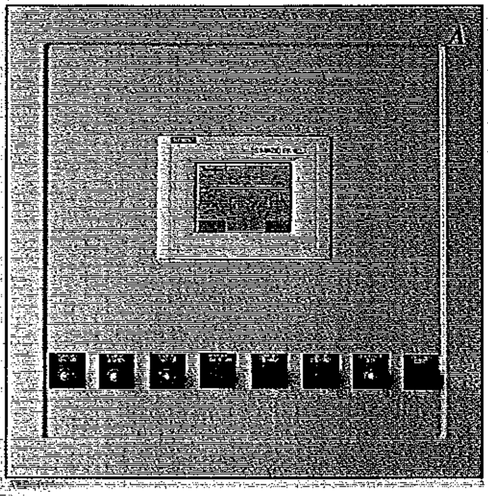
Local Cromaglass representatives and/or Cromaglass' factory field technicians provide Customer/Operator on-site training and service after the sale. Factory engineers are available to assist with specifications, design work, and troubleshooting on new and existing systems.

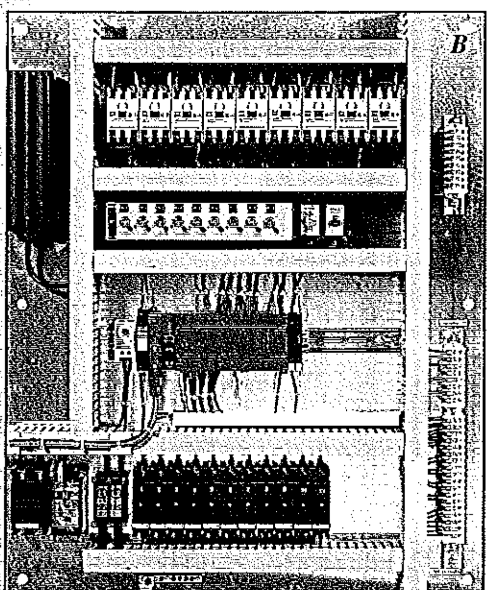




Cromaglass Advantage

Leading The Industry





A. ALWAYS THINKING! User friendly thermal-touch screen with LCD display allows for quick, accurate, operator interface with indicator lights to monitor pump sequence or treatment cycle.

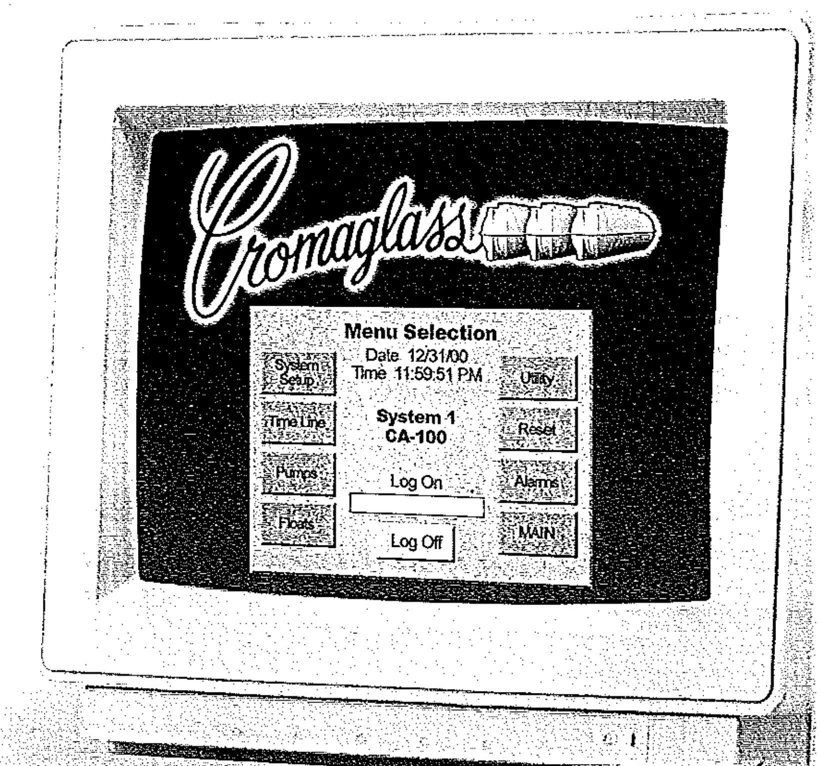
B. ELEVATED STANDARDS! Our UL certified panels use the highest quality components from trusted names like: Siemens, Square D, Cutler-Hammer and Phoenix Contact.

Cromaglass Wastewater Treatment Systems are designed as a continuously fed activated sludge process with clarifiers that are filled on a batch basis. All Cromaglass systems operate on identical principals: turbulent aeration of incoming wastes and batch treatment of biomass in a separate aeration and quiescent settling chamber.

Remote Monitoring & PLC Controls

The Cromaglass system is designed to provide maximum operational flexibility. The state-of-the-art PLC Controls will respond to the inputs from level sensors and probes in the tanks. The PLC Controls offer:

- *Automatic adjustments to treatment parameters*
- *Permanent records of all operational functions*
- *Suggested service and maintenance schedules*



In addition, Cromaglass has made standard 24-hour remote monitoring capabilities for all systems. This industry leading initiative offers significant savings on system operation and maintenance. The Cromaglass remote monitoring system features:

- *A complete web-based operating platform*
- *Centralized and secure system*
- *Automatic notification of potential alerts or alarms*

A complete, accurate, timely update on the status of the system to guarantee that each Cromaglass system is operating at maximum efficiency.

Cromaglass®

Cromaglass Advantage

Sets The Standard

Denitrification Solutions

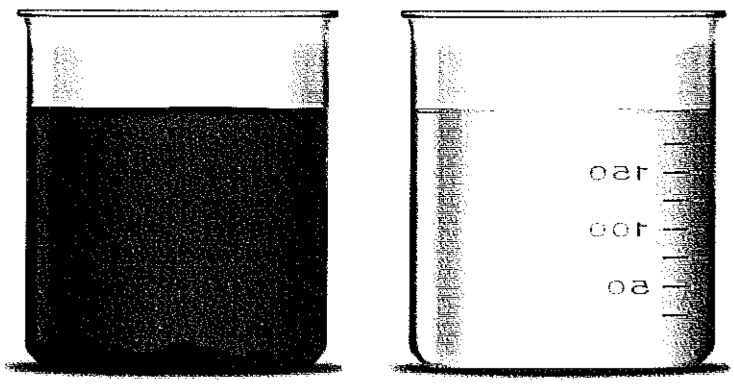
With total nitrogen removal rates of 90%, the Cromaglass Wastewater Treatment and Recycling process is setting the standard for denitrification. The patented Cromaglass wastewater treatment process is quickly becoming the system of choice by engineers and developers when denitrification is required.

Effective denitrification requires proper aerobic treatment of the wastewater to convert ammonia nitrogen to nitrate called nitrification. Nitrate is then converted into harmless nitrogen gas during the denitrification cycle in the Cromaglass Batch Treatment process. Cromaglass Treatment Systems are effective in both nitrification and denitrification because of controlled process conditions in the Cromaglass reactor.

Denitrification, or nutrient removal, is now mandated in many areas of the country including densely populated areas served by both on-site wastewater treatment and drinking water wells.

Final Effluent After FILTRATION & DISINFECTION

BODs	2.84 mg/L	97.87% reduction
TSS	2.48 mg/L	98.65% reduction
TN	90% reduction	



Thoroughly Tested

Assurance of treatment quality has been accomplished through independent laboratory research and testing supported by sampling from installed systems. National standards as established by the Federal EPA and the National Sanitation Foundation have been surpassed. In fact, effluent quality with over 95% reduction of BOD and Suspended Solids enables Cromaglass to be designed where other methods are not acceptable.

Lightweight & Reusable

Cromaglass **Sequencing Batch Reactors** (SBR) are constructed of lightweight fiberglass. Covers and locking hatches are also of fiberglass. Being light in weight means expensive cranes are not required, saving installation costs. Because Cromaglass wastewater treatment and recycling systems are completely integrated, compact and transportable, they can be reused, relocated and/or resold when changing circumstances warrant.

Recycled and Reusable

Recycle and reuse of wastewater is critical in arid areas of the world. Cromaglass has developed a system that allows irrigation and recycling of water for toilet use. This system incorporates the Cromaglass aerobic treatment unit in conjunction with pressure sand filter for effluent polishing and UV treatment for disinfection that allows recycling of water for irrigation and toilet flushing.

Odorless

The Cromaglass System employs recognized principles of biological science, as well as an exclusive oxidation and settling process. It accomplishes fast, odorless decomposition of offensive sewerage.

Easily Installed & Expanded

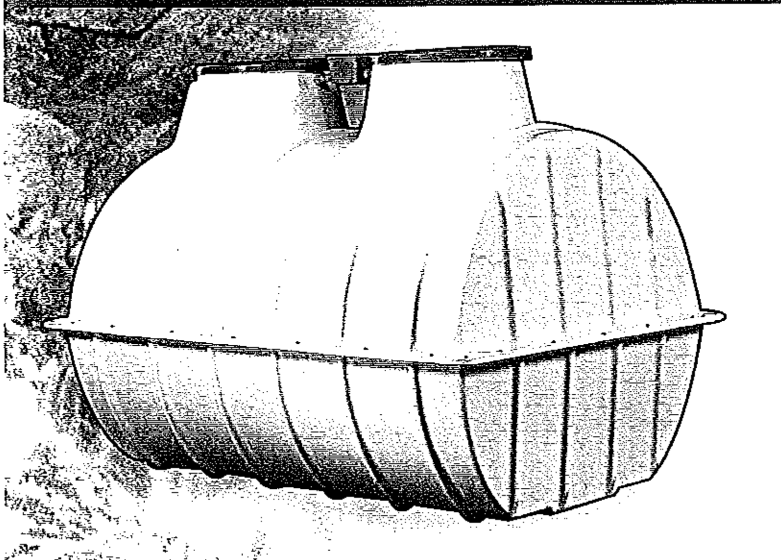
Cromaglass can be installed in modules, meaning a lower initial investment. The system can start with one independent module designed to treat the initial loading. As development grows, additional modules can be added. Modules can be added at the initial site, or if more economical, a new treatment site can be used. Because a batch system requires less land area, it can be placed in multiple locations – saving additional piping/plumbing and pump station costs.

Non-corrosive

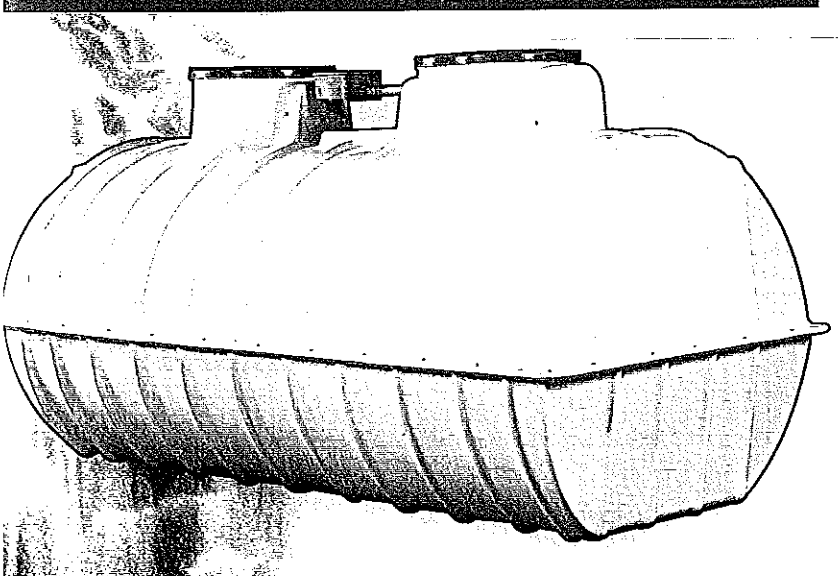
All Cromaglass systems are manufactured using non-corrosive fiberglass tanks, PVC Sch. 40 piping, and all stainless steel hardware. The systems are preassembled during our manufacturing process and arrive at the job site with tank, internal piping, pumps, internal electrical terminated in an at-grade accessible junction box, and an electrical control panel.

Cromaglass®

Models CA 5



Models CA 12, 15



Models CA 25, 30

Model CA-5

First introduced in 1965 to accommodate single-family home applications. Cromaglass set the standard by incorporating the Sequencing Batch Reactor (SBR) mode of operation into a Pre-Engineered, modular design for flows under 500 gallons per day. Simple, user-friendly controls, in combination with dual submersible pumps, make this the complete model for homes with 3 bedrooms or less.

Models CA 12/15

A cousin to the smaller CA-5 model with larger aeration and clarifier compartments, the CA-12 and CA-15 are ideally suited for larger homes with more than 3 bedrooms. The Model CA-12 has maximum hydraulic capacity of 1,200 gallons per day, while the CA-15 is 1,500 gallons per day. Both units operate under standard SBR principles; fill, react, settle and discharge.

Applications range from residential, commercial, and recreational. Due to its unique modular design and simple controls, design engineers around the world specify the CA-12 and CA-15. Single discharge pump is standard, but may be engineered with duplex for redundancy. With higher organic loading obtainable and increased surge volume for peak flows, the CA-12 and CA-15 are the preferred choice for flows up to 1,500 GPD.

Models CA-25/30

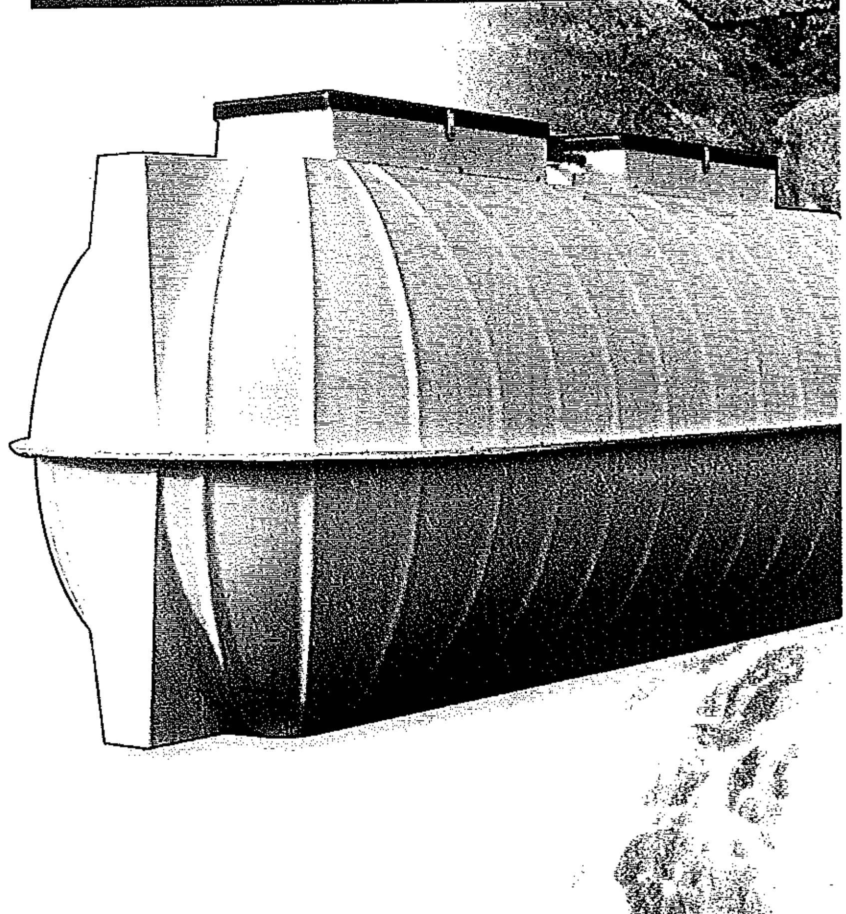
Similar to the CA-12 and CA 15, the CA-25 operates most efficiently when used on residential applications ranging from 1,500 – 2,000 GPD. With a peak flow capacity of 2,500 GPD, the CA-25 may be applicable for small clustered development projects or in some small flow commercial/institutional flows.

Due to increased demand by design engineers for sludge management, Cromaglass developed the CA-30 with sludge wasting capabilities. This provides the operator a tool to optimize the activated sludge process. With redundancy in aeration and discharge, the CA-30 was the first complete fail-safe batch reactor. The CA-30 comes standard with built-in automation for responding to fluctuations in order to satisfy the oxygen requirement. The Alternating Discharge Pumps include Pump Failure Alarms to alert the owner to mechanical difficulty and a unique floating decanter for optimal effluent low in Total Suspended Solids. This advanced design translates into reduced on-site time required by the plant operator.

The CA-30 is well suited for small shopping centers, office complexes, medical offices, schools, or small residential sub-divisions. Modular flexibility enables multiple units to be placed in parallel to accommodate higher flows for increased growth.

The Electrical Control Panel comes standard with a mechanical time clock, or optional Programmable Logic Controls (PLC).

Models CA 50, 60



Models CA-50/60

Both models have all features and benefits of the CA-30 but on a larger scale. Increased aeration and clarifier sections allow for higher organic and hydraulic loads. Manways are easily accessible for routine operation and maintenance. All Cromaglass models have the ability to batch discharge clarified effluent with continued aeration and mixing all in the same tank. This unique design reduces the overall footprint required thereby creating otherwise useless real estate into a valuable commodity.

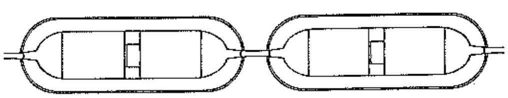
Models CA-100/120/150

Cromaglass has long been a leader offering modular, SBR technology with flows under 15,000 gallons per day. By incorporating all the features and benefits of its predecessors, the CA-100, CA-120, and CA-150 models set the standard for secondary and tertiary treatment at flows up to 200,000 GPD.

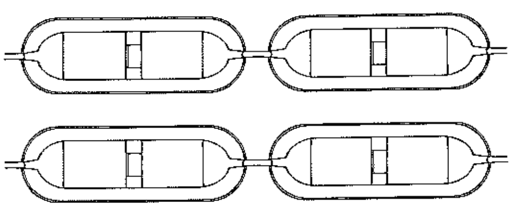
With the incorporation of automated controls, hydraulic overloads are virtually eliminated. The aeration process is self-adjusting as needed, to satisfy increased liquid volume and organic loading.

Multiple units may be placed in parallel for larger flow systems.

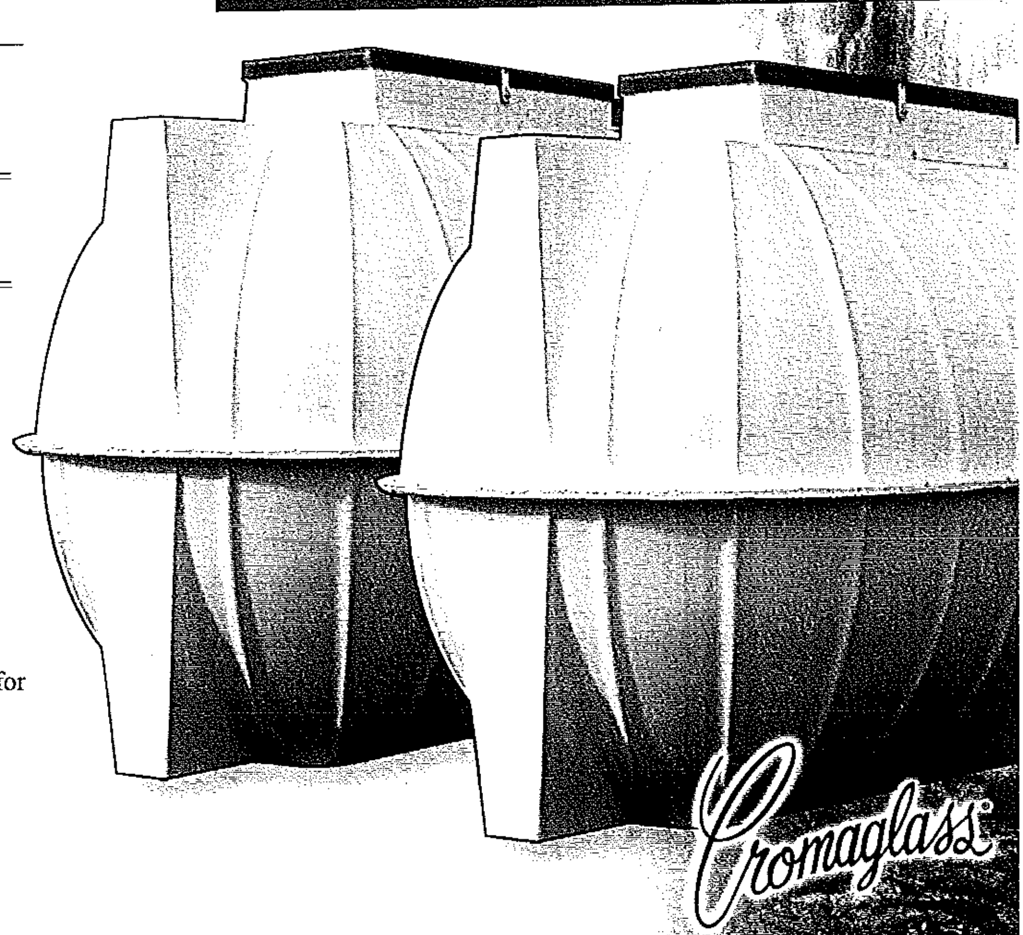
PHASE 1



PHASE 2



Models CA 100, 120, 150



Multiple tank systems enable the operator to maintain efficient treatment at peak flows as well as during low flow periods.

Primary uses include large residential sub-divisions, restaurants, retail shopping centers, schools, country clubs, hotels, resorts, airports, and many more.

The unique two tank construction allows for easy installation at almost any site. The strong lightweight tanks are typically installed end-to-end, but may be installed side-by-side if space restrictions require.

Specifications

Batch Treatment Process

Residential, Commercial, Industrial

POWER:
115v/230v – Single Phase.
230v/460v – 3 Phase available.

CONTROL PANEL:
Nema 1 enclosure standard.
Nema 3R, 4, 7 and 12 available.

ALARM:
Red light mounted on panel with optional audible alarm.
Remote monitor to phone preset numbers in case of alarm.

CONSTRUCTION MATERIALS:
Tank – Fiberglass.
Comminution Chamber – Fiberglass and noncorrosive screen.
Piping and Fittings – Schedule 40 PVC.
Metal Fittings – Stainless steel.

PUMPS	TOTAL HEAD – FEET (METERS)					AMPERAGE	
MODEL	5 (1.52)	10 (3.05)	15 (4.57)	20 (6.10)	25 (7.62)	MAX. RUN AMPS.	LOCKED ROTOR AMPS.
	CAPACITY – G.P.M. (L/MIN.)						
1/4 H.P. DISCHARGE	30 (114)	26 (98)	20 (76)	12 (45)		10	15.6
1/3 H.P. WE0311M	85 (322)	70 (265)	52 (197)	35 (132)	14 (53)	9.4	32.2
1/2 H.P. WSO511B	150 (567)	120 (454)	90 (340)	52 (196)	8 (30)	14.5	34.9
1 H.P. WS1012B	—	180 (681)	157 (595)	127 (481)	95 (360)	12.3	—

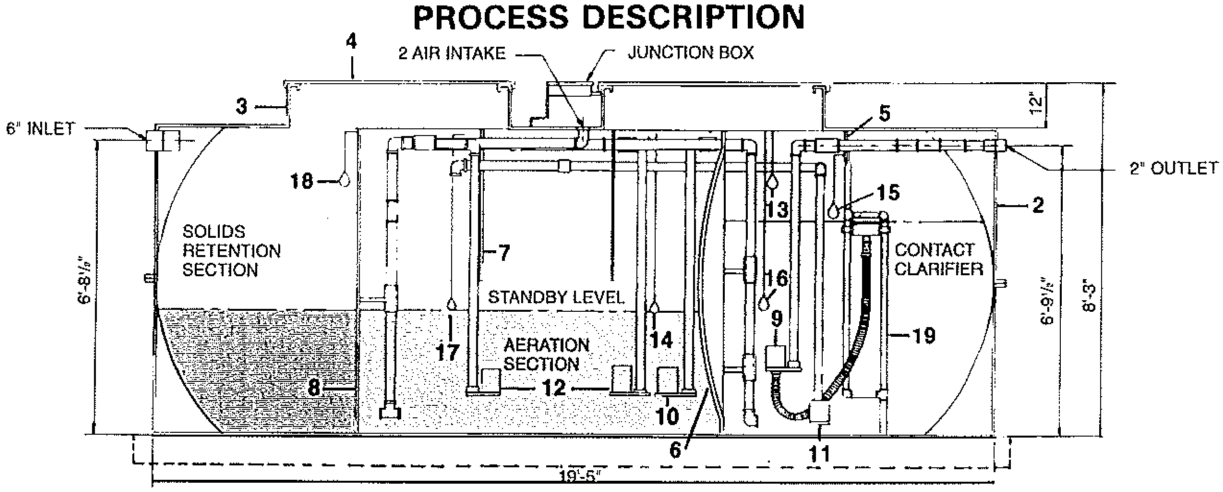
ADDITIONAL SYSTEM SPECIFICATIONS

MODEL	LENGTH	WIDTH	HEIGHT	SHIPPING WEIGHT LBS. (KG.)	24 HR. MAX. CAPACITY GALS. (M^3)	STNDRD DISCHG. VOL. GALS. (M^3)	STNDRD DISCHG. PER DAY	DENITE DISCHARGE VOL. GALS. (M^3)	DENITE DISCHARGE PER DAY	ELECTRICAL CONSUMPTION KWH/24 HRS.	TANK VOLUME GALS. (M^3)	TOTAL AMPS REQUIRED 120v/230v
CA-5	7'11" (2.4m)	5'7" (1.7m)	5'7" (1.7m)	704 (319)	500 (1.9)	85 (.32)	6	340 (1.3)	4	8.0	923 (3.5)	15a - 120v
CA-12	11'3" (3.4m)	5'7" (1.7m)	5'7" (1.7m)	1020 (463)	1200 (4.5)	200 (.76)	6	800 (3.0)	4	8.0	1358 (5.1)	15a - 120v
CA-15	11'3" (3.4m)	5'7" (1.7m)	5'7" (1.7m)	1020 (463)	1500 (5.7)	250 (.95)	6	1000 (3.8)	4	10.0	1358 (5.1)	20a - 120v
CA-25	14'10" (4.5m)	6'10" (2.1m)	6'10" (2.1m)	1720 (780)	2500 (9.5)	420 (1.6)	6	1680 (6.4)	4	21.0	2910 (11.0)	40a - 120v
CA-30	14'10" (4.5m)	6'10" (2.1m)	6'10" (2.1m)	2070 (939)	3000 (11.4)	375 (1.42)	8	2250 (8.5)	6	55/66*	2910 (11.0)	60a - 230v
CA-50	19'5" (5.9m)	7'4" (2.2m)	8'3" (2.5m)	2684 (1217)	5000 (18.9)	625 (2.37)	8	3750 (14.2)	6	55/65*	4590 (17.4)	60a - 230v
CA-60	19'5" (5.9m)	7'4" (2.2m)	8'3" (2.5m)	2684 (1217)	6000 (22.7)	600 (2.27)	10	3600 (13.6)	6	55/65*	4590 (17.4)	60a - 230v
CA-100	42'10" (13.1m)	7'4" (2.2m)	8'3" (2.5m)	4885 (2216)	10,000 (37.9)	1000 (3.79)	10	6000 (22.7)	6	60/78*	9186 (34.8)	100a - 230v
CA-120	42'10" (13.1m)	7'4" (2.2m)	8'3" (2.5m)	4885 (2216)	12,000 (45.4)	1000 (3.79)	12	6000 (22.7)	6	60/78*	9186 (34.8)	100a - 230v
CA-150	42'10" (13.1m)	7'4" (2.2m)	8'3" (2.5m)	4950 (2245)	15,000 (56.8)	1250 (4.73)	12	7500 (28.4)	6	82/100*	9186 (34.8)	100a - 230v

* Dependent on biological and hydraulic loading, electrical consumption may vary.

System specifications are subject to change without notice.

PROCESS DESCRIPTION



VIEW: A-A

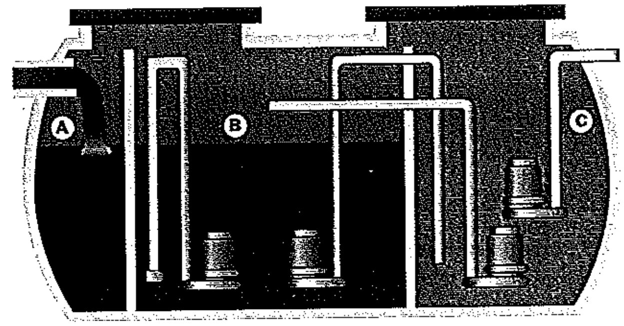
1	Aerobic Wastewater Treatment Plant Model CA-50	11	Sludge Return Pump
2	Tank Model CA-50	12	Aeration Pump P1 & P2
3	Manhole	13	Float - Sludge Return F1
4	Cover	14	Float - Discharge F1
5	Baffle	15	Float - Discharge Alarm
6	Concave Baffle	16	Float - Discharge Shut Off
7	Support Baffle	17	Float - Dual Aeration
8	Screen Baffle	18	Float - High Water Alarm
9	Discharge Pumps - Duplex	19	Floating Discharge Assembly
10	Transfer Pump		

Cromaglass®

Typical Cycle

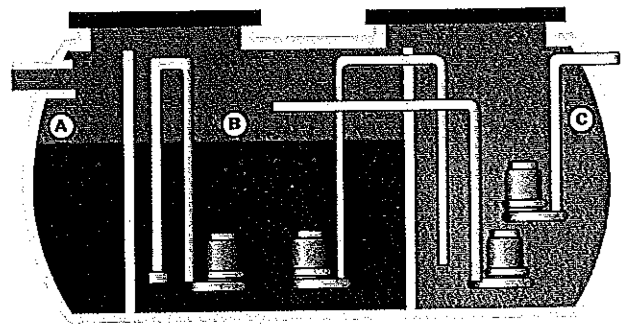
FILL; AERATION

Flow enters the Solids Retention Section (A) that is separated by non-corrosive screen. Inorganic solids are retained behind the screen. Organic solids are broken by turbulence created with mixed liquor being forced through screen by submersible aeration pumps. This eliminates the need for mechanical comminution.



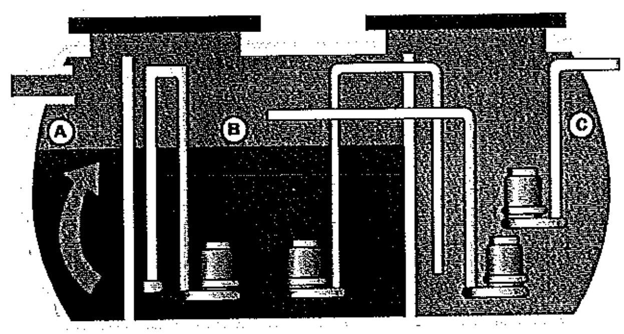
AERATION

Liquid and small organic solids pass through the screen into the continuing Aeration Section (B). Air and mixing are provided by submersible pumps with venturi aspirators that receive air through pipe intake from the atmosphere.



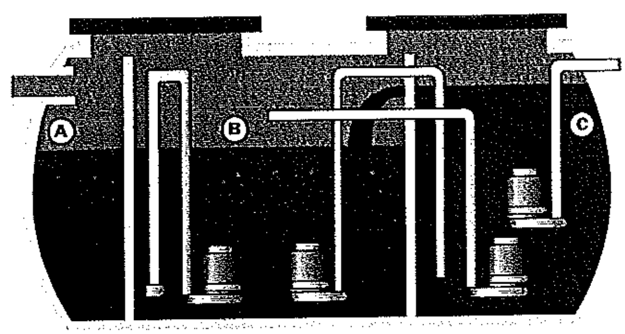
DENITRIFICATION (OPTIONAL)

Provided by an anoxic period during the regular treatment cycle. ***Cromaglass*** units create anoxic conditions by closing the air intakes of the aeration pumps with electric valves. This stops aeration, but the system continues mixing.



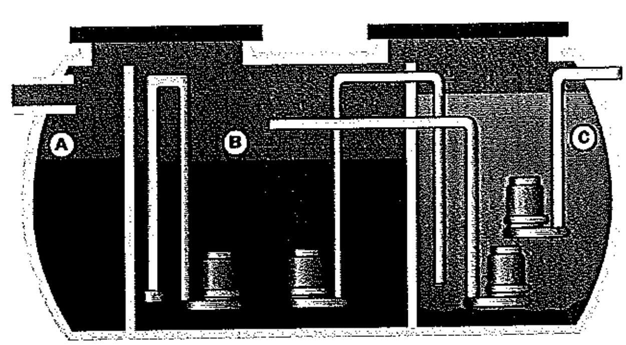
TRANSFER/SETTLE

Treated mixed liquor is transferred by pumping to the Clarification Section (C). The transfer period overfills the Clarifier with the excess spilling through over-flow weirs back into the main Aeration Section. Transfer ceases and Clarifier (C) is isolated – solids separation occurs under quiescent conditions.



DISCHARGE

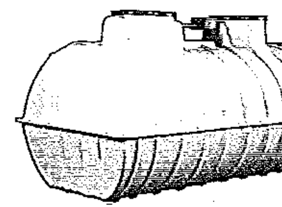
After settling, effluent is pumped out of the Clarifier (C) for discharge. Return sludge is pumped from the bottom of the Clarifier (C) back into the main Aeration Section (B) using a submersible pump, or sludge can be wasted to a Sludge Processing Tank.



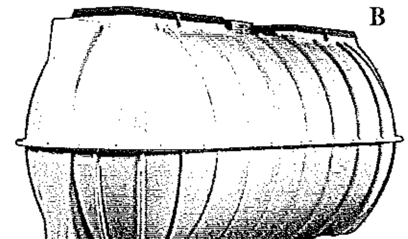
Cromaglass®

Accessories

Aerated Pre-Equalization Tanks



A. 1,300 gallon Aerated Pre-Equilization Tank includes: Mechanical Controls, Dual Discharge Pumps, NEMA 1 Electrical Enclosure, Tie-down package. ***Optional equipment:*** NEMA 4 Enclosure, Three-phase pumps and Controls, HOA (Hands-Off-Auto) switches for all pumps.

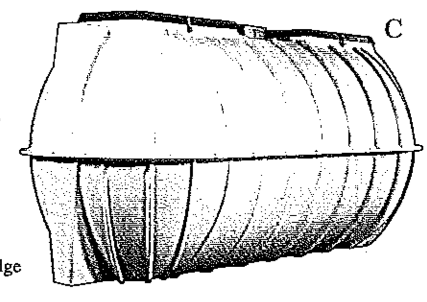


B. 3,000 / 5,000 gallon Aerated Pre-equalization Tank include: Mechanical Controls, Dual Discharge Pumps, NEMA 1 Electrical Enclosure, Tie-down package. ***Optional equipment:*** NEMA 4 Enclosure, Three-phase pumps and Controls, HOA (Hands-Off-Auto) switches for all pumps.

HOW IT WORKS!

The tank is divided into two (2) main sections. The first section is the solids retention section, which is seperated from the remaining section of the tank by a stainless steel mesh screen. The second section of the tank has the aeration pumps and the dual (redundant) discharge pumps. The pumps are controlled by a time clock or PLC which alternates power to the aeration pumps every two hours. The timer or PLC is adjustable for the amount of programmed ON and OFF time for pump operation. Hand-Off-Auto switches are provided for confirming the proper mechanical operation of the motors or for manually overriding the control circuit.

Aerated Sludge Processing Tanks



C. 1,300 / 3,000 / 5,000 Gallon Aerated Sludge Processing Tank: Available with aeration system and Gravity Discharge or Pump Discharge. All systems come complete with fiberglass tank, internal parts, controls, piping and pumps.

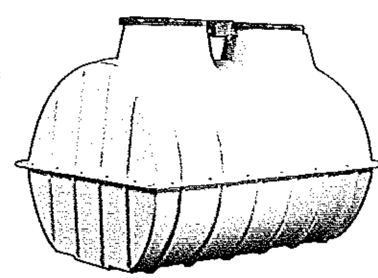
HOW IT WORKS!

Provided as an ancillary process primarily for sludge management, the Cromaglass Aerated Sludge Processing Systems greatly reduce Biosolids produced. This translates to annual savings and allows for a more efficient operating Wastewater Treatment System.

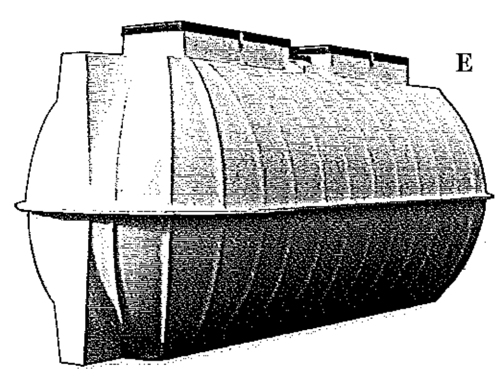
The Sludge Processing Tank (SPT) receives excess sludge produced from each treatment module via manual ball valve located in-line with the return activated sludge pipe. The operator, at his discretion, will manipulate the valves to direct the excess sludge to the SPT during routine site visits.

When the sludge tank is full, sludge thickening is accomplished by manually turning off the aeration pump(s), allowing the tank to settle, and manually pumping the supernatant. After the tank has settled, a decant pump is provided to send the clear supernatant back to the head of the treatment works. The decant pump is located at the back of manway number two and manually controlled by a separate breaker as noted on the control panel enclosure door. The decant pump is suspended from an adjustable chain and should be set by the operator to a height slightly above the sludge/supernatant interface. A float switch mounted directly to the pump will disengage the decant pump as the water level drops.

Chlorine Contact Tanks



Cromaglass Wastewater Treatment Systems applications may include the necessity for disinfection of treated effluent by means of chlorination. Non-corrosive fiberglass tanks are available to suit most volumes up through 75,000 GPD. Capacities of the chlorine contact tanks have been equated to treatment and discharge volume of the appropriate batch units with consideration for a minimum thirty (30) minute detention time in the chlorine contact tanks.
Below are available sizes:

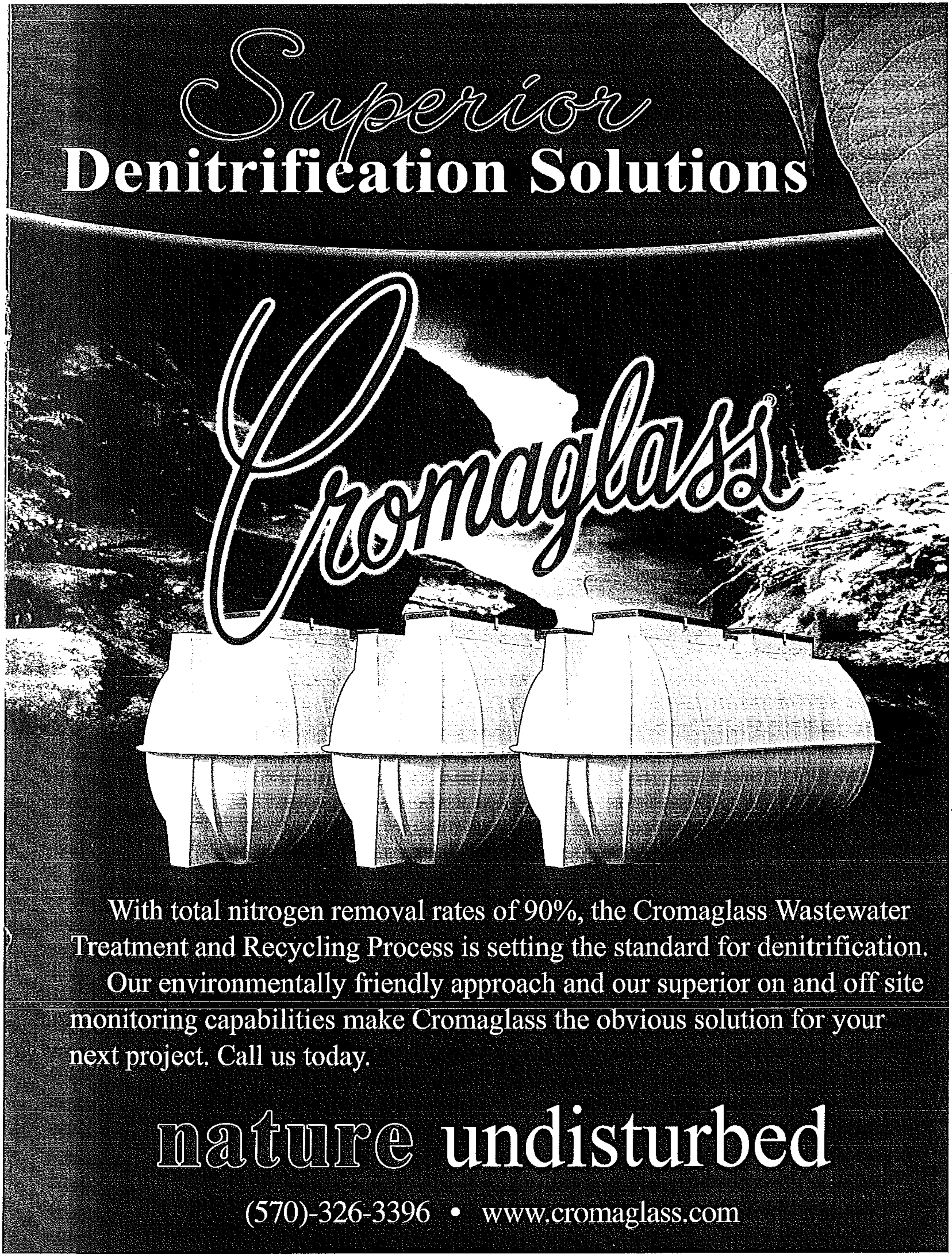


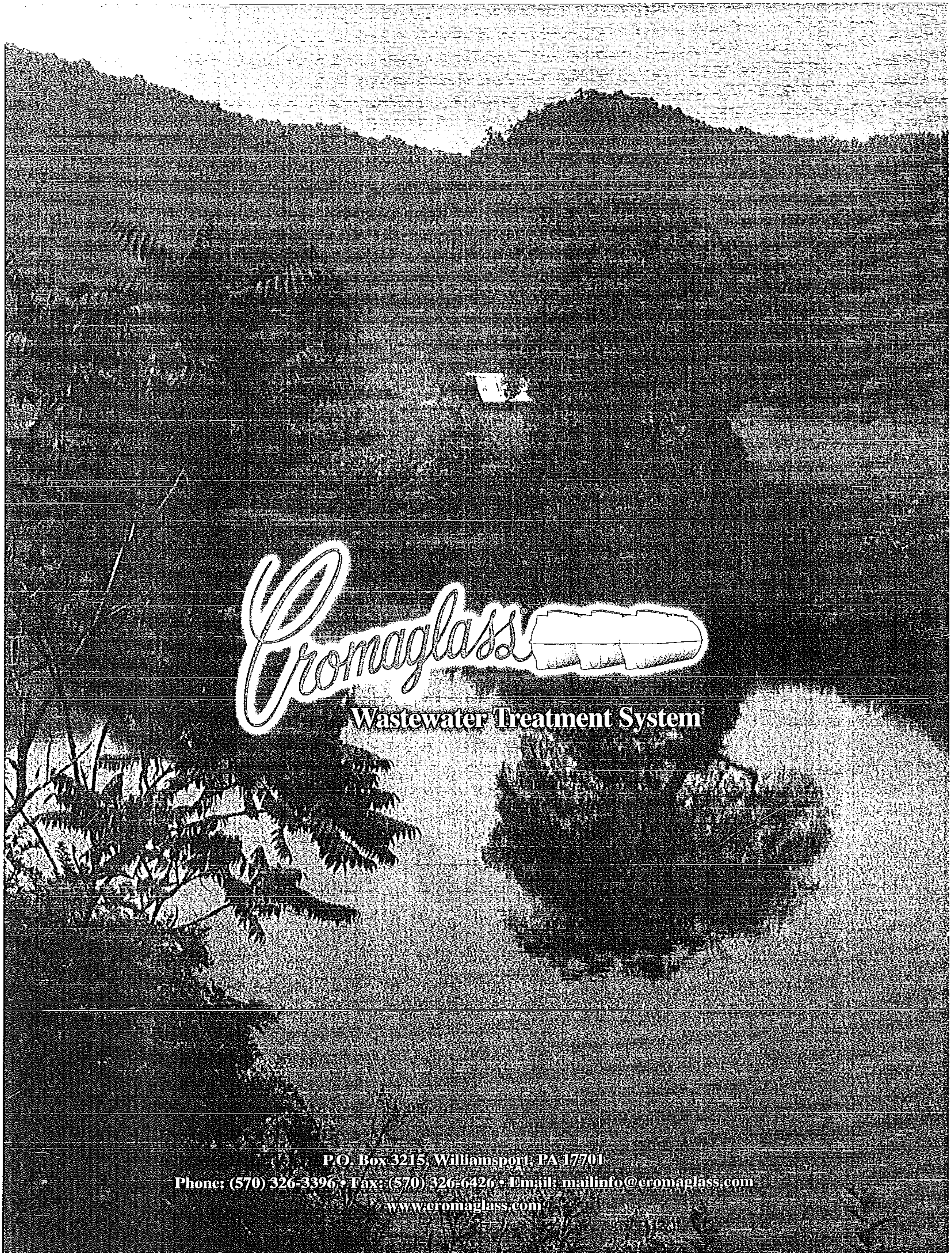
D. 750 Gallon Capacity (three baffles):
Dimension: 7'11" x 5'7" x 5'7", Weight: 385 lbs.
Includes solid state clorinator / #9 chlorine

E. 5,000 Gallon Capacity (three baffles):
Dimension: 19'5" x 8' 3" x 7' 4",
Sphere Weight: 1,325 lbs.
Includes solid state clorinator / #9 chlorine

OTHER MODELS INCLUDE:
300 gal., 500 gal., 1,300 gal., and 3,000 gal.

Cromaglass®


Superior
Denitrification Solutions
Cromaglass®
With total nitrogen removal rates of 90%, the Cromaglass Wastewater Treatment and Recycling Process is setting the standard for denitrification.
Our environmentally friendly approach and our superior on and off site monitoring capabilities make Cromaglass the obvious solution for your next project. Call us today.
nature undisturbed
(570)-326-3396 • www.cromaglass.com



Cromaglass

Wastewater Treatment System

P.O. Box 3215, Williamsport, PA 17701
Phone: (570) 326-3396 • Fax: (570) 326-6426 • Email: mailinfo@cromaglass.com
www.cromaglass.com

Cromaglass® CORPORATION

Wastewater Treatment Systems

Box 3215 • Williamsport, PA 17701
Phone (570) 326-3396 • FAX (570) 326-6426
Website: www.cromaglass.com • Email: mailinfo@cromaglass.com

STATE APPROVAL LETTERS				
STATE	**DATE OF APPROVAL**	**APPROVED SYSTEM SIZE**	**O&M AGREEMENT REQUIRED**	**COMMENTS**
Massachusetts	19-Oct-05	CA-5, CA-12, CA-15, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120, CA-150	YES	Approved for general use as well as denitrification
Maryland	28-Sep-89	CA-5, CA-12, CA-15, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120, CA-150		
Maine	9-Jul-98	CA-5		
New Hampshire	7-Jul-98	CA-5, CA-12, CA-15, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120, CA-150	YES, must be sold with system	Subsurface soil discharge
New Jersey	29-Jan-04	340 GPD < FLOW< 1600 GPD	YES	For Pinelands area with denitrification
Ohio		CA-5, CA-12		Filter required for off-lot discharge
Pennsylvania	4-Aug-97	CA-5, CA-12, CA-15, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120, CA-150		
Virginia	27-Feb-87	CA-5		
Wisconsin	8-Jul-04	CA-5, CA-12, CA-15, CA-25, CA-30, CA-50, CA-60, CA-100 (maximum 10,000 GPD)		

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

STEPHEN R. PRITCHARD
Secretary

ROBERT W. GOLLEDGE, Jr.
Commissioner

October 19, 2005

Allan N. Young, President
Cromaglass Corporation
P.O. Box 3215
Williamsport, PA 17701

Re: Application for BRP WP61f – Draft Renewal of Approval for Remedial Use
Trade name of technology and model: Cromaglass Wastewater Treatment Systems:
CA-5, CA-12, CA-15, CA-25, CA-30, Ca-50, CA-60, CA-120, CA-150
Transmittal Number: W064954

Dear Mr. Young:

The Department of Environmental Protection has completed its review of your application for approval of the above referenced technology and has prepared the enclosed Draft Renewal of Approval for Remedial Use. The Department is providing a comment period in order to allow you an opportunity to comment on the Department's proposed Approval. The comment period for the Approval will begin on the date of this letter and will end in thirty days.

The Department requests that you provide any updated electronic schematic file of drawings of these particular units. The files will become a part of the Approval.

Please carefully review the enclosed draft. The Department has highlighted in **bold text** those sections of the renewal that have been changed.

Should you have any comments, please submit them to:

Director
Watershed Permitting Program
Department of Environmental Protection
One Winter Street – 6th Floor
Boston, MA 02108

Following our review of any comments, the Department will issue a final decision.

State of Maryland

DEPARTMENT OF THE ENVIRONMENT
2500 Broening Highway, Baltimore, Maryland 21224
Area Code 301 • 631-3652

William Donald Schaefer
Governor

Martin W. Walsh, Jr.
Secretary

September 28, 1989

Mr. Robert W. Nichols
500 Indian Lane
Hagerstown, Maryland 21740

Dear Mr. Nichols:

Enclosed are two comments from staff personnel. Please know that Cromaglass is an approved unit and, as such, may be used in lieu of an approved septic tank in a permitted on-site sewage disposal system.

As per our telephone conversation, I believe you should ask the local Department of Public Works and the Planning Department whether or not they would support the issuance of a National Pollution Discharge Elimination Permit (NPDES) for a single family residence.

Thank you for your cooperation in this matter.

Respectfully,

Jack R. Holthaus

Jack R. Holthaus, R.S.
Chief
Division of Residential Sanitation

JRH:jde

Attachments

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

ANGUS S. KING, JR.
GOVERNOR

EDWARD O. SULLIVAN
COMMISSIONER

July 9, 1998

Quay Schappell
Chromoglass Corporation
Box 3215
Williamsport, PA 17701

RE: Your letter of June 19, 1998.

Dear Mr. Schappell:

Thank you for you letter regarding the Maine Department of Environmental Protection's (MEDEP) approval of Chromoglass treatment systems for installation in the State of Maine. I would like to explain our position on this issue and explain the circumstances that led to our decision to amend the regulations to allow non-National Science Foundation (NSF) approved systems to be installed.

In 1991, Code of Maine Regulations Chapter 596 was promulgated to clarify portion of the waste discharge law (38 Maine Revised Statutes Annotated §413) regarding overboard discharges (OBDs). OBDs are defined as approved discharges of sanitary waste to the surface waters of the State not carried by a municipal of quasi-municipal treatment system. There are approximately 2000 OBDs throughout the State of Maine including many residential discharges as well as those from restaurants, nursing homes, and schools. These discharges receive treatment by two basic categories of systems; sandfilters and mechanical (aerobic) treatment systems. Included within CMR Chapter 596 was a stipulation that any facility that was required by site restrictions or waste type to install a mechanical system must install a treatment system that met NSF Standard 40 for individual aerobic waste water treatment plants. The MEDEP included this standard to ensure that the systems being installed were designed to and performed well enough to treat the waste to the level required by MEDEP.

RECEIVED JUL 1 3 1998

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688
RAY BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04769-2094
(207) 764-0477 FAX: (207) 764-1507

web site: www.state.me.us/dep

NHDES

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
(603) 271-3501 FAX (603) 271-6683

July 7, 1998

Mr. Quay Schappell
Cromaglass Corporation
Box 3215
Williamsport, PA 17701

Re: Cromaglass® Sequencing Batch Reactor Package Sewage Treatment Plant

Dear Mr. Schappell:

The NH Department of Environmental Services (DES) has reviewed material dated April 30, 1998 submitted in which you request approval of the referenced treatment unit under NH Administrative Rule Env-Ws 1024. The submittal included performance evaluation data, a March 1997 equipment catalog, and several articles on sequencing batch reactors in general.

Based on material submitted, DES approves the use of the Cromaglass® Sequencing Batch Reactor treatment units (Cromaglass units), models numbered CA-5, CA-12, CA-15, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120 and CA-150, inclusive, subject to the following limitations:

1. Units must be installed in accordance with manufacturer's recommendations.

2. All other details of the overall wastewater disposal system using Cromaglass units must comply with the provisions of NH Code of Administrative Rules, Chapter Env-Ws 1000, except that a septic tank (in addition to the treatment unit) is <u>not</u> required for systems which use a Cromaglass unit.

3. Warning buzzers per the equipment catalog are required on the control panel.

4. The optional chlorinator may not be used. This approval only covers Cromaglass units for subsurface soil discharge.

5. Please review the requirements in Env-Ws 1024.03. All units must be sold with a maintenance contract per the submitted March 1997 Cromaglass Equipment Catalog.

6. Per Env-Ws 1024.06(c), a copy of this letter shall accompany any specific design involving the use of the Cromaglass unit under this approval which may be submitted to DES.

RECEIVED JUL 1 3 1998

State of New Jersey
THE PINELANDS COMMISSION
PO Box 7
New Lisbon NJ 08064
(609) 894-7300

JAMES E. MCGREEVEY
Governor

JOHN C. STOKES
Executive Director

FAX COVER SHEET

Date 1/29/2004 Pages (including cover) 4

To	Joshua Gliptis
Fax	570 326-6426
Phone	570 326-3396

From	Ed Wengrowski
Fax	(609) 894-7330
Phone	(609) 894-7300

☐ For Your Review ☐ Please Comment ☐ Reply ASAP ☐ URGENT!

Joshua -
Enclosed, please find the Memorandum in which our Executive Director, John Stokes has certified the Crownglass system & documentation. See you tomorrow.
Ed

h. Four page Design Specifications, for Cromaglass Model CA-5 Wastewater Treatment System (340 GPD denitrification unit), Model CA-12 Wastewater Treatment System (800 GPD denitrification unit), Model CA-15 Wastewater Treatment System (1000 GPD denitrification unit), & Model CA-25 Wastewater Treatment System (1600 GPD denitrification unit), dated 02/26/01, 02/26/01, 4/24/03 and 02/26/01 respectively.

2. One (1) three ring binder entitled: Cromaglass® Wastewater Treatment Systems, Operations & Maintenance Manual containing a Homeowners Manual, CromaWatch™ Autodialer installation details, descriptive system information and detailed operation and maintenance information.

3. One (1) spiral bound booklet entitled: Cromaglass® Wastewater Treatment Systems, Engineer's Packet containing a description of the CromaWatch™ automatic dialer alarm system.

I have reviewed the above materials and offer the following comments:

Pursuant to the provisions of the Comprehensive Management Plan (CMP) at N.J.A.C. 7:50-10.22(a)2, the manufacturer of each alternate design pilot program treatment system is required to submit specific documents to the Executive Director for review and approval prior to the technology being accepted for inclusion in the pilot program.

Based upon a detailed review of materials submitted by Cromaglass Corporation for the Cromaglass® wastewater treatment system, the writer respectfully recommends that you approve the Cromaglass® system for participation in the Pinelands Pilot Program for Alternate Design Wastewater Treatment Systems. The Cromaglass system is proposed for residential use where total daily design flows range between 340 GPD and 1600 GPD. The system is designed to discharge treated effluent by pump to downstream components, typically either an effluent dispersal field d-box or manifold.

The system Cromaglass® is a sequencing batch reactor that is designed as a continuously fed activated sludge process with clarifiers that are operated on a batch basis. The system provides turbulent aeration of incoming wastewater, and batch treatment of sludge in a separate aeration and quiescent settling chamber within a single vessel. Denitrification is achieved by incorporating an anoxic cycle following aeration. Air and mixing are provided by submersible pumps with venturi aspirators that receive air through a pipe intake from the atmosphere. Anoxic conditions are created by closing the air intakes of the aeration pumps with electric valves, stopping aeration but continuing wastewater mixing. Treated wastewater is pumped to a dispersal field at the end of the batch cycle. The treatment process employed in the current version of the Cromaglass® system is consistent with that employed in the systems evaluated by Anish Jantrania, Ph.D., P.E., M.B.A and described in the report entitled "Performance Expectations for Selected On-site Wastewater Treatment Systems," dated December 2000.

Consistent with the requirements of the pilot program, Cromaglass Corporation has provided a

Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P. O. Box 8774
Harrisburg, PA 17105-8774
August 4, 1997

Bureau of Water Quality Protection
717-787-8184
Fax: 717-772-5156

Mr. Frank Moltz, Vice President
Cromaglass Corporation
Box 3215
Williamsport, PA 17701

Dear Mr. Moltz:

Thank you for your recent correspondence regarding the Cromaglass CA-5 aerobic treatment tank unit. We appreciate your prompt response to our request for a NSF Standard 40 equivalency evaluation. As a result of our technical review, we find that the Cromaglass CA-5 unit is acceptable for use in the state of Pennsylvania under Chapter 73.32(b)(1)(ii), Title 25 of the PA Code.

Although the CA-5 unit does not specifically conform with certain sections of NSF's Standard 40 criteria, we find that in such an instances, Cromaglass either exceeds the NSF standard or that Cromaglass performs an adequate "substitute" test which provides the necessary performance data.

This equivalency determination is based on current NSF Standard 40 test procedures and will remain in effect until NSF revises its Standard 40 requirements.

Sincerely,

Gary Obleski
Division of Wastewater Management

SAFETY AND BUILDINGS DIVISION
Plumbing Product Review
P.O. Box 2658
Madison, Wisconsin 53701-2658

commerce.wi.gov
Wisconsin
Department of Commerce

Jim Doyle, Governor
Cory L. Nettles, Secretary

July 8, 2004

RECEIVED JUL 1 2 2004

CROMAGLASS CORPORATION
DENNY DYROFF
PO BOX 3215
WILLIAMSPORT PA 17701

Re: Description: SEWAGE TREATMENT SYSTEMS, AERATED
Manufacturer: CROMAGLASS CORPORATION
Product Name: WASTEWATER TREATMENT SYSTEM
Model Number(s): CA-100 (10000 GPD)
Product File No: 20020359

The specifications and/or plans for this plumbing product have been reviewed and determined to be in compliance with chapters Comm 82 through 84, Wisconsin Administrative Code, and Chapters 145 and 160, Wisconsin Statutes.

The Department hereby issues an approval based on the Wisconsin Statutes and the Wisconsin Administrative Code. This approval is valid until the end of July 2009.

This approval is contingent upon compliance with the following stipulation(s):

- This tank must be designed to withstand the pressures to which it will be subjected.
- The manufacturer must keep at the manufacturing plant a set of plans and specifications bearing the department's stamp of approval. The plans and specifications must be open to inspection by an authorized representative of the department.
- The maximum daily wastewater flow which may discharge through this product is 10,000 gallons per day.
- When this product receives wastewater from dwellings, it will produce an effluent quality with a maximum monthly average value for BOD5 of less than or equal to 30 mg/L, TSS of less then or equal to 30 mg/L TSS and F.O.G. of less than 30 mg/L.

This approval supercedes the approval issued on July 5, 2000, under product file number 20000581.

This approval letter shall be incorporated with your previously approved plans and/or specifications approved under product file number 20000581.

The department is in no way endorsing this product or any advertising, and is not responsible for any situation which may result from its use.

Sincerely,

Michael J. Beckwith

Michael J. Beckwith, CIPE
Plumbing Product Reviewer
phone: 608-266-6742
fax: 608-267-9566
e-mail: mbeckwith@commerce.state.wi.us

CROMAGLASS REFERENCES

Cromaglass sites with Netafim Sewaclear filters for reuse of treated wastewater

- Rivervine Subdivision- Boise, ID
  Reed Demordaunt
  President
  Castle Rock Development Corp.
  7011 Moon Valley
  Eagle, ID 83616
  208-608-0040

  2x CA-50D
  With Netafim 48" Sand Media Filter System
  Installed 2005

- US Embassy and Consulate- Baghdad, Iraq
  Ray Nilsen
  US Agency for International Development
  202-216-6276

  3xCA-150
  With Netafim 16" Sand Media Filter System
  Installed 2004

Cromaglass sites with reuse of treated wastewater

- Xel-Ha Ecological Park-Riviera Maya, Mexico
  Ricardo Soenz
  +52(984)875-6000
  Carretara Chetumal-Cancun
  Km. 240, Xel-Ha-Quintano Roo
  MEXICO

- Presque Isle State Park- Erie, PA
  Mr .Ken Smith
  Operator
  814-871-4251

  Various modules (17) in 13 locations
  Installed 1987

- Chesapeake Bay Bridge Tunnel- VA
  Robert Johnson
  Assistant Director of Maintenance
  Chesapeake Bay Bridge Tunnel
  875-331-2960

  2x CA-120, chlorination with discharge into Chesapeake Bay/Atlantic Ocean
  Installed 1989

- Brecknock Elementary School- Shillington, PA
  Lynn Anspach
  Buildings and Grounds
  Governor Mifflin School District
  610-775-1461

  CA-100 with Denitrification
  Installed in 1992

- S.C. Johnson Warehouse- Carlisle, PA
  First Industrial Realty Trust, Inc.

  CA-30 with Denitrification
  Installed in Jan 2002

- Hillcrest Retirement Community
  6000 Running Valley Road

3x CA-100 with Denitrification

- Greenview Court
  Bayshore, Suffolk County, Long Island, New York

  2x CA-120 with Denitrification

Engineer's
Packet

Cromaglass®

WASTEWATER TREATMENT SYSTEMS

CROMAGLASS CORPORATION
Williamsport, Pennsylvania

Cromaglass® CORPORATION

Wastewater Treatment Systems

Box 3215 • Williamsport, PA 17701
Phone (570) 326-3396 • FAX (570) 326-6426
Website: www.cromaglass.com • Email: mailinfo@cromaglass.com

WHY AERATION?

WHAT IS THE ADVANTAGE OF AN AEROBIC WASTEWATER TREATMENT SYSTEM OVER A SEPTIC TANK?

STREAMS AND GROUNDWATER BECOME POLLUTED WHEN THEY RECEIVE MORE ORGANIC MATERIAL THAN THEY CAN OXIDIZE. The effluent from septic tanks contain organic material in solution and in suspended solids. The effluent from an aerobic treatment unit is free from organic matter and contains dissolved oxygen, which may be a credit to the receiving stream or groundwater.

Any treatment unit that discharges its effluent to the surface of the ground or that discharges to a tile field or seepage pit that overflows, is tantamount to stream discharge since the effluent will flow over the ground surface or through storm sewers to a stream.

The biochemical processes that take place in the two methods of treatment are totally different. Both are affected by microorganisms that are present in the sewage itself, and that uses the organic material in the sewage as food to produce energy. Aerobic microorganisms are dependent upon oxygen to multiply and grow, will die in an atmosphere lacking oxygen. Anaerobic microorganisms, on the other hand, thrive in an atmosphere devoid of oxygen and die in its presence. There are also facultative microorganisms that live under either condition but these do not play a significant role in these processes.

In either process, aerobic or anaerobic (septic), the organic matter in human waste is degraded biochemically. THE ANAEROBIC DEGRADATION IS INCOMPLETE AND THE PROCESS GIVES OFF OFFENSIVE BY-PRODUCTS IN GASEOUS STATE. AEROBIC DEGRADATION, ON THE OTHER HAND, IS UNDER PROPERLY CONTROLLED CONDITIONS COMPLETE AND THERE ARE NO OFFENSIVE BY-PRODUCTS TO CONTEND WITH. The end products are oxidized to a point where the effluent from an aerobic treatment system may contain a higher proportion of oxygen than that of the water, stream, or underground, into which it may discharge.

Human waste contains organic material, several chemicals in combined form. These include carbon, hydrogen, nitrogen, sulfur, and phosphorus. In anaerobic degradation these combine to form other organic compounds and produce objectionable gases that escape. The carbon becomes organic acid that forms carbon dioxide and methane. Methane that escapes is commonly known as marsh gas. The nitrogen becomes an amino objectionable gases that escape. The carbon becomes organic acid that forms carbon dioxide and methane. Methane that escapes is commonly known as marsh gas. The nitrogen becomes an amino acid that produces ammonia gas and amines. The sulfur becomes organic sulfur compounds and the highly objectionable foul smelling hydrogen sulfide gas that escapes. The phosphorus becomes organic compounds and phosgene gas that escapes. Thus it may be seen that anaerobic degradation is an incomplete process. It not only contributes the undesirable marsh gas, hydrogen sulfide, and phosgene, but also creates objectionable organic compounds that are found in the effluent. These are a burden to any receiving water that will spontaneously undertake oxidation of the organic material in the effluent and thereby reduce its own oxygen supply.

DISCHARGES OF UNTREATED OR INADEQUATELY TREATED SEWAGE RESULT IN POLLUTED STREAMS.

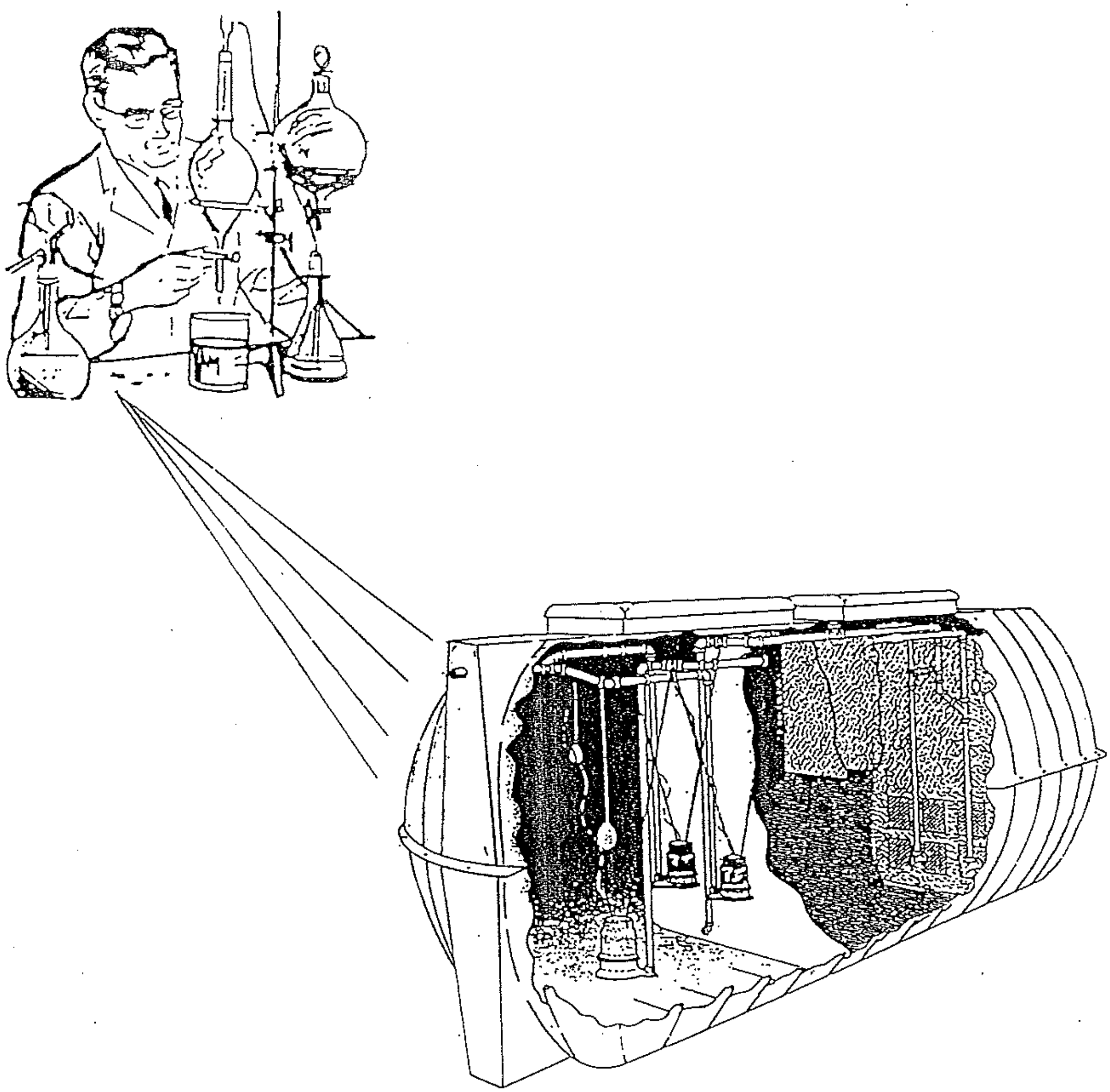
Aerobic degradation is a complete process; all the organic material in the sewage is reduced. The carbon becomes dioxide that becomes in turn, various carbonates and bicarbonates, combining with minerals present in the water. The hydrogen becomes water. The nitrogen becomes, in turn, ammonia, nitrous acid and nitric acid that becomes mineralized, becoming nitrates and nitrites. The sulfur becomes sulfuric acid that is usually mineralized, becoming a sulfate or sulfite. The phosphorus becomes phosphoric acid that becomes mineralized, to a phosphate.

The various inorganics thus formed, carbonates, bicarbonates, nitrates, nitrites, sulfates, sulfites, and phosphates go into solution in the effluent along with dissolved oxygen, all of which are sources of oxygen for the receiving stream or underground water. All of the organic material in the sewage has been degraded so no organic material is discharged, the effluent of an effective aerobic treatment unit will not contribute to the pollution of receiving water but may well contribute oxygen, free or in a compound, to be utilized by the receiving waters.

WHAT IS THE ADVANTAGE OF AN AEROBIC WASTEWATER TREATMENT SYSTEM? IT IS IN THE QUALITY OF THE EFFLUENT.

by the late A. A. Autilio, P. E.
Autilio-Doran Associates
Newtown Square, PA

PERFORMANCE EVALUATION OF A BATCH TYPE COMMUNITY WASTEWATER TREATMENT SYSTEM



BY

David A. Long, Ph.D., P.E.

The Pennsylvania State University

University Park, PA 16802

(SUMMARY REPORT)

AN UPDATED PERFORMANCE EVALUATION OF A BATCH TYPE AEROBIC COMMUNITY WASTEWATER TREATMENT SYSTEM

by

David A. Long, P.E., and
John J. Yamona

February 1985

The Pennsylvania State University
Civil Engineering Department
in cooperation with
Small Industries Research

and

Institute for Research of Land and Water Resources
University Park, PA 16802

I. Introduction

A. Statement of the Problem

Over the last few decades, statistics indicate that approximately 70 percent of the population of the United States is served by sewers and of those served, approximately 92 percent are served also by wastewater treatment facilities. The 30 percent of the population not served by sewers depend on some 15 to 17 million septic tanks and cesspools; and 5 to 10 million households use more primitive techniques such as privies or direct discharge to water courses.

In many states where rural development is taking place, particularly that for second homes, officials are faced with a serious problem in regulating disposal of wastewaters generated from these homes and related commercial and community development.

Although evidence is being accumulated which indicates that a large number of on-site wastewater disposal systems have failed, the U.S. Environmental Protection Agency (EPA), state, and local officials are advocating the use of alternative disposal techniques to offset the rising cost of large collection systems and centralized treatment. The failure of systems employing current on-site technology and the demand for alternative disposal systems has made the development of new technology imperative. Development of small, effective, and economical treatment alternatives would make significant contributions to protecting rural water resources as well as aiding needed development.

B. Objective of the Evaluation Project

The specific objective of the evaluation project reported herein was to demonstrate and critically evaluate the overall operating performance and efficiency of batch type wastewater treatment units which are intended for use with community on-site wastewater disposal systems. The unit, which was evaluated, is manufactured by Cromaglass Corporation, Williamsport, Pennsylvania.

Although the basic aerobic treatment of wastewater has been well documented, most of the small systems studied have been continuous-flow units. Batch type operation

No data were collected on ammonia or nitrate nitrogen levels during this study due to the limited manpower available. However, it was noted that the sludge often would rise in the cylinder used for the 30-minute settling test shortly after the settling test was completed. Such occurrences often are attributed to denitrification of the settled sludge. This denitrification only will occur after significant nitrification has taken place during the aeration cycle.

The mixed liquor solids (MLSS) varied widely during the evaluation period from a minimum of 296mg/L to a maximum of 3,990mg/L. The average MLSS for this portion of the study was 1,854mg/L. Some of the variability in the MLSS concentration data likely was due to the difficulties experienced in getting true representative samples from the aeration tank due to the variable volume of mixed liquor in the aeration tank and the presence of foam on the surface of the tank. Calculation of food to microorganism (F/M) ratio was not attempted due to the variable volumes encountered because of the batch mode of operation. No sludge was wasted from the unit during this portion of the study even though the volume of sludge after 30 minutes of settling was quite high on occasion. The batch mode of operation apparently can handle such volumes of sludge as indicated by the consistently low TSS in the effluent.

B. School Flow Pattern Test Phase

The flow pattern to the unit was changed to the simulated school flow (8-hour steady flow) on August 27, 1985. No adjustment was made in the MLSS level prior to starting the school flow pattern portion of the study.

The performance evaluation of the Cromaglass CA-25 batch type treatment unit operating on the school flow pattern was begun on September 13, 1984. The unit ran continuously until the conclusion of the study on December 12, 1984, a period of 90 days. A total of 22 samples were collected over this period to represent process performance. As pointed out earlier, the total daily flow to the unit during this phase of the study was 1,200gpd. Results from the earlier study (2) showed that it was necessary to reduce the loading on the unit for an 8-hour steady flow pattern. Based on an analysis of equalized flow loading as indicated earlier, it was decided to load the unit at 60 percent of the daily loading used during the subdivision flow pattern portion of the study.

Table 3

Data Summary
CA-25 Batch Type Treatment Unit

Flow Pattern: Subdivision   Flow: 2,000 gpd

Parameter		Date - 1985 6/20	6/21	6/22	6/27	6/28	6/29	7/12	7/13	7/18	7/25	7/26
Aeration Tank D.O., mg/L		5.45	4.2	5.3	6.2	6.2	6.5	5.2	2.0	4.3	5.5	7.0
Biochemical Oxygen Demand, mg/L	Influent	270	220	241	482	372	390	235	195	238	250	275
	Effluent	16	11	5	6	8	11	18	17	15	8	7
Suspended Solids, mg/L	Influent	353	176	193	982	332	252	130	167	141	163	124
	Effluent	6.6	5.2	4.9	16	12	11	12	11	7.2	11	4.8
	MLSS	1580	1518	1746	453	356	296	1433	1447	1414	1780	1363
Settled Sludge Volume - 30 min, mL		250	200	280	55	45	35	190	185	170	210	190
SVI		158	132	160	121	126	118	132	128	120	118	139

Comments:

6/27/85 - influent was very "gritty" and MLSS had decreased significantly.
6/28/85 - mixed liquor supernatant was turbid.
6/29/85 - 6 day BOD due to July 4 Holiday.
7/5/85 - a power failure had occurred at the PSU plant which shut down the CA-25 unit.
7/12/85 - solids floated in settling test after 45 min.
7/13/85 - solids floated in settling test after 50 min.

The process performance summary results from this portion of the study also are presented in Table 2. These results show that the unit effluent BOD_5 and TSS average 9.7mg/L and 12.6mg/L respectively. Percentage removals for BOD_5 and TSS, based on the average results, were 95.7 and 92.8 percent respectively. These results show that the batch type treatment unit performed very well under the high intensity-loading pattern. Some problems were encountered with partial clogging of the screen used to protect the raw waste loading pump in the grit chamber (See Figure 2) during this portion of the study. It is believed that this partial clogging accounted for the lower influent suspended solids observed. A summary of all data collected during this portion of the study is presented in Table 4.

As was the case during the subdivision flow pattern phase of the study, the MLSS varied widely from a minimum of 1,394mg/L to a maximum of 3,737mg/L. The average MLSS for this portion of the study was 2,282mg/L. These results reflect a gradual buildup of MLSS during the more than 6 months the unit had been in operation without any wasting of sludge. The volume of sludge as reflected by the 30 minutes settling test data was quite high throughout this portion of the study, which probably accounts for the slightly higher effluent TSS observed.

Summary and Conclusions

A Cromaglass CA-25 batch type treatment unit, modified on the basis of recommendations made as a result of an earlier study (2), was tested under two different simulated flow patterns at The Pennsylvania State University. Effluent quality from the unit under both loading patterns was excellent and well below the EPA secondary treatment requirements of 30mg/L BOD_5 and 30mg/L suspended solids.

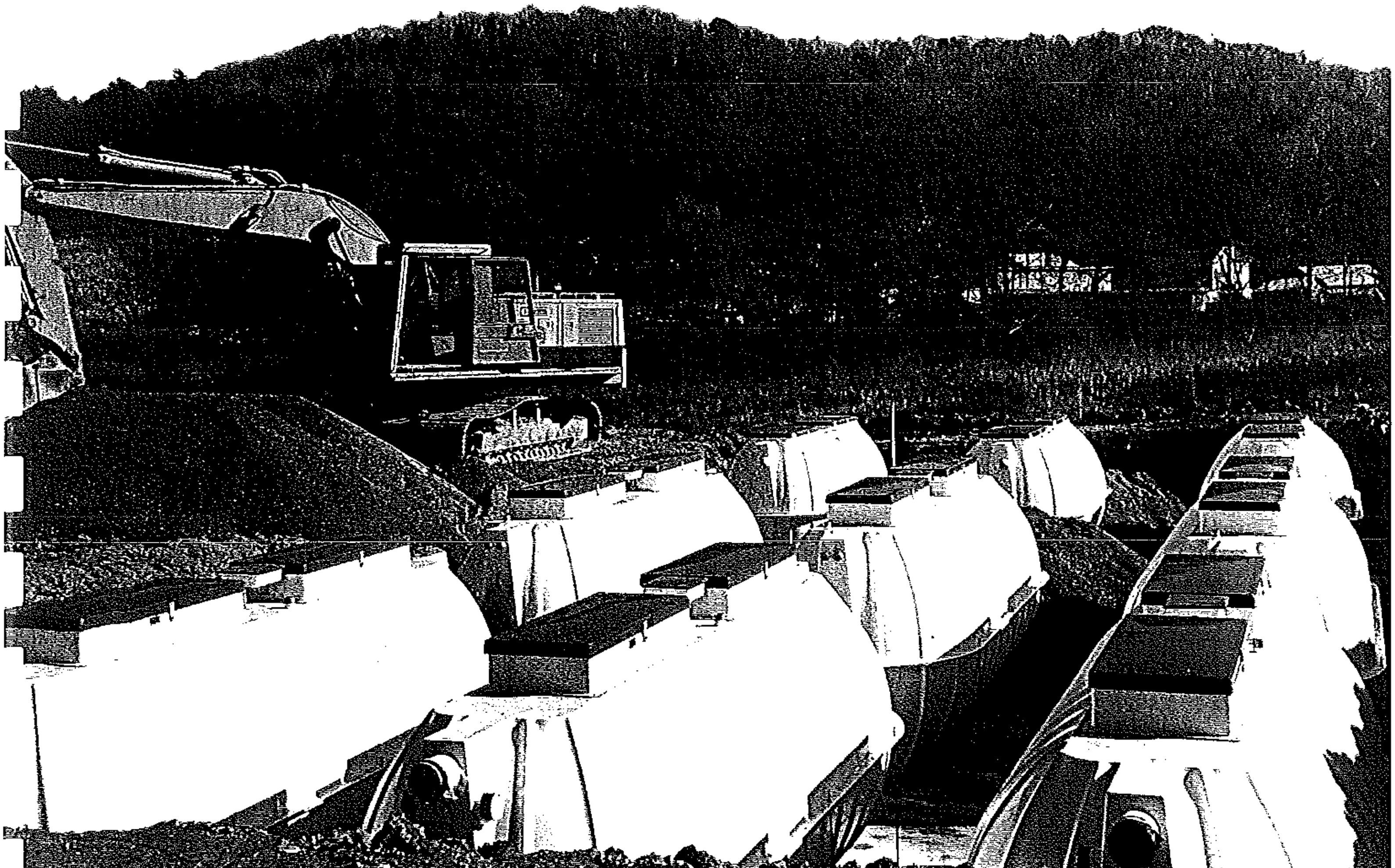
Under the subdivision flow pattern (24 hours per day) loading, the effluent BOD_5 and TSS concentrations averaged only 10mg/L each. This effluent quality represented removals of 96.2 and 96.1 percent for BOD_5 and TSS respectively.

The effluent quality under the school flow (8-hour steady flow) pattern was nearly as good. Under this loading pattern, the effluent BOD_5 and TSS concentrations were 9.7mg/L and 12.6mg/L respectively. These results represented 95.7 and 92.8 percent removal of BOD_5 and TSS respectively.

Cromaglass®

WASTEWATER TREATMENT SYSTEMS

A Leader In Wastewater Technology Since 1965.



Patent No. 5,268,094

Cromaglass Wastewater Treatment Systems

DESIGNED as a continuously fed activated sludge process with clarifiers that are operated on a batch basis.

All ***Cromaglass*** treatment systems operate on identical principles: Turbulent aeration of incoming wastes and batch treatment of bio-mass in separate aeration and quiescent settling chamber.

DISCHARGED effluent is an odorless liquid, almost clear in color, with a reduction in BOD and Suspended Solids over 90%. Even higher efficiencies can be achieved if required.

DENITRIFICATION is now mandated in many areas and ***Cromaglass Systems*** are capable of Denitrification with the addition of an anoxic cycle following aeration.

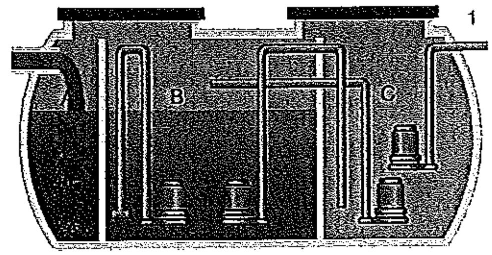
Per-batch cycling is 120-240 minutes. Optimum quality standards are maintained even at peak intake levels because of batch-transfer and batch-reserve functions.

Proven effluent quality is attested to by independent laboratory research and testing. National standards such as established by the National Sanitation Foundation and Federal EPA have been surpassed. Effluent quality is accepted for RECYCLE use with irrigation and toilet flushing.

TYPICAL CYCLE

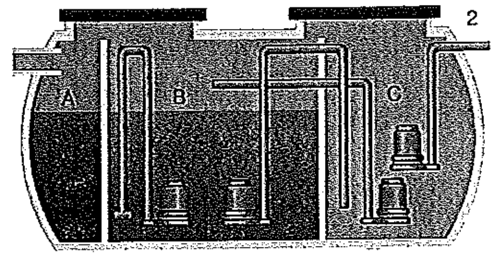
FILL; AERATION

Flow enters the Solids Retention Section (A) which is separated by non-corrosive screen. Inorganic solids are retained behind the screen. Organic solids are broken by turbulence created with mixed liquor being forced through screen by submersible aeration pumps. This eliminates the need for mechanical comminution.



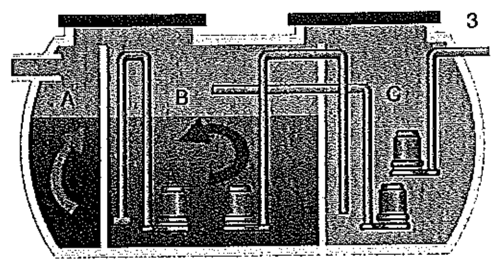
AERATION

Liquid and small organic solids pass through the screen into the continuing Aeration Section (B). Air and mixing are provided by submersible pumps with venturi aspirators that receive air through pipe intake from the atmosphere.



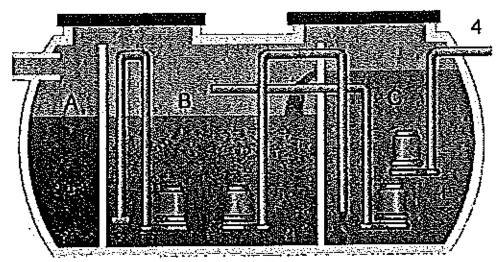
DENITRIFICATION (OPTIONAL)

Provided by an anoxic period during the regular treatment cycle. ***Cromaglass*** units create anoxic conditions by closing the air intakes of the aeration pumps with electric valves. This stops aeration, but the system continues mixing.



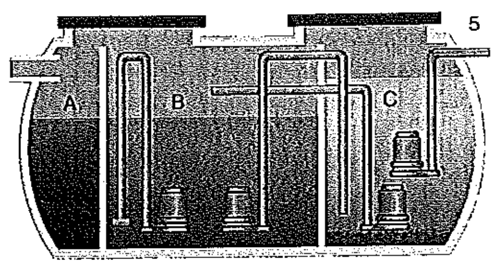
TRANSFER/SETTLE

Treated mixed liquor is transferred by pumping to the Clarification Section (C). The transfer period overfills the Clarifier with the excess spilling through overflow weirs back into the main Aeration Section. Transfer ceases and Clarifier (C) is isolated – solids separation occurs under quiescent conditions.



DISCHARGE

After settling, effluent is pumped out of the Clarifier (C) for discharge. Return sludge is from the bottom of the Clarifier (C) back into the main Aeration Section (B) using a submersible pump, or sludge can be wasted to a Sludge Processing Tank.

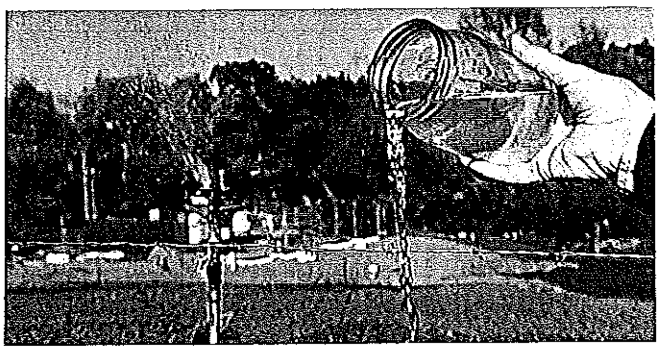


Cromaglass® BENEFITS

- Thoroughly Tested
- Modular Construction
- Easily Expanded
- Lightweight
- No Offensive Noise or Odors
- Easily Installed
- Positive Discharge
- "Flow Thru" Eliminated
- Accepts Overload
- Automatic Controls
- Monitoring 24 Hours
- Noncorrosive

PROVEN QUALITY

Assurance of treatment quality has been accomplished through independent laboratory research and testing supported by sampling from installed systems (results available upon request). National Standards as established by Federal EPA and the National Sanitation Foundation have been surpassed. Effluent quality with over 90-95% reduction of BOD and Suspended Solids enables ***Cromaglass*** to be designed where other methods are not acceptable. Recycled effluent is currently being used for landscape irrigation and as a toilet flushing medium.



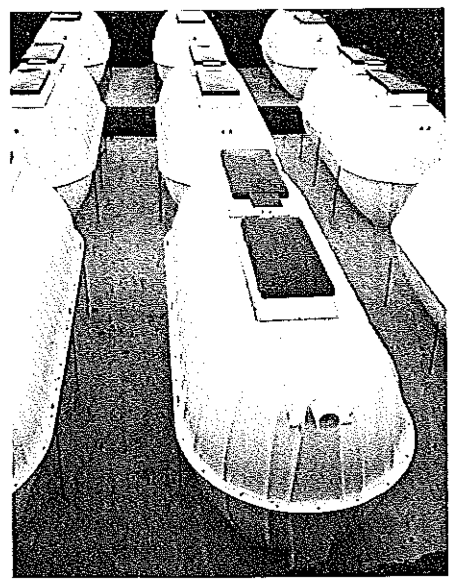
Effluent Sample from Model CA-120 Showing Surface Discharge by Irrigation System.

COST-EFFECTIVE SMALL COMMUNITY SYSTEMS

Treatment of wastewater in small communities and schools located beyond a municipal system presents a challenge to consulting engineers. ***Cromaglass Systems*** offer a cost-effective alternative solution. Many of these professionals have turned to the ***Cromaglass Batch Treat Process***, an alternative and innovative technology assessed favorably by Federal EPA to be used where conventional sewerage systems are unavailable or not cost effective. This modular concept design has proven less costly and more environmentally sound than other sewerage installations. Several schools as well as small community projects have specified ***Cromaglass***.

REDUCED DRAIN FIELD SIZE AND SURFACE DISCHARGE CAPABILITIES

Because of the clear, odorless quality and high treatment standards of ***Cromaglass Systems***, drain field size can be reduced substantially from that required for conventional systems. With optional disinfection added, these systems are permitted for surface discharge under conditions normally unsuitable for subsurface disposal.



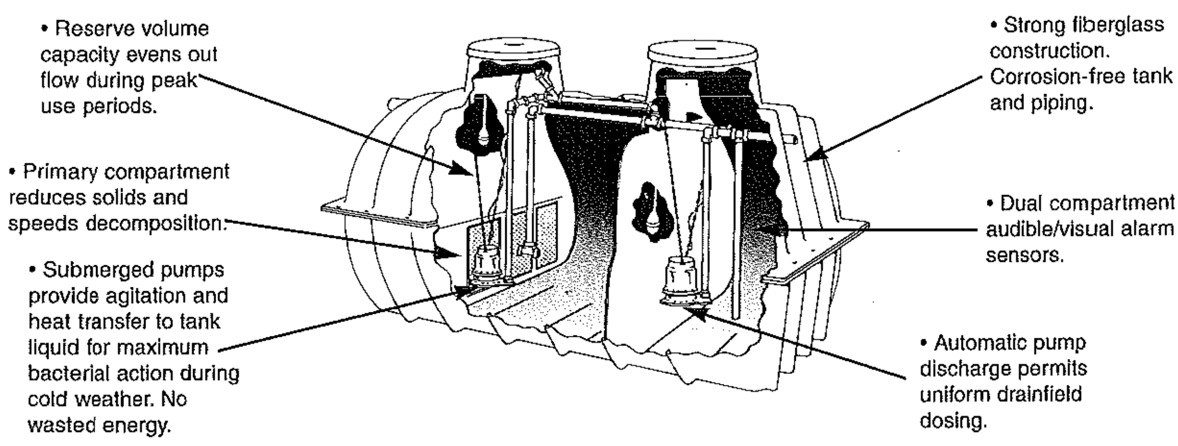
All tanks in place ready for backfill. Note concrete pads and stainless steel tie-down rods.

ADEQUATE OVERLOAD RESERVE

Batch Processing is capable of high treatment even under a wide range of flows as found in growing communities. Also with varying organic loadings of commercial, school and institutional use, excellent effluent standards are maintained. This feature is an integral part of the system to cover temporary emergencies or upsets.

DESIGN FEATURES

Models CA5 • CA12 • CA15



SPECIFICATIONS

POWER:
115v/230v – Single Phase.
230v/460v – 3 Phase available.

CONTROL PANEL:
Nema 1 enclosure standard.
Nema 3R, 4, 7 and 12 available.

ALARM:
Red light mounted on panel with optional audible alarm.
Remote monitor to phone preset numbers in case of alarm.

CONSTRUCTION MATERIALS:
Tank – Fiberglass.
Comminution Chamber – Fiberglass and noncorrosive screen.
Piping and Fittings – Schedule 40 PVC.
Metal Fittings – Stainless steel.

PUMPS	TOTAL HEAD – FEET (METERS)					AMPERAGE	
MODEL	5 (1.52)	10 (3.05)	15 (4.57)	20 (6.10)	25 (7.62)	MAX. RUN AMPS.	LOCKED ROTOR AMPS.
	CAPACITY – G.P.M. (L/MIN.)						
1/4 H.P. DISCHARGE	30 (114)	26 (98)	20 (76)	12 (45)		10	15.6
1/3 H.P. WE0311M	85 (322)	70 (265)	52 (197)	35 (132)	14 (53)	9.4	32.2
1/2 H.P. WSO511B	150 (567)	120 (454)	90 (340)	52 (196)	8 (30)	14.6	34.9
1 H.P. WS1012B	—	180 (681)	157 (595)	127 (481)	95 (360)	12.3	—

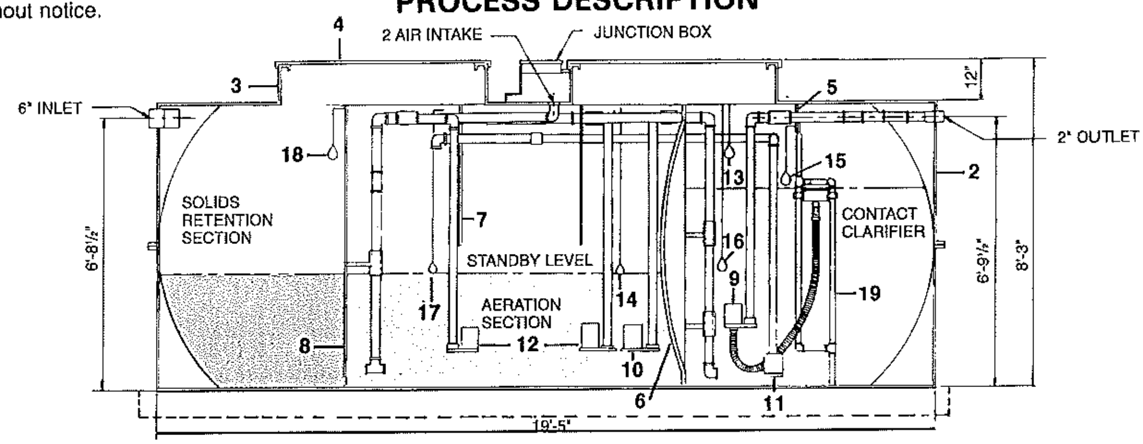
ADDITIONAL SYSTEM SPECIFICATIONS

MODEL	LENGTH	WIDTH	HEIGHT	SHIPPING WEIGHT LBS. (KG.)	24 HR. MAX. CAPACITY GALS. (M^3)	STNDRD DISCHG. VOL. GALS. (M^3)	STNDRD DISCHG. PER DAY	DENITE DISCHARGE VOL. GALS. (M^3)	DENITE DISCHARGE PER DAY	ELECTRICAL CONSUMPTION KWH/24 HRS.	TANK VOLUME GALS. (M^3)	TOTAL AMPS REQUIRED 120v/230v
CA-5	7'11" (2.4m)	5'7" (1.7m)	5'7" (1.7m)	704 (319)	500 (1.9)	85 (.32)	6	340 (1.3)	4	8.0	923 (3.5)	15a - 120v
CA-12	11'3" (3.4m)	5'7" (1.7m)	5'7" (1.7m)	1020 (463)	1200 (4.5)	200 (.76)	6	800 (3.0)	4	8.0	1358 (5.1)	15a - 120v
CA-15	11'3" (3.4m)	5'7" (1.7m)	5'7" (1.7m)	1020 (463)	1500 (5.7)	250 (.95)	6	1000 (3.8)	4	10.0	1358 (5.1)	20a - 120v
CA-25	14'10" (4.5m)	6'10" (2.1m)	6'10" (2.1m)	1720 (780)	2500 (9.5)	420 (1.6)	6	1680 (6.4)	4	21.0	2910 (11.0)	40a - 120v
CA-30	14'10" (4.5m)	6'10" (2.1m)	6'10" (2.1m)	2070 (939)	3000 (11.4)	375 (1.42)	8	2250 (8.5)	6	55/66*	2910 (11.0)	60a - 230v
CA-50	19'5" (5.9m)	7'4" (2.2m)	8'3" (2.5m)	2684 (1217)	5000 (18.9)	625 (2.37)	8	3750 (14.2)	6	55/65*	4590 (17.4)	60a - 230v
CA-60	19'5" (5.9m)	7'4" (2.2m)	8'3" (2.5m)	2684 (1217)	6000 (22.7)	600 (2.27)	10	3600 (13.6)	6	55/65*	4590 (17.4)	60a - 230v
CA-100	42'10" (13.1m)	7'4" (2.2m)	8'3" (2.5m)	4885 (2216)	10,000 (37.9)	1000 (3.79)	10	6000 (22.7)	6	60/78*	9186 (34.8)	100a - 230v
CA-120	42'10" (13.1m)	7'4" (2.2m)	8'3" (2.5m)	4885 (2216)	12,000 (45.4)	1000 (3.79)	12	6000 (22.7)	6	60/78*	9186 (34.8)	100a - 230v
CA-150	42'10" (13.1m)	7'4" (2.2m)	8'3" (2.5m)	4950 (2245)	15,000 (56.8)	1250 (4.73)	12	7500 (28.4)	6	82/100*	9186 (34.8)	100a - 230v

* Dependent on biological and hydraulic loading, electrical consumption may vary.

[1] System Specifications are subject to change without notice.

PROCESS DESCRIPTION



VIEW: A-A

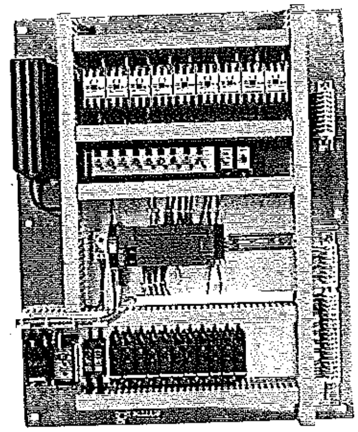
1	Aerobic Wastewater Treatment Plant Model CA-50	11	Sludge Return Pump
2	Tank Model CA-50	12	Aeration Pump P1 & P2
3	Manhole	13	Float - Sludge Return F1
4	Cover	14	Float - Discharge F1
5	Baffle	15	Float - Discharge Alarm
6	Concave Baffle	16	Float - Discharge Shut Off
7	Support Baffle	17	Float - Dual Aeration
8	Screen Baffle	18	Float - High Water Alarm
9	Discharge Pumps - Duplex	19	Floating Discharge Assembly
10	Transfer Pump		

CROMAGLASS Corporation
P. O. Box 3215, 2902 North Reach Road
Williamsport, PA 17701
Phone: (570) 326-3396 • Fax: (570) 326-6426
Email: mailinfo@cromaglass.com • www.cromaglass.com

Represented By:

NOISE AND ODORS CONTROLLED

Attractive tank modules with locked maintenance hatchways enable ***Cromaglass Systems*** to be installed without odors or noise associated with other types of open sewage treatment plants, when operated properly. Tanks can be installed below ground close to buildings being served – saving unneeded pipe and/or pump expense.



BY-PASS NOT POSSIBLE

Cromaglass Systems are designed to make by-pass and intertank contamination impossible. When operated properly, no bio-mass can transfer from one section to another except through the programmed pumping system. All sludge collected in the settling chamber is automatically returned to the aeration section for further aeration and breakdown. This results in low sludge accumulation. Most residual sludge that collects is made up of biological ash and insoluble particles. Sludge can also be wasted to a Sludge Processing Tank.

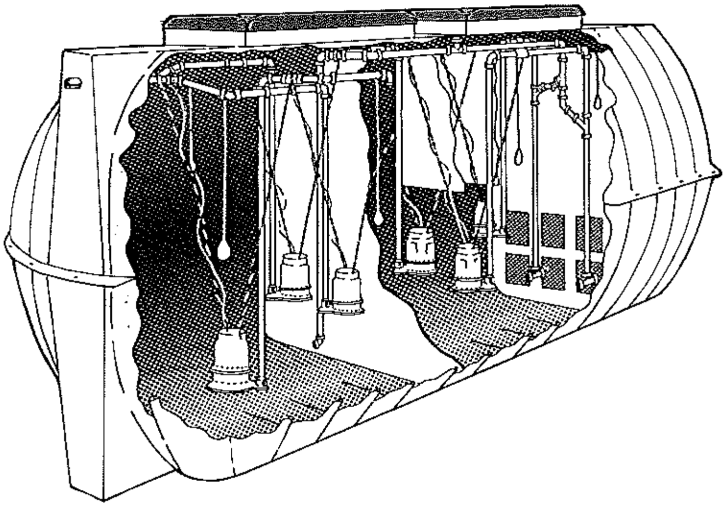
MAXIMUM OPERATIONAL FLEXIBILITY PROVIDED BY PLC CONTROLS

State-of-the-Art PLC controls will respond to the inputs from level sensors and probes in the tanks. The PLC automatically adjusts treatment parameters in response to changes sensed in the influent. It can store a permanent record of all operational functions, which provides information on each function of each cycle for whatever time reference desired. Such information can indicate if service or maintenence is needed, and the operator can then schedule it before a failure occurs.

STRONG, LIGHTWEIGHT, and REUSABLE

Corrosion-proof vessel construction of strong, lightweight fiberglass. Covers and locking hatches are also of fiber-glass. Tanks are constructed to withstand pressure involved when installed at acceptable depths below ground. Being light in weight means expensive cranes are not required, saving installation costs. Because ***Cromaglass Systems*** are completely integrated, compact and transportable, they can be reused, relocated and/or resold when changing circumstances warrant.

Lightweight fiberglass modules being off loaded and set in place in the excavation/concrete pad. This is typically done by backhoe used to excavate the site.



Cromaglass Wastewater Treatment Systems are essentially Sequencing Batch Reactors (SBR) as opposed to conventional continuous flow activated sludge systems. Treatment is by timed sequences within a single vessel. Continuous flow systems require several vessels, using a larger land area and higher installation costs.

Because time functions can easily be changed, an SBR provides custom treatment dependent on varying hydraulic and biological loading up to the designed capacity of the system.

Cromaglass Systems can be installed in modules, meaning a lower initial investment. The system can start with one independent module designed to treat the initial loading.

As development grows, additional modules can be added as needed.

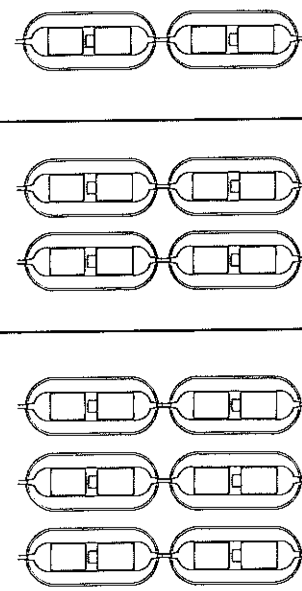
Modules can be added at the initial site, or if more economical, a new treatment site can be used.

Because a batch system requires less land area, it can be placed in multiple locations – saving additional piping/pumping cost.

PHASE 1

PHASE 2

PHASE 3



CROMAWATCH

Cromaglass has introduced one of the industry's first central station monitoring wastewater treatment systems.

With the use of a unique combination of telecommunication computers, word processors, and dedicated people, the Plant Operator, ***Cromaglass***, and the Servicing Distributor are all notified if a treatment unit should malfunction.

The microprocessor is built into the ***Cromaglass System***. This 24-hour monitor will relay over an "800" telephone line to the control center computer the reason for an alarm. An on-duty operator will then call to report a ***CromaWatch*** activity. This will assure prompt response to a malfunction.

THE Cromaglass® DIGEST

Vol. 18 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL AUGUST 2004

CROMAGLASS SYSTEMS PROVIDE CLEAN WATER TO IRAQ

Cromaglass* Systems** are providing essential wastewater treatment to Iraq. As one step towards the goal of reconstruction, the systems will improve the Iraqi infrastructure destroyed through years of neglect and war. Three ***Cromaglass systems were shipped in late May of 2004. After a one-month journey, they arrived in Baghdad where they accommodate 350 Embassy workers at the US Embassy and Consulate located at the site of a former palace of Saddam Hussein.

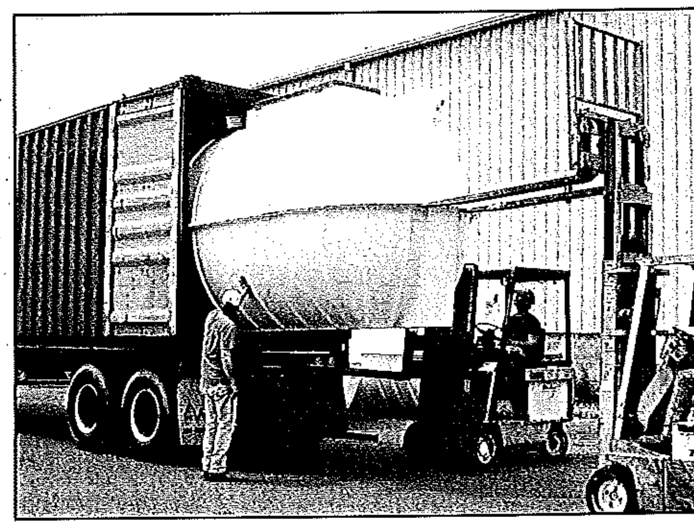
Cromaglass obtained the contract through the U.S. Agency for International Development (USAID), an independent federal government agency providing economic development and humanitarian aid worldwide and is now spending billions on the reconstruction of Iraq.

Denny Dyroff, ***Cromaglass's*** vice president and environmental programs director will travel to Iraq to oversee the unit's start-up and operation training. He will spend approximately one week in Baghdad in addition to a three-day roundtrip flight. During his stay in Baghdad he must remain in the heavily protected Green Zone where an armed escort closely guards him.

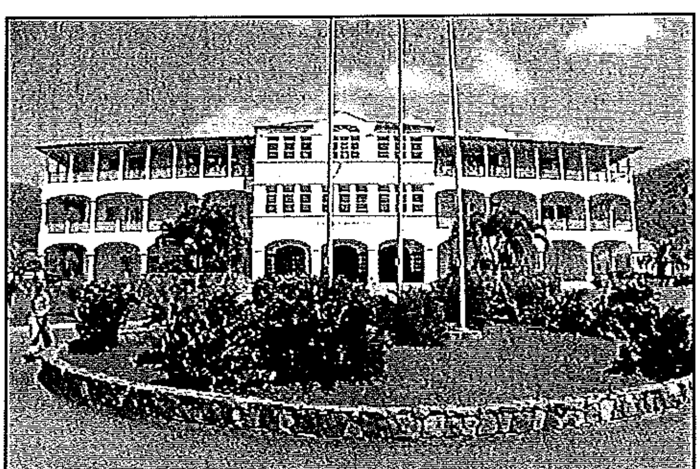
Three module CA-150 systems will treat 45,000 gallons per day of wasterwater and create a byproduct that is used for irrigation.

Due to Iraq's extremely hot climate and different electrical system, there was a need for modifications such as instructing the contractors in Iraq to build a special air-conditioned structure so that the high desert heat does not damage the system's computer control panel. Also, a problem arose due to differences in foreign electrical systems. Iraq's electrical system is 380/220 volts as compared to the US's 240/120 volts; as a result, ***Cromaglass*** engineers redesigned the treatment system's electrical components.

As reconstruction in Iraq continues, ***Cromaglass*** hopes to be used to provide even more clean water systems in that area.



Workmen load tank in container for shipment.



PROTECTION DURING EXPANSION

Cromaglass systems have provided a college the opportunity to protect the environment during expansion. The H. Lavity Stoutt Community College, located in the Paraquita Bay Valley in Tortola, BVI, was established in 1990 with 400 students and faculty. By 2001, its numbers doubled which demanded the use of a better wastewater treatment system.

Wastewater originally was channeled to a septic system that flowed to an adjacent drainage field constructed for that purpose. In 1999, expansion

(continued on page 2)

PROTECTION DURING EXPANSION

(continued from page 1)

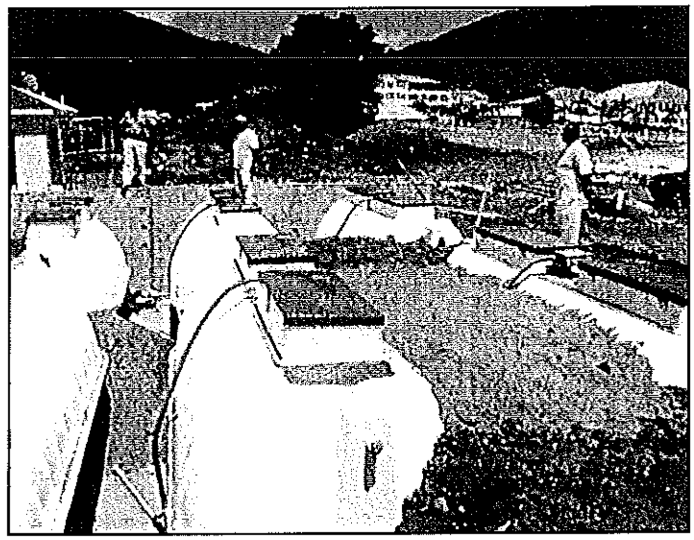
necessitated the addition of another septic tank; but as the college continued to grow, the originally constructed drainage field failed.

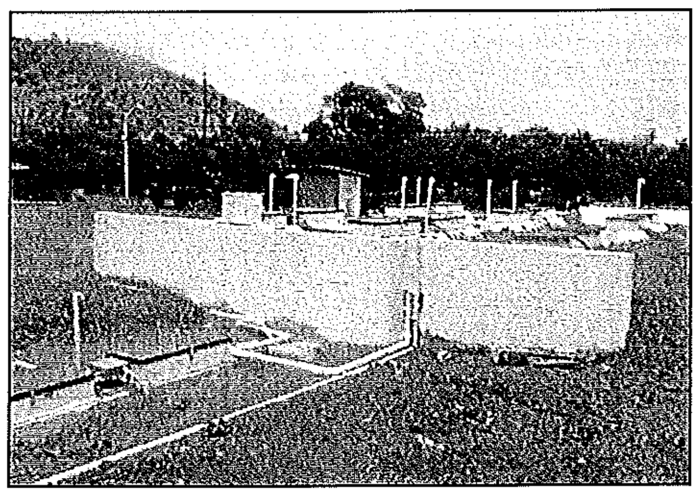
The college administration decided to install ***Cromaglass*** Secondary Treatment Facilities. They employed ***Caribbean Basin Enterprises (BVI) Limited*** to design and construct a Gravity Collection System and an expandable Tertiary Treatment and Recycle Wastewater Facility. This system handles not only wastewater from the college but from nearby buildings, both present and future, as well.

Preserving the treasured lagoon continued to be the goal when they decided to protect it even more by adding an emergency pumping dicharge to the existing septic tank system to prevent any accidental overflow to the Paraquita Bay Valley.

To counteract high groundwater conditions from the nearby bay and lagoon, installation was designed such that the ***Cromaglass*** modular tanks were tied down to concrete pads at ground level and a wall being constructed within which was placed sand and gravel for stability and appearance.

An 840-foot gravity collection system, with nine manholes, transports wastewater from the buildings to the treatment process. The first phase is the ***Cromaglass*** Aerated Pre-Equalization Unit, which retains some of the solids and begins the aeration phase. An emergency pumping discharge is connected to this unit to transport any overflow to the existing septic tank system. Next, the wastewater flows to the 18,000 gallons-per-day treatment modules where the wastewater will be treated in the sequencing batch reactor phases of filling, reaction, settling, and discharge. The next step is the Aerated Sludge Processing Tank that provides supplementary sludge management for a more efficient operating system. For further treatment, the wastewater continues into the Aerated Post-Equalization Unit then flows to the Chlorine Contact Tank where the effluent will be disinfected by means of chlorination.





WISCONSIN RENEWS APPROVAL

The State of Wisconsin recently renewed approval of ***Cromaglass Wastewater Systems***. Approval is based upon Wisconsin Statutes and the Wisconsin Administrative Code. The State of Wisconsin requires the following stipulations: ***Cromaglass Systems*** must handle the maximum amount of wastewater flow according to their size specifications and must possess a set of plans and specifications bearing Wisconsin's approval and readily present them for inspection, Also, the systems shall produce an effluent quality with a maximum monthly average value for Biochemical Oxygen Demand (BOD) 5 or less or equal to 30 mg/L, Total Suspended Solids (TSS) of less than or equal to 30 mg/L and Fats, Oils, and Grease (F.O.G.) of less than 30 mg/L.

NSFC Celebrates 25th Year

NATIONAL SMALL FLOWS CLEARINGHOUSE

1979–2004

25TH ANNIVERSARY

Cromaglass was one of several wastewater companies that helped to establish the National Small Flows Clearing-house (NSFC) at West Virginia University in 1979. It is now celebrating its 25th year anniversary with the same amount of devotion to protecting the public health and environment of small communities by providing wastewater information and assistance.

The NSFC was established in legislation through the Clean Water Act of 1977 with the help of West Virginia Senator Jennings Randolph and WVU professors Willem Van Eck and Raul Zaltzman. They started working in a basement in Morgantown, West Virginia where they reviewed technical articles published in journals and magazines. The articles were added to a bibliographic database of literature regarding small wastewater systems.

In the 1990s, growth and expansion started to occur in the wastewater industry which required the NSFC to shift direction and enter new areas. The audience for their information was changed to the general public and local officials. In addition, two new programs joined the NSFC, the National Environmental Training Center for Small Communities (NETCSC) and the National Drinking Water Clearinghouse (NDWC). Plus, as the country became increasingly technologically knowlegeable, the NSFC started its own website (www.nsfc.wvu.edu).

In the future, the NSFC plans to continue its good customer relations and become better acquainted with increasing regulations and financial stress that many small communities encounter.

Although the direction of the clearinghouse has changed in 25 years, their goal of working in the community to protect public health and the environment still remains.

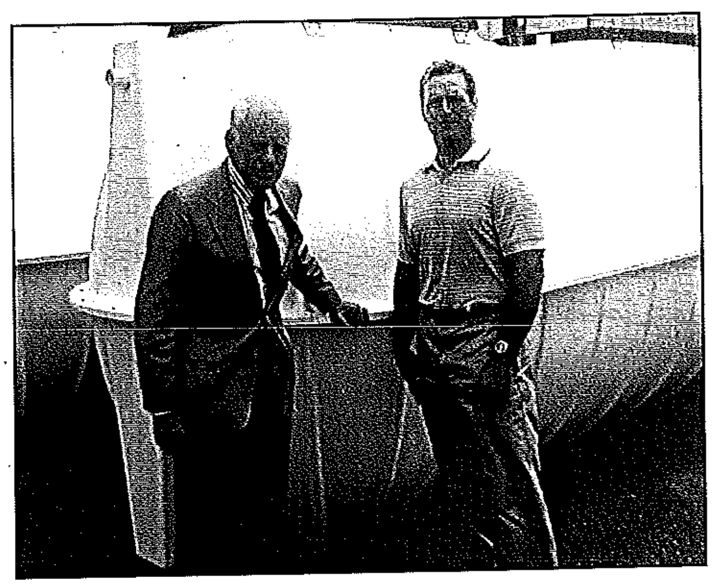
FOR THE HEALTH OF THE WORLD

The majority of people living in developing countries lack clean water and basic sanitation which cause illnesses that directly link to the low productivity of these nations.

The May 15, 2004 edition of *The Economist* spotlights a study titled "The Water Challenge" by Frank Rijsberman, director-general of the International Water Management Institute in Colombo, Sri Lanka. This study states that at any given time close to half the population in the developing world suffers from one or more diseases associated with inadequate provision of water and sanitation services, and the result is a loss of economic productivity. Rijsberman finds that the benefits from additional spending on water and sanitation far exceed the costs of their installation.

The United Nation's Millennium Development Goal for water and sanitation is to double the number of people with access to basic water and sanitation supplies by 2015. Rijsberman suggests that improving sanitation is the most practical and cost-effective method to fulfill this goal. The estimated one-time cost of supplying the whole developing world with improved sanitation is $9.3 billion, while the annual benefits are $55 billion using detailed estimates of improved productivity and better health.

The use of ***Cromaglass*** systems in developing countries would fulfill the UN's goal as evidenced by their use in developing countries such as Bangladesh, Indonesia, and Thailand. ***Cromaglass*** systems provide the safe and effective sanitation needed for basic human health.



A.N. Young, Jr. and Denny Dyroff, both of Cromaglass, stand beside tank that was shipped to Iraq.

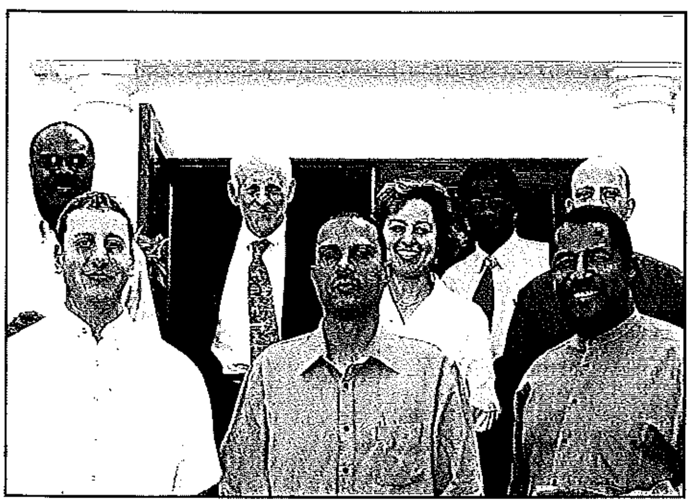
THE FUTURE OF OUR INDUSTRY

According to Smith Barney, the water and wastewater treatment industries are expanding at an incredible rate. Several Fortune 500 companies, such as ITT Industries and General Electric, are now investing a considerable sum of money into research and development in these industries. This report, published in Smith Barney's *Portfolio Strategist*, explains the expanding industry for investment purposes. Nonetheless, it provides a useful forecast for ***Cromaglass.***

The article lists several factors that will propel the water and wastewater markets forward. Here in the US, the Congressional Budget Office estimates that in the next twenty years, the annual investment for water and wastewater facilities will be $32.5 billion. Internationally, there exists a dire need for water-related infrastructure; this problem, combined with an exploding population, creates a huge demand. Fortunately, increasing foreign aid will provide the funds for some improvements. In addition, both domestic and international regulations regarding the cleanliness of water are becoming stricter, which will result in even more demand for ***Cromaglass*** systems.

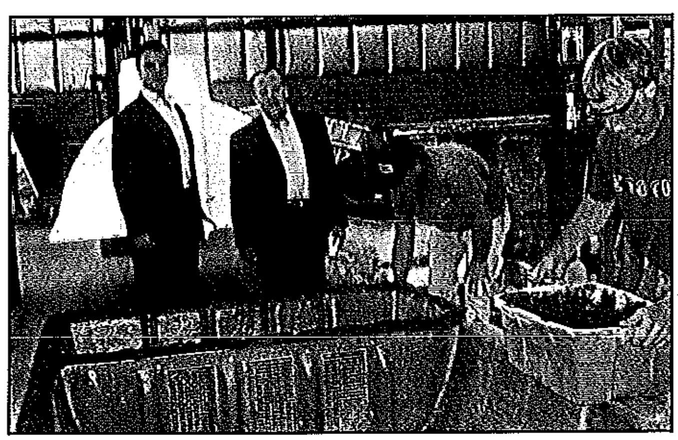
As the news of this growing market spreads, more companies will want to participate – increasing competition. The authors feel that, due to the enormous demand for these goods and services, the companies in the industry will not suffer from extra competition. Instead, every company will find its own respective market in the world provided they continually improve technologies. In accordance, ***Cromaglass*** continues to improve its systems with technological advancements such as state-of-the-art PLC Controls and 24-hour remote monitoring of ***Cromaglass*** systems to assure that they continue to operate up to regulations.

DISTRIBUTORS VISIT CROMAGLASS OPERATIONS FOR TRAINING IN MARKETING AND OPERATION OF SBR PROGRAMS



A most recent visit to Cromaglass for observance of and training in Cromaglass operations was by a contingent of distributors from Islands of the Caribbean which include: (back row, L to R) Bobby Miller, Jamaica; A. N. Young of Cromaglass; Judith Baynes, Barbados; Dr. Alison Williams, Tobago; Ian Baynes, Barbados; (front row, L to R) Josh Gliptis of Cromaglass; Terrence Smith, Grenada; Ian Redhead.

A.J. Nastasi and Bob Kaufman (president of AMS) are shown observing a company recycle/reuse demonstration through the fountain located at the front of the company office complex.



Jose and Marcelo Garcia, Cromaglass distributors in Mexico, observe assembly of system during their recent visit to the plant.

Editor – Ashley Bogart

CGD0804

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THE Cromaglass® DIGEST

Vol. 17 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL JANUARY 2003

CROMAGLASS TECHNOLOGY CONTINUES ITS COMBINATION WITH PUBLIC INSTITUTIONS TO BENEFIT SOCIETY

Memorial Sloan-Kettering Cancer Center is recognized as one of the very best medical facilities in the world with its major complex at 106th Street and Central Park West, New York City, since 1884. Its first major satellite outpatient center opened in Suffolk County, Long Island, New York using a wastewater treatment system meeting all denitrification requirements established by US EPA and New York State DEP standards.

Designed by the Philadelphia architectural firm, Ewing Cole Cherry Brott, the building is located on eleven wooded acres of Commack, Long Island. Memorial Sloan-Kettering Cancer Center employs 60 people including 12 physicians treating about 35,000 patients annually. Its services cover a range of sciences including cancer diagnosis, chemotherapy, radiotherapy and surgical consultations.

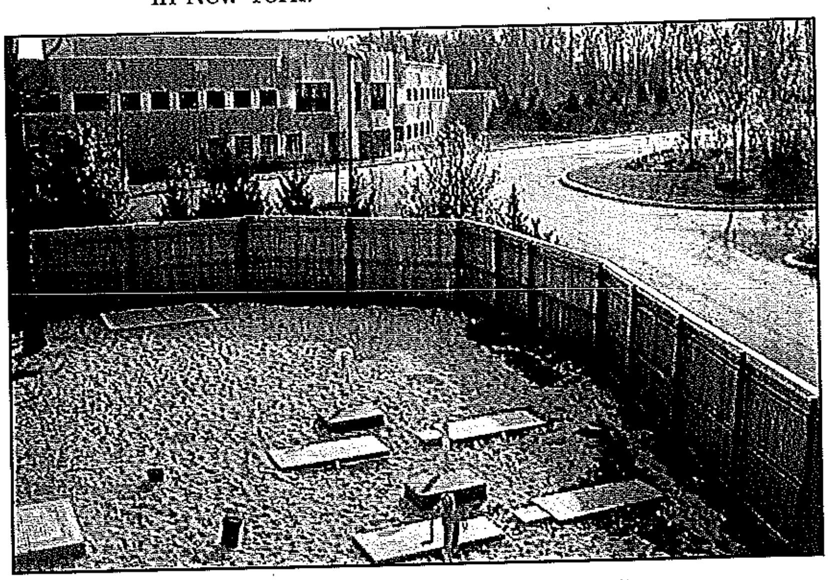
Engineering for the wastewater treatment system was provided by Frank Russo and Chris Weiss of H_2M Group of Melville, Long Island. The Cromaglass System with denitrification capability was chosen based on the equipment sizing and space available at the property location.

Total nitrogen reduction down to 10 mg/l meets the stringent requirements of government programs.

These total nitrogen limits were initiated in order to decrease the instances of methomoglobinimia or Blue Baby Syndrome caused by lack of oxygen in the blood of an infant.

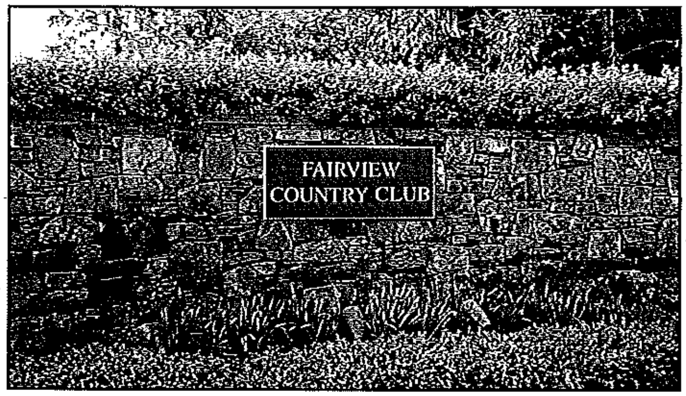
Cromaglass distributor, E^3 Environmental, worked closely with the engineering and construction companies to maximize adherence to all federal and state regulations.

Componentry of the total treatment equipment consists of an equalization tank, two (2) Cromaglass model CA-50D sequential batch reactor modules treating 7,500 maximum gallons per day, plus a 3,000 gallon sludge processing tank. Ongoing operation and maintenance is strictly performed by Rich Flöhr of Pure Process and his associates who also operate many other Cromaglass systems in New York.



Cromaglass installation located next to the suburban Cancer Center.

FAMOUS CONNECTICUT COUNTRY CLUB UTILIZES CROMAGLASS BATCH TREAT SYSTEM



The famous old Fairview Country Club in Greenwich, Connecticut, had been experiencing problems with its sewage treatment system and had initiated contacts with engineering professionals to obtain the optimum type of treatment system from all aspects including design, cost, and availability.

As a result, in 1998 Lou Kircher, owner of E[3] Environmental, Cromaglass Representative for Eastern New York State, had a response from a postcard solicitation he had made to engineering contacts in his area of marketing.

Mr. Kircher and his associates were requested to visit the club site upon which three to four initial visits were made for observation of how a Cromaglass Wastewater Treatment System would best serve the premises of the club.

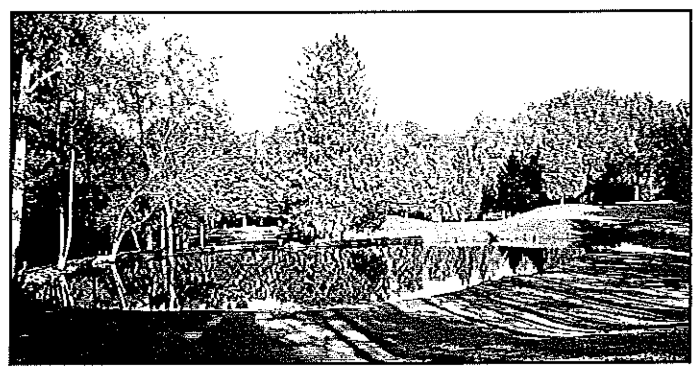
Having had five years experience with acceptance of Cromaglass denitrification by the State of New York and counties in other nearby states, Mr. Kircher worked with a very experienced professional engineering company registered in the State of Connecticut, Mr. Jack Naylor, PE.

Mr. Naylor reviewed the site and requirements of the Connecticut Environmental Agency with eventual submittal of a permit request. This included the specifications for Cromaglass Batch Treat Systems that he had previously reviewed and submitted to other government agencies in states or counties where the Cromaglass process had been most desirable.

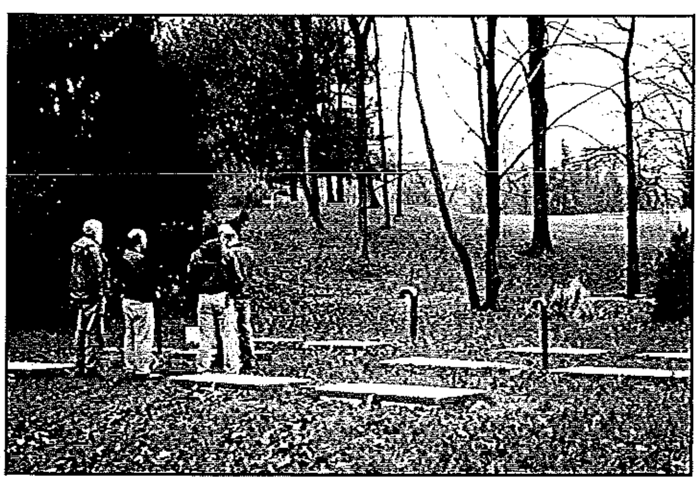
Following the thorough review of the application and acceptance by the appropriate agencies, two Cromaglass 12,000 gpd systems were ordered through E[3] Environmental from Cromaglass Corporation to process 24,000 gpd of flow.

Treated effluent from the installed system is disinfected and flows from the processing units into water collection and runoff ponds. There the resulting combination of groundwater runoff and wastewater effluent is contained for recycling of the water in spray irrigation onto the golf course at a maximum of 22,000 gallons per day capacity.

It has been indicated by the country club manager for the water resources programs, that key factors of use have resulted in a low visual profile of the treatment components themselves; no obtrusive sound and importantly low or no odor emanating from the treatment process. Proof of these assets is the fact that the system is installed very near tees and greens of the beautiful golf premises.



Recycled water is retained in pond adjacent to tee and fairway.



Viewing the Inconspicuous Cromaglass Installation.

FAIRVIEW COUNTRY CLUB PERFORMANCE DATA

Client: Fairview Country Club, Greenwich, CT.
Equipment Installed: Two CA-120 Modules
Design Flow: 24,000 gpd

		Influent		Effluent	
Month	$Flow_{avg}$	BOD	TSS	BOD	TSS
May-02	12,130	155	81	13	26
Jun-02	17,000	437	140	8	17
Jul-02	17,000	358	168	15	24
Aug-02	18,300	480	424	16	36
Sep-02	14,000	64	31	3	18
Oct-02	13,400	105	44	3	0.5
AVERAGE		**267**	**148**	**10**	**20**

Average Percent Removals – BOD: 96% TSS: 86%

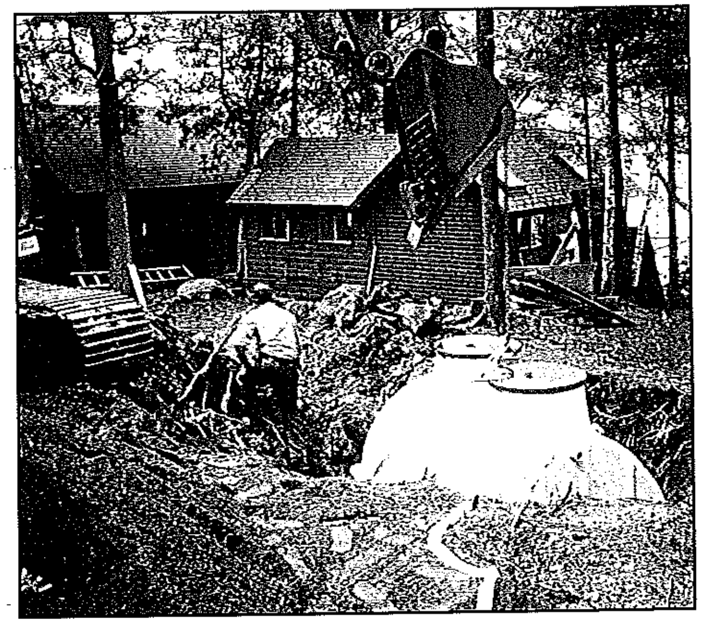
UNIQUE LAKEFRONT PROPERTY

Frontage on Moosehead Lake in Maine demanded efficient and reliable treatment for wastewater coming from this vacation property.

The local permitting authority had no prior experience with on-lot treatment systems, but they approved this application after discussions with Maine Cromaglass Representative, Harold White.

This property, with 171-foot lake frontage was part of old Camp Allagash, which was a well-known camp in years prior to World War II. It is one of nine sites which were sub-divided, and has the original camp boathouse. The cabin was originally the camp director's cabin.

A Cromaglass Model CA-5 (500 gpd unit) is installed about 30 yards up from the cabin with treated effluent discharged to a 20' x 80' disposal bed, which includes an Infiltrator disposal system for maximum water dispersal.



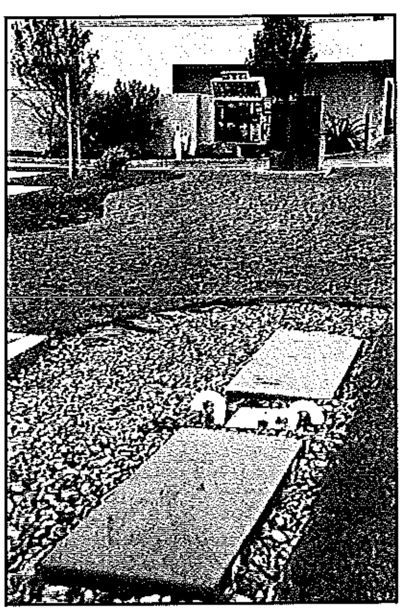
Treatment System being Installed on Moosehead Lake shoreline.

CARL'S JR. RESTAURANT

Very popular fast-food establishments in Central California, Carl's Jr., specify Cromaglass Wastewater Treatment Systems when built in decentralized areas.

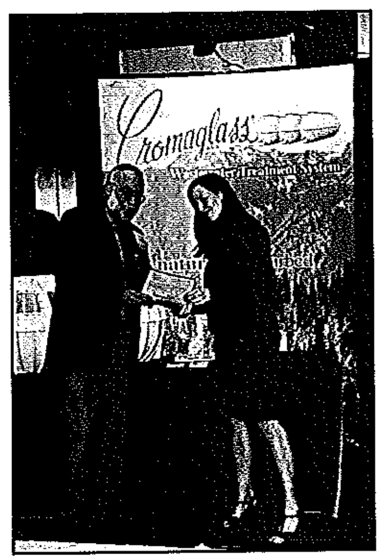
Due to strict environmental regulation involving commercial establishments in Stanislaus County, California, aerobic treatment facilities are mandatory. With fluctuations in daily flows, engineering representatives insisted upon flow equalization and a non-passive mode of process control. The batch treatment process, inherent with each Cromaglass system, was an ideal solution. Also, ability to biologically treat in batches (i.e., incremental volumes), combined with positive discharge, met all design specifications.

Daily flows will average from 2,000 gpd to 12,000 gpd depending upon time of year and seasonal activities. Grease removal occurs via 2,500-gallon interceptor prior to entering the CA-120. This significantly reduces organic loading and allows for a further polished effluent. Continuous monitoring of the system by a factory-trained service agent is critical to efficient operation.

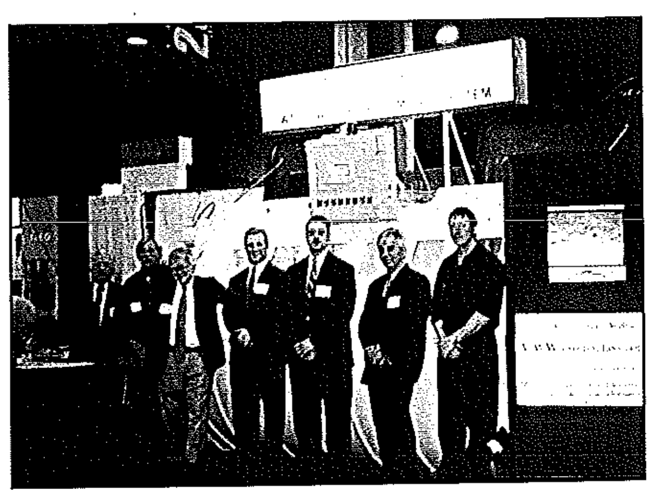


Model CA-120 Batch Treat Unit

AT THE SHOWS



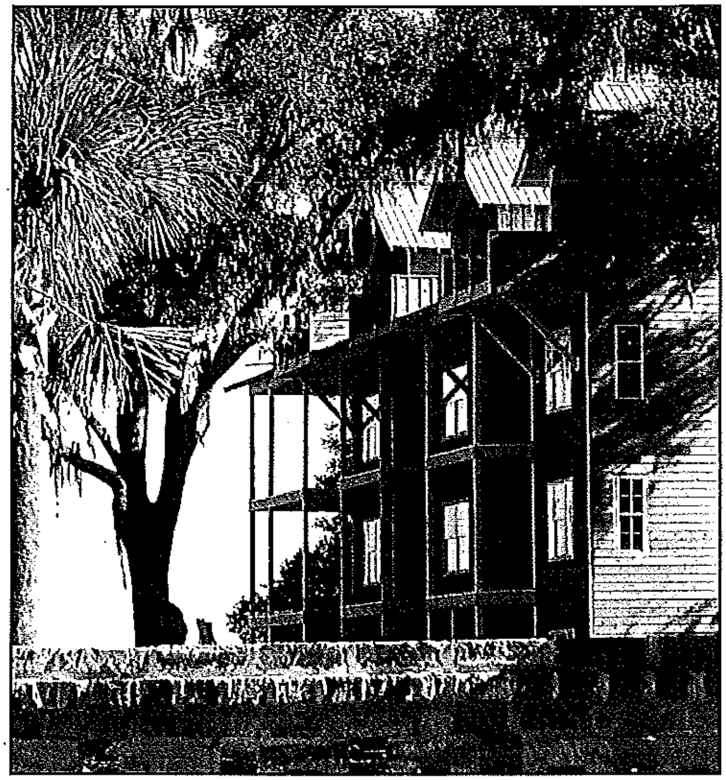
Engineering Services Representative Craig Stead reviewing Cromaglass specifications with a customer.



Cromaglass marketing and engineering personnel at NAHB exhibits and conferences.

GEORGIA APPROVAL PROVIDES FAST TRACK COMPLETION OF CONDOMINIUM COMPLEX

Cromaglass Georgia Representative and Cromaglass Engineering combined to obtain the approvals for Merchants Wharf Project. Better understanding of advantages provided by Cromaglass small community wastewater treatment systems resulted in permit approval by the state regulatory agency.



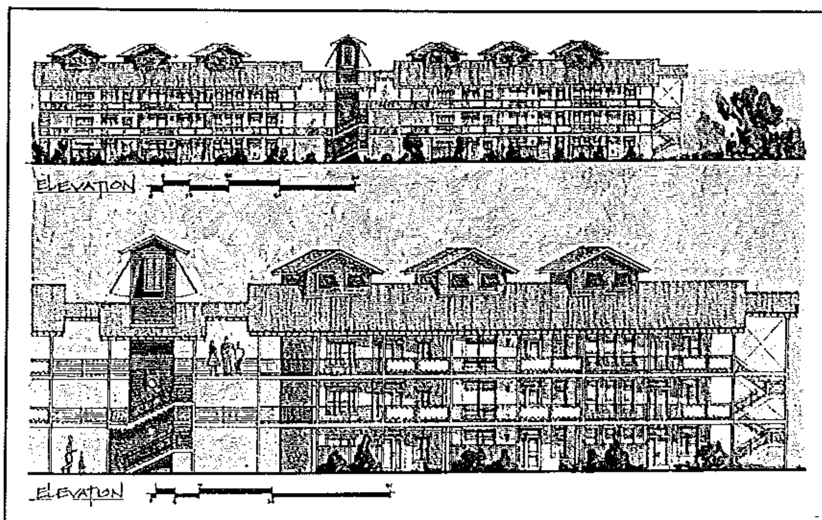
Technically sound and cost-effective wastewater treatment processes are in more demand as indicated by the requirements in Savannah, Georgia for a system to process wastewater for a condominium complex. Located near Sunbury, the historic Ft. Morris site which was totally destroyed in the Revolutionary War, had limited space for the necessary equipment.

Property owner and developer, Bob Van Degejuchte, with his contact person, Ben Turnage, at Carter and Sloope Engineers, had investigated products to meet demands of time limits and costs.

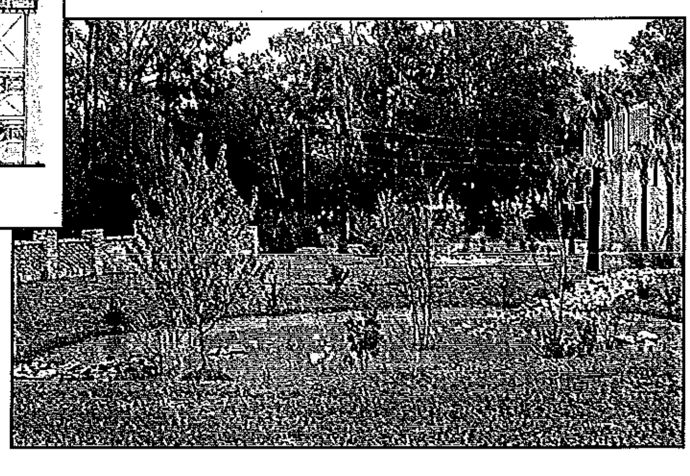
During visits at the NAHB home builders show in Atlanta, Bert Gerber, PE, who serves the Georgia area for marketing and sales for Cromaglass, demonstrated how Cromaglass SBR systems could be designed, produced and installed in time to allow tenants to move into the condominiums for the 2002-03 winter season and provide much lower installed cost than other available products.

This system was ordered September 16, 2002 and shipped November 15, 2002 for connection to the condominium complex requiring approximately only four days for installation and start-up.

The owner/operator of this property decided upon use of Cromaglass systems with primary concern for less space required which allowed more units to be constructed and the non-obtrusive aspect for the location involved. His engineering consultants were also made aware of the easier operational characteristics for Cromaglass as opposed to other more complex systems.



Architect's rendering of the 36 condominium units.



Pond and landscaping newly installed for this beautiful residential property.

CGD1202

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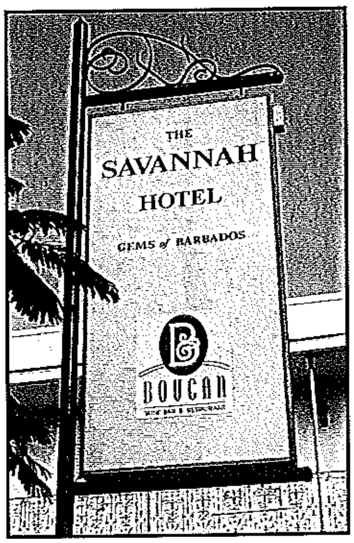
THE Cromaglass® DIGEST

Vol. 16 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL JANUARY 2002

CONSERVATION OF ENVIRONMENT AND LAND BY WATER REUSE AND RECYCLING

As many communities throughout the world approach the limits of their available water supply, water reclamation and reuse has become an attractive option for conserving and extending those supplies. In addition, water reuse presents the communities an opportunity for pollution abatement as it replaces effluent discharge to sensitive surface waters or marginal soils.



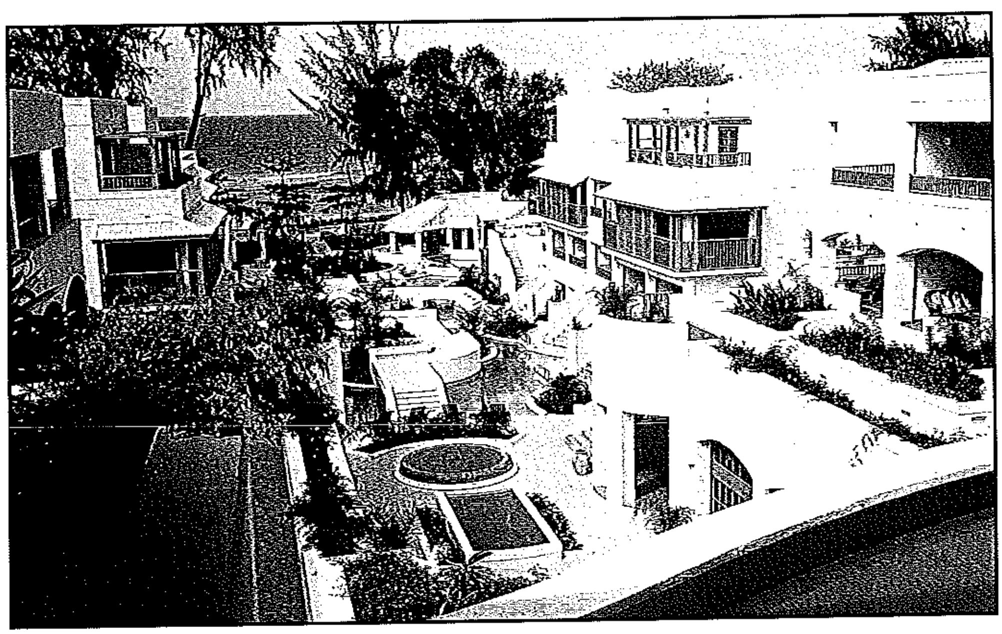
In the United States the Environmental Protection Agency has published a manual entitled "Guidelines for Water Reuse," and many other countries or territories around the world are incorporating much of this important information in their areas.

Water reclamation and non-potable reuse only require conventional water and wastewater treatment technology that is widely practiced and readily available throughout the world. It has been determined that an increasing population can be served from existing potable water resources through water reclamation and reuse programs, many of which have been found in arid or water scarce areas such as Middle Eastern countries and island type environments.

It has also been determined that a more vigorous program for pollution control has led to advanced wastewater treatment processes with water reuse programs serving both water conservation and pollution abatement. Another item of consideration in developing reuse/ recycle systems is that the quality of the reclaimed water be appropriate for its intended use. In addition to specific areas of the United States, several Caribbean Island localities have instituted water-recycling programs.

One such island is that of Barbados, where the government has permitted resort hotel owners to utilize the ***Cromaglass Wastewater*** processing, with treated effluent being stored and reused in lieu of potable water supply for flowering plants. An excellent example of this water conservation can be found at the Savannah Hotel in Barbados, where 30% of the treated water is used for toilet flushing and the

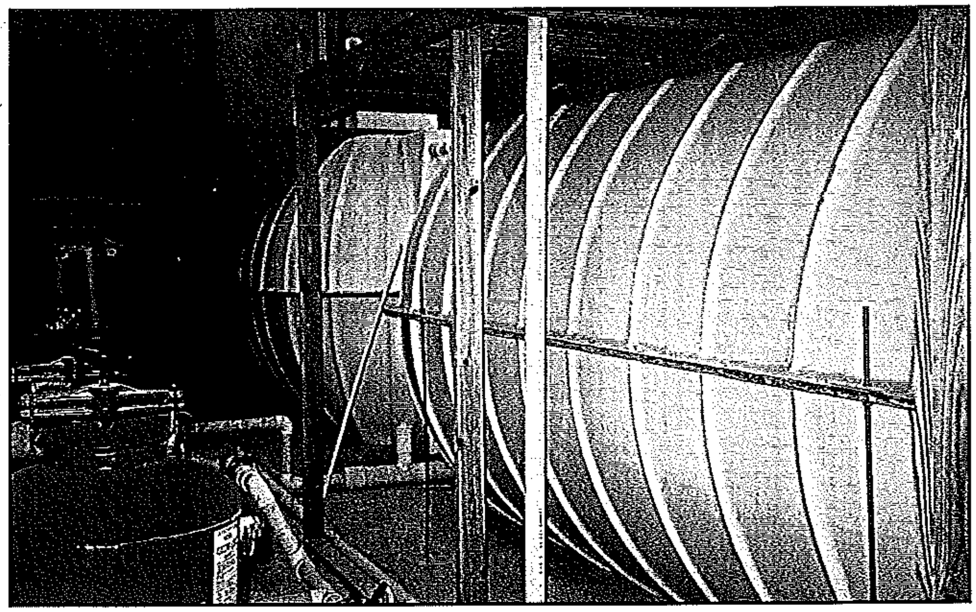
(Continued on page 2)



An upscale hotel, Savannah, utilizes a valuable property located on the ocean where sewer hookups are unavailable – and is served by Cromaglass Batch Treat System which enables recycling of the wastewater for irrigation of plants surrounding the guest rooms. Water usage is reduced further by reuse for toilet flushing.

 Continued from page 1

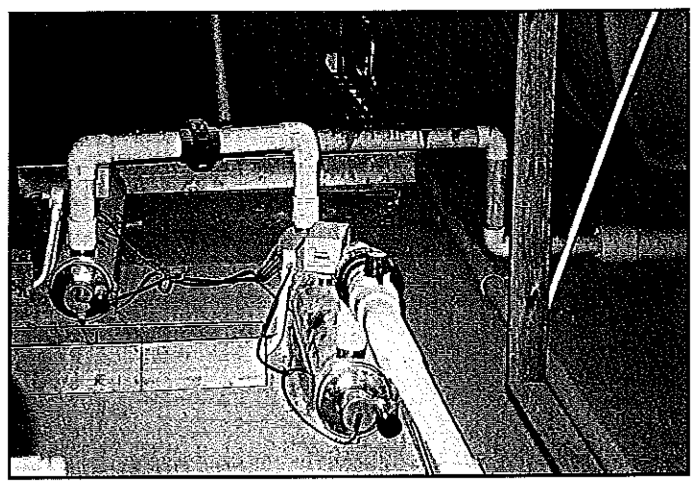
remainder with irrigation of flowering plants surrounding the rooms and swimming pools. With this, the need for conventional sewage disposal and design has been eliminated. Wastewater from the rooms and kitchen dining facilities is conveyed to a 15,000 gallon ***Cromaglass*** sequential batch reactor system located in a ground floor room near the bedrooms and patio swimming pool area. A pump station carries the wastewater to an adequately sized equalization tank from where it is piped to the 15,000 GPD ***Cromaglass*** system. Piping connections are between tank sections including a sludge-processing component.



From the treatment tanks, treated effluent is pumped into a two-stage filter with an automatic backflushing capability. From the filter, effluent then travels through two ultraviolet disinfection units, where cleaning of the radiation tubes is indicated as part of the control program in which indicator lights advise the operator of cleaning frequency.

As part of the island government program for disinfection, a two-section chlorinator follows the ultraviolet system and resulting treated effluent is drained into a holding tank whereby it is combined with rainwater runoff from the building's rooftops.

Two heavy-duty water pumps then convey the treated effluent to a 90,000 gallon holding tank from which this water is transferred to perforated piping under plants and other vegetation surrounding the rooms and pools.

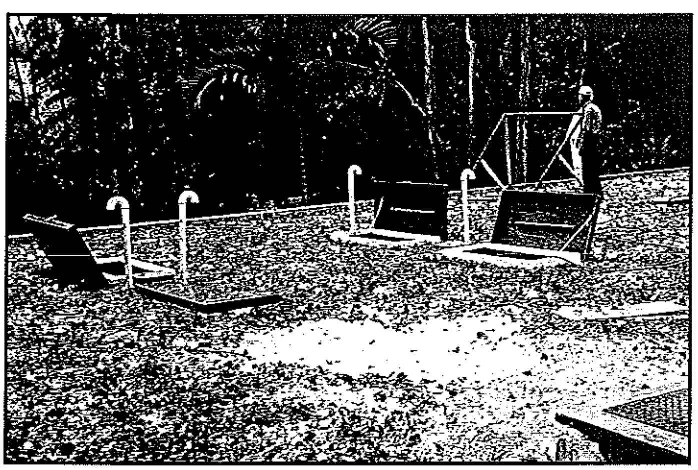


Many other hotels and private homes in Barbados utilize ***Cromaglass*** systems for reuse of their water supplies. A large hotel resort, Port St. Charles, utilizes four ***Cromaglass*** Model CA-150 treatment modules processing 60,000 GPD of wastewater.

Included in the areas using the treated effluent, are the plants and flowers around the rooms and boat canals.

One of the more prominent ***Cromaglass*** installations in the Caribbean is a new hotel, Villa Nova, which was a home originally constructed for Sir Anthony Eden, a Minister under Winston Churchill and eventually an English Prime Minister himself. This hotel is located within the beautiful sugarcane plantations of Barbados.

VILLA NOVA INSTALLATION

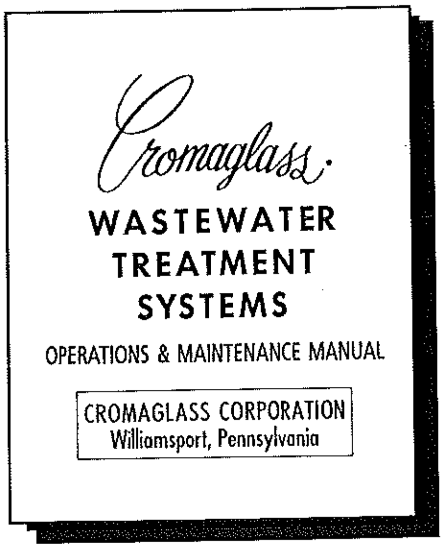


The hotel of Villa Nova is served by Cromaglass Model CA-150 (15,000gpd) wastewater treatment system. Treated effluent is used for irrigation of beautiful tropical flowering plants located throughout the estate.

Acknowledgement goes to Cromaglass Distributors, SIR and its owners, Ronald and Ian Baynes for their contribution to this article.

COMPREHENSIVE TECHNICAL AND PERFORMANCE DATA MANUALS NOW AVAILABLE

Continuing its efforts to be a leader in pollution abatement, ***Cromaglass*** strives towards product research and development into the next millennium. Encouraged by Federal and State regulatory officials, ***Cromaglass*** felt the necessity to design a comprehensive manual to assure treatment standards utilizing the ***Cromaglass Batch Treat Process.***



Recently introduced and available are the newly released Operation and Maintenance Manuals for all ***Cromaglass Wastewater Treatment Systems.*** The manual was created to provide technical guidance for engineers, operators, and owners, with information presented necessary to operate and maintain the ***Cromaglass Sequencing Batch Reactor Process.*** This manual was designed to be a guide for individuals familiar with operations of a sewage treatment facility, or as a valuable tool to supplement the training of an inexperienced person. Material is intended to promote normal operations under "steady-state" conditions. Experienced and inexperienced persons can take advantage of the information offered concerning sewage treatment plant operations. The format of this manual is to provide operators with detailed instructions on proper operation of each process component.

Each manual consists of a basic description of biological capabilities of the activated sludge process and kinetics associated with the suspended growth process. Once a basic familiarity is established, specific details regarding ***Cromaglass*** technological advantages are provided. An operational strategy to achieve nutrient removal for nitrogen is explained in detail. Valuable information such as process control and related recommended equipment can be found as well.

Detailed engineering drawings depicting pump placement, plumbing, dimensions, and configuration are included as well as all Original Equipment Manufacturer cut sheets.

Separately, test results have been collected from various locations around the world demonstrating standard and nutrient removal capabilities. Biochemical Oxygen Demand, Suspended Solids, and Total Nitrogen reduction resulted in percent removals exceeding 90 percent with Performance Evaluation Programs having demonstrated the excellent efficiency of ***Cromaglass Batch Systems.*** All data has been tabulated for presentation purposes to once again prove the superiority of the ***Cromaglass Process.***

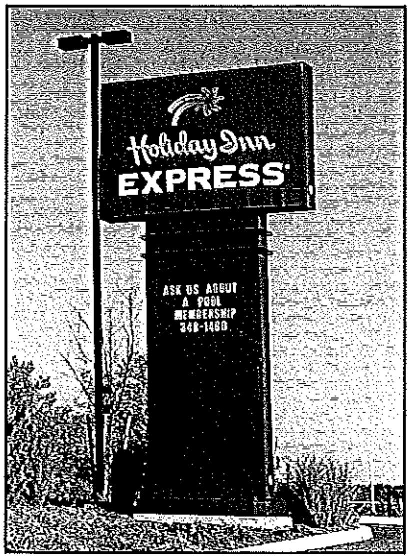
Cromaglass will continue its search for ways to provide the end user of its products with ongoing support and service.

BIOLOGICAL REDUCTION PERFORMANCE DATA

Urban Acres Mobile Home Park – MODEL CA-150						
DATE 2001	Monthly Flow avg.*	BOD_5	TSS	NH_3-N	pH	Coliform fecal
January	3000	5.4	22.5	5.5	7.2	35.0
February	3000	5.5	15.5	8.4	7.1	37.7
March	3000	5.1	22.0	1.2	6.9	175.0
April	3000	2.8	22.5	1.0	6.9	71.0
May	4000	2.8	10.0	4.0	6.8	69.4
June	4000	2.0	10.5	1.0	6.9	4.5
July	3000	2.0	18.5	1.0	6.9	180.0
August	3000	3.5	12.5	17.0	6.9	7.7
September	3700	2.2	7.5	1.0	6.9	4.5
October	4000	2.2	5.0	1.0	6.9	10.0
AVERAGE	3370	3.3	14.7	4.1	6.9	59.5

*System currently receiving less than designed flow in Phase I.
Phase II expansion increasing flow, demonstrating Cromaglass flexibility.

CROMAGLASS DENITRIFICATION PROCESS ENABLES DEVELOPMENT OF NEW YORK COMMERCIAL PROPERTY

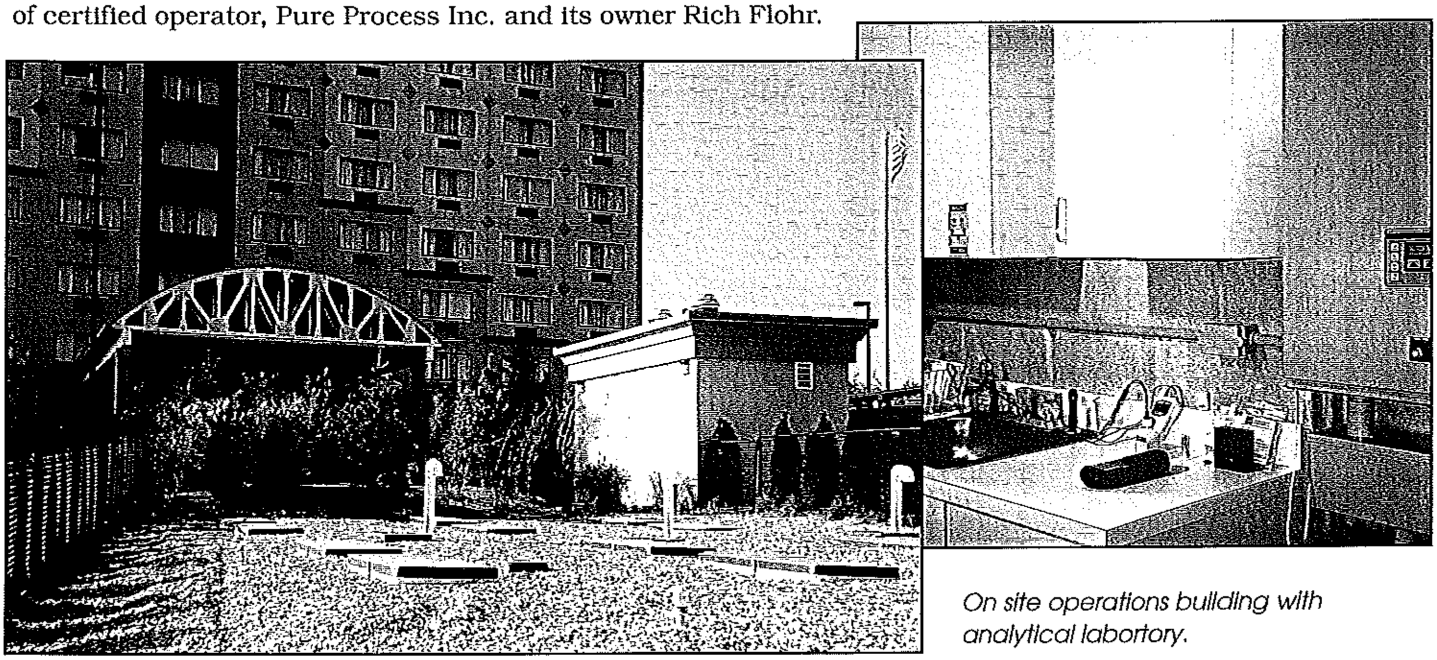


National and State Environmental Standards have brought unprecedented local changes to areas such as Long Island, NY where engineering consultants must design building components to meet new codes that better protect the health of its population. One prominent new enterprise located in the heart of Long Island at Hauppauge near a busy interstate interchange and surrounding commercial and industrial properties is the new Holiday Inn Express with wastewater treatment system as designed by Naylor Engineering. This basic SBR process was provided by ***Cromaglass Corporation*** of Williamsport, PA and its representative E3 Environmental of Garden City, NY.

Guests and visitors are generally unaware of the modern wastewater treatment system placed near the hotel's main entrance.

The inconspicuous process equipment receives all of the wastewater from the guest rooms, dining, and kitchen facilities and not only provides conventional waste treatment but also reduction of water polluting nutrients meeting strict county and state requirements of <10 mg/L Total Nitrogen.

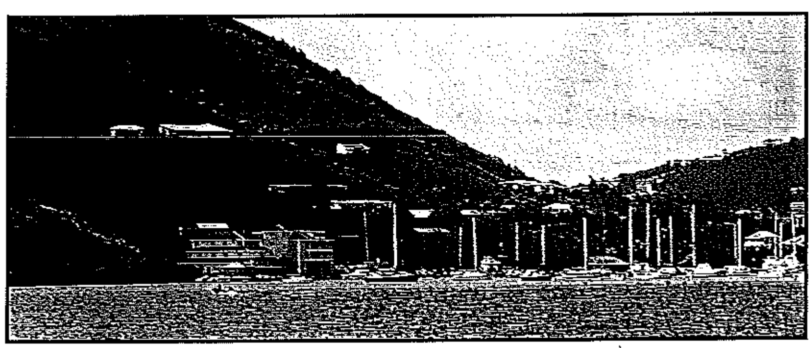
Operational integrity is maintained under the trained watchful supervision of certified operator, Pure Process Inc. and its owner Rich Flohr.



On site operations building with analytical labortory.

Marina
East End Tortola, BVI

Owner, Romney Penn chose a Cromaglass Model CA-50 to eliminate pollution in the area of his hotel restaurant complex, Hodges Creek, serving primarily the boating trade of the British Virgin Islands.



CGD102

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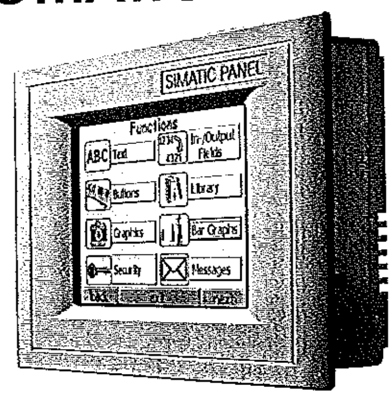
THE Cromaglass® DIGEST

Vol. 15 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL JANUARY 2001

EVOLUTION IN *CROMAGLASS* AUTOMATION



Over 25 years ago ***Cromaglass*** management became aware of the importance of operation and maintenance to marketing wastewater treatment systems.

Programs were initiated to implement these requirements on providing alert or alarm componentry that could promptly communicate to local area stations the basic conditions of specific systems in question.

Thus was initiated the ***CromaWatch***™ program of monitoring all ***Cromaglass*** systems.

CromaWatch™ enables 24-hour minute-by-minute contact with ***Cromaglass*** servicing distributors, the property owners, and even those regulatory agencies that may desire a connection with the ***Cromaglass*** control program.

It has been the objective of ***Cromaglass*** to offer the optimum control systems available for use throughout the world.

As a result, in cooperation with the leaders of the control industry in providing control systems products, ***Cromaglass*** has been able to be brought to a whole new level in control technology.

With worldwide service and support, this automation allows a significant increase in the quality of ***Cromaglass***® ***Wastewater Management Programs***. This newest of control products enables ***Cromaglass*** to reduce the hardware space requirements, improve start-up time, and make subsequent necessary modifications easier.

Built-in expansion modules and scalable software make modification applications more simple.

MEXICAN ECOLOGICAL THEME PARK

From industrial and business parks to theme parks Aquaser S. A., ***Cromaglass*** Distributor in Mexico, has marketed and serviced batch treat systems for nearly 10 years.

One of the most recent projects sold by Aquaser is Xel-Ha, a three theme ecological park located in the Riviera Maya – a strip of land bordering the Caribbean Sea from Cancun to Chetumanal. This is a high exposure vacation area of the Yucatan Peninsula, which divides the Gulf of Mexico from the Caribbean Sea. Featured in the parks are not only warm sunny beaches and boating areas but unusual environmental compounds containing butterflies, porpoises, sea turtles and even more exotic animals.

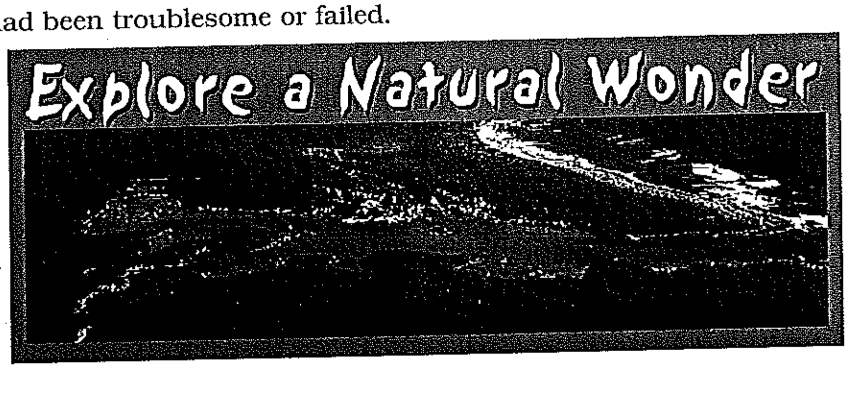
A very special attraction found at Xel-Ha is an underground tunnel through which "brave souls" can swim for approximately 500 yards while observing natural underground wonders of a cave-like setting. Again, we see the obvious need of maintaining pollution-free water for this ecological park.

Owners of the Xel-Ha theme parks realized the need for reliable wastewater treatment but were concerned due to sewage plants at other locations that had been troublesome or failed.

Aquaser's Gerardo and Antonio Garcia met with Xel-Ha's officials for over a year during which time the project was analyzed and systems sized with comparison to other technologies.

The size of the park did not allow consideration of a single wastewater collection and treatment system and therefore the decision was made to install three

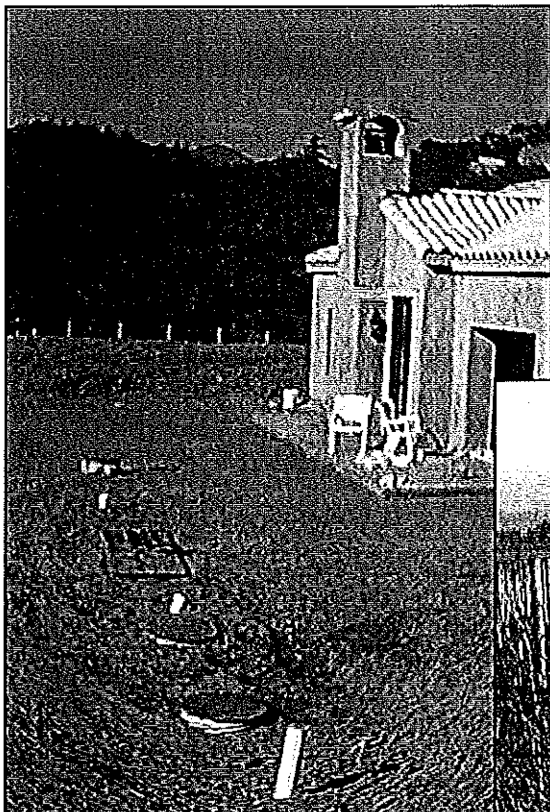
(Continued on page 2)



WINE COUNTRY EXPOSURE TO *CROMAGLASS*

Napa Valley, CA, one of the centers of wine country USA, has discovered the use of ***Cromaglass Wastewater Treatment Systems*** for protection of the area environment, plus advantages accruing to optimizing conditions for improvement of the quality of the fruit used in wine production.

Very marginal soils contained on the mountain terraces overlooking Napa Valley contributed to the regulatory agencies not permitting construction of residential housing in preferred locations. One such property, the Macke Residential Complex is comprised of a four-bedroom main residence, two-bedroom pool house, and a two-bedroom caretaker's cottage. The project is situated within an old rock quarry being reclaimed to a new vineyard for the Macke family. The wastewater disposal system for this project is designed for a flow of 960 gallons per day on the use of low flow fixtures for water conservation purposes.



Local project engineer, Randall E. Bryant, P.E., introduced to the County Department of Environmental Health, ***Cromaglass Batch Treat Systems*** which would not only improve greatly the quality of treated wastewater but also reduce significantly the amount of total nitrogen, an excess of which is a detriment to quality of the fruit used in wine making. Added to this wastewater improvement is the use of engineered subsurface pressure distribution of that treated effluent. Drip irrigation design used is that of Geoflow, which combined with ***Cromaglass*** treatment can be used for landscaping with the provision that county and state ordinances are followed.

...MEXICAN ECOLOGICAL THEME PARK

Continued from page 1

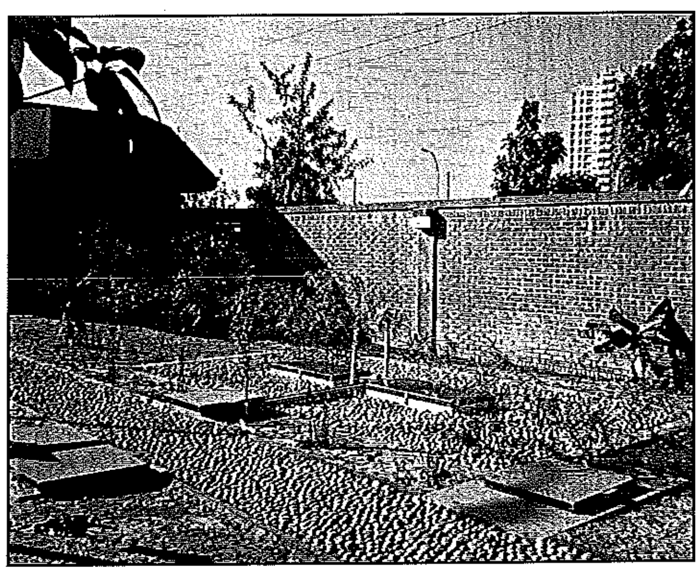
Cromaglass units, including a 15,000gpd (Model CA-150), a 3,000gpd (Model CA-30) and a 1200gpd (Model CA-12) respectively in the main restroom area, restaurant area, and the office areas.

Comparisons having been made with other available technologies, ***Cromaglass*** proved to be the most reliable, easy to operate and high-quality product for this large capacity environmental park.

With final design completed and engineers approval, the batch treat systems were purchased in May 2000. As is customary with their marketing and operational programs, Aquaser personnel traveled to Xel-Ha several times to train the park maintenance personnel and to assure that the units were running smoothly.

Cromaglass and Aquaser are very pleased that Xel-Ha officials have recommended highly the use of their systems to other customers.

U.S. EMBASSY, DHAKA, BANGLADESH



Cromaglass Model CA-60 treating 6,000gpd of wastewater from the embassy compound -- Installed December 1999.

CROMAGLASS ASSISTS REDUCTION OF URBAN SPRAWL

Much of the population of the United States appears not to be prepared for urban sprawl – "they prefer the wide open spaces."

A good example of this is found in Suffolk County, Long Island, NY. Suffolk County comprises the eastern 2/3 of Long Island beginning 35 miles east of Manhattan at the Route 110 corridor and stretching eastward approximately 70 miles.

The population of this region reflects the post World War II "boom" in regional growth. This aging population, their children and grandchildren desire to remain in the region, which obviously means more housing will be needed. However, they also want to maintain the character and beauty of the region for future generations. While this may seem like an impossible proposition, ***Cromaglass Corporation*** has helped to provide a solution on a number of projects. Small, community wastewater treatment systems, such as those offered by ***Cromaglass*** have been the alternative to large multi-million (or billion) dollar municipal treatment plants. ***Cromaglass®*** allows for cluster community development, thus avoiding "urban sprawl" and preserving open space.

Following is a chart furnished by ***Cromaglass*** distributor, E^3 Environmental, Inc., headquartered in Garden City, L.I., which is owned and managed by Lou Kircher and assisted by his son, Jeff.

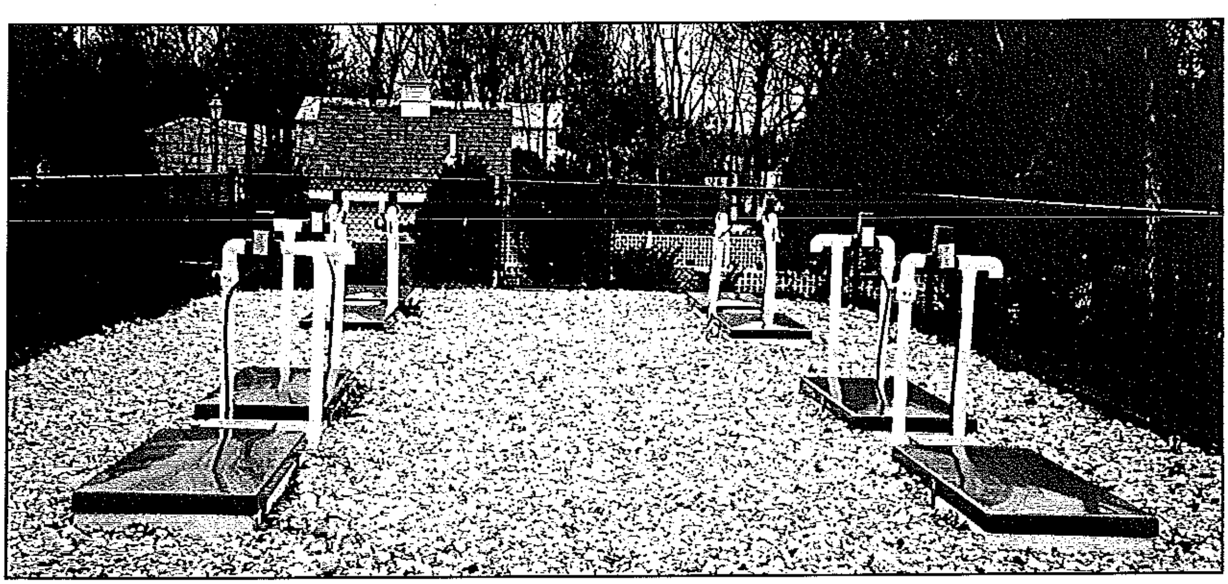
All of the systems listed in the chart are located in Suffolk County and must perform to meet stringent effluent total nitrogen requirements of TKN ≤ 10 mg/l where TKN includes: Ammonia N, Nitrite N, Nitrate N *and* Organic N. It is important to note that since total nitrogen data is a key regulatory specification, Organic Nitrogen is included in the requirements for treatment system use in Suffolk County – but not normally for other jurisdictions within the country.

E^3 Environmental, Inc. is currently working with eight different engineering companies for projects in which ***Cromaglass Batch Treat Systems*** are specified. In addition to the projects listed there are numerous other ones in various stages of engineering and agency review.

In complying with county requirements for optimum operations control, all systems installed use controls with PLC and Operator Interface componentry.

As can be seen from the type of projects listed in the chart, they have broadly varying usage with a population of extremely diverse demographic makeup. This includes properties from hotels to senior apartments all the way to assisted living quarters. ***Cromaglass Batch Treat*** design features easily meet these requirements.

SITE	LOCATION	TYPE	DESIGN FLOW	CROMAGLASS® EQUIPMENT	POWER	START-UP
Greenview Court	Oakdale, NY	68 Senior Apts.	10,800 gpd	2 ea CA-100-D + ST5000	230v, 1ø	6/97
Woodbridge	Hampton Bays, NY	29 Senior Apts.	4,350 gpd	2 ea CA-50-D + ST3000	230v, 1ø	1/99
Sunrise Smithtown	Smithtown, NY	84-Bed Assisted Living	9,340 gpd	3 ea CA-50-D + ST5000	230v, 1ø	6/99
Springhorn	Blue Point, NY	70 Senior Condos	11,000 gpd	4 ea CA-50-D + ST5000	230v, 1ø	2/00
Broadway West	Brentwood, NY	72 Senior Apts.	11,000 gpd	4 ea CA-50-D + ST5000	230v, 1ø	3/00
St. Anne's Gardens	Brentwood, NY	100 Senior Apts.	15,000 gpd	3 ea CA-100-D + ST5000	208v, 3ø	11/00
Holiday Inn Express	Haupage, NY	Hotel	15,000 gpd	3 ea CA-100-D + ST5000	208v, 3ø	1/01
Sunrise Holbrook	Holbrook, NY	100-Bed Assisted Living	11,000 gpd	4 ea CA-50-D + ST5000	208v, 3ø	3/01
Sloan Kettering	Commack, NY	Medical Office	5,000 gpd	2 ea CA-50-D + ST3000	208v, 3ø	In Production
Marriott Residence Inn	Hauppauge, NY	Hotel	15,000 gpd	3 ea CA-100-D + ST5000	208v, 3ø	In Production



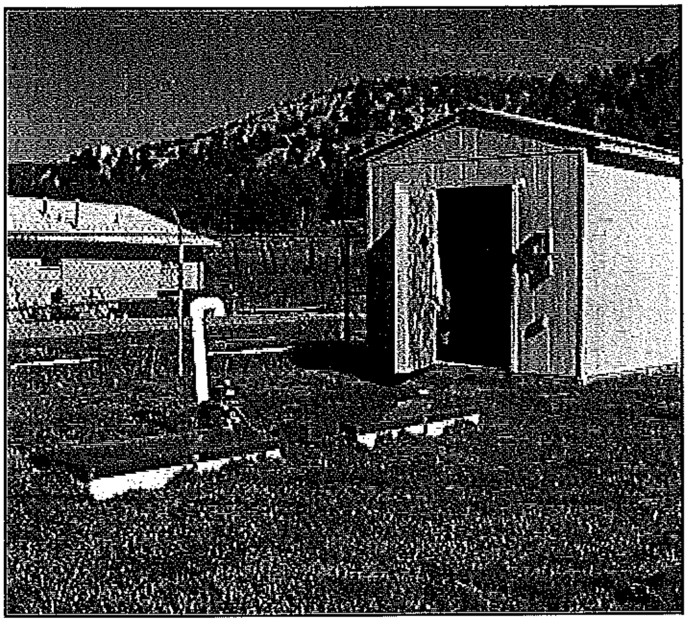
Greenview Court
Oakdale, NY
Senior Apts.
10,800 gpd
2 ea CA-100-D + ST5000

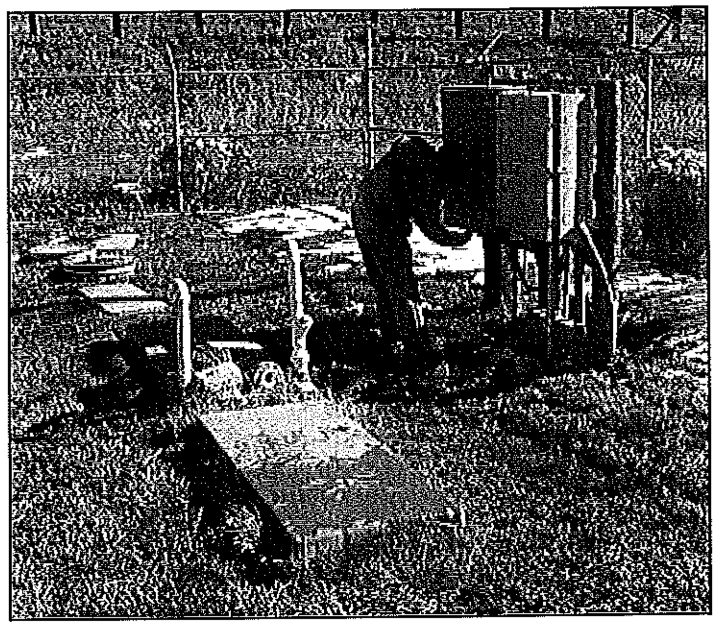
TAOS HUD DEVELOPMENT IN NEW MEXICO

Penasco is an Indian community located in the Taos area of New Mexico. It is part of a HUD Development and is served by two ***Cromaglass*** Model CA-60 Wastewater Treatment Systems with denitrification components. Originally these Batch Treat Systems received approximately 2,000gpd each with the one system located at a lower location being gravity fed and the unit on the upper section is fed by a pump station.

A third module was added to the upper section to support expected expansion. This has added flexibility to the operation since only one module can be used as the capacity requires.

Cromaglass servicing distributor, Onsite Consulting, owned by Robert Chacey, operates and maintains these systems to meet conditions mandated by the regulatory agencies. Bob, has at times, consulted with ***Cromaglass*** representative, Dick Conant of Rucon Enterprises, headquartered in Albuquerque, NM.





USE IN CAYMAN ISLANDS

BPC, Inc. ***Cromaglass*** distributor for Cayman Islands, BWI, has over the years installed and operated several ***Cromaglass*** systems at high profile projects including the Batch Treat System serving Cayman National Bank. It is notable that with any ***Cromaglass*** installation, tanks can be located and landscaped so as to be non-intrusive and actually visibly pleasing. BPC owner, Mike Brown and his manager, Jim Ross, as assisted by Craig Price and Anthony McInerney assure their customers that the wastewater treatment systems are operated so as to provide the best wastewater treatment with the minimum of environmental impact.

Cromaglass Corporation

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THE *Cromaglass*® DIGEST

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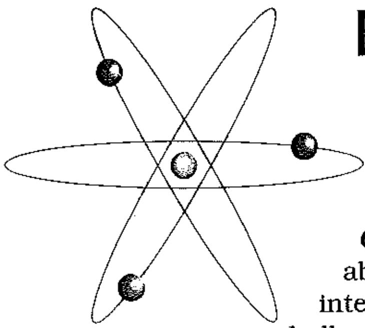

ELECTRONIC AGE LEADS *CROMAGLASS* INTO THE 21ST CENTURY

The Internet has become a global marketplace. As part of the worldwide water and wastewater industry which is undergoing a significant transformation, ***Cromaglass*** has been using electronic commerce to not only inform customers about its equipment and processes, but just as importantly to maintain operational integrity after installation. This is necessary due to accelerating environmental challenges. Space age advances and technologies have provided the necessary componentry.

Cromaglass has been aggressive through these historical changes by utilizing the best of E-Commerce. Leading this progress is a young staff, well-trained in the newest technology. This group of people work daily responding to customers' design requirements through tools such as Project Data Forms. System drawings are put into Auto-CAD form as needed and transferred to engineering consultants by E-mail over the Internet.

Continued on page 2

SENSITIVE ECOLOGICAL CONCERNS AT LAKE TAHOE

Well-known is the environmental protection emphasis placed by States of California and Nevada on the Lake Tahoe Region. The border between these states bisects that magnificent body of water thereby dividing equally responsibility for pollution control.

Located within only a few miles of Incline Village, the home of many rich and famous, is Lake Tahoe Nevada State Park. This is one of several state parks in the United States that have chosen ***Cromaglass*** for wastewater treatment. Others include those in Florida, Pennsylvania, Wisconsin, and New Mexico.

The first ***Cromaglass System*** installed for Tahoe was in 1996 at Spooner Lake serving an outdoor recreational center for biking, skiing and hiking.

With the construction of a new visitor information center in 1998 park management chose a ***Cromaglass*** 3,000gpd-batch treat unit for wastewater processing. Treated effluent from the ***Cromaglass Systems***, although meeting US EPA standards for surface type

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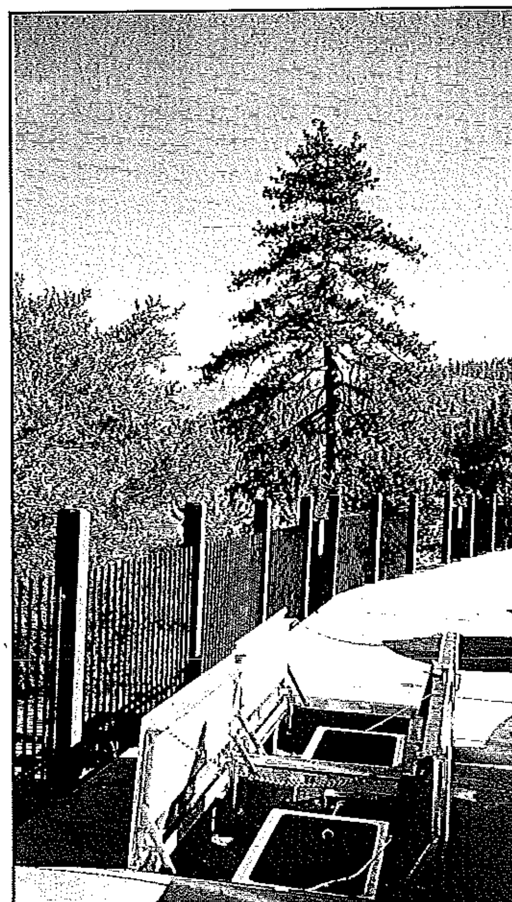


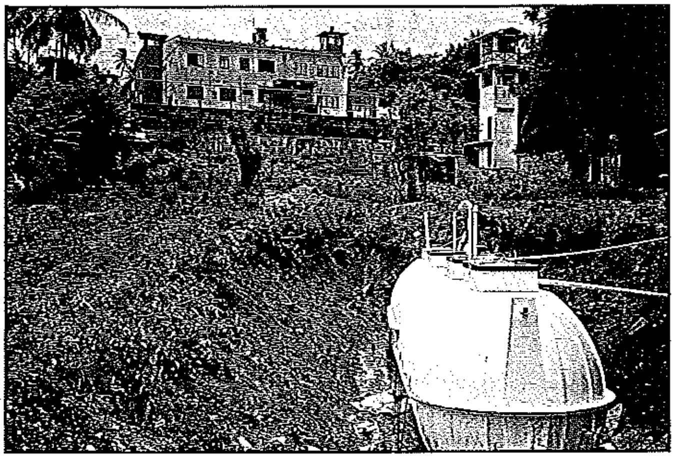
3,000gpd system installed at walkway from visitor center overlooking Lake Tahoe.

New Marketing Promotions

Continuing marketing programs have been utilized by ***Cromaglass*** to bring its product and services to a vast customer sphere. Most recent of these has been the placement of display advertising with *Thomas Regional Directory Company*.

With the "click of a mouse" potential buyers are brought immediately in contact with the ***Cromaglass*** WebPage and its extensive amount of data on wastewater treatment designs.

MOST UNUSUAL PROJECT FOR *CROMAGLASS* SUPPORTED BY COMTIGREEN



For a new distributor, Comtigreen of Medellin, Colombia, certainly surprised ***Cromaglass*** by selling a Batch Treat System for an island institution located 300 miles from Nicaragua out in the Caribbean Sea.

Why, you may ask is this so unusual? Well, how about the prisoners running the institute? On San Andreas Island, this is true, as Bill Young of ***Cromaglass*** found when he traveled to this Colombian Island to supervise start-up of a 12,000gpd-batch treat system where effluent is being discharged to a watercourse.

Actually, the contracting workers and engineering personnel were all members of the institution – and will also be operating the process as well.

...INTO THE 21ST CENTURY *Continued from page 1*

OPERATIONAL ASSURANCE

While its ***CromaWatch*** monitoring program has been very successful in alerting of process interruptions, this is being expanded whereby remote controls can make operational assurance much more positive and thereby increase cost effectiveness.

TOTAL NITROGEN REDUCTION

While federal and state requirements have been added to include strict limits on total nitrogen in groundwater, ***Cromaglass*** had been very successful through its mechanical or Program Logic Control unit (PLC) to reduce this total nitrogen by over 90% in the effluent – and this is accomplished without addition of potentially dangerous chemicals.

Customers or prospects are invited to contact ***Cromaglass*** and its representatives for further information on this advanced process. Third party verification studies as well as ongoing system field evaluations provide data available on request.

This has led to engineering designs, which in turn have provided water pollution abatement in many situations and additionally use of very valuable property that would have otherwise been useless.

ADMINISTRATIVE EFFICIENCIES

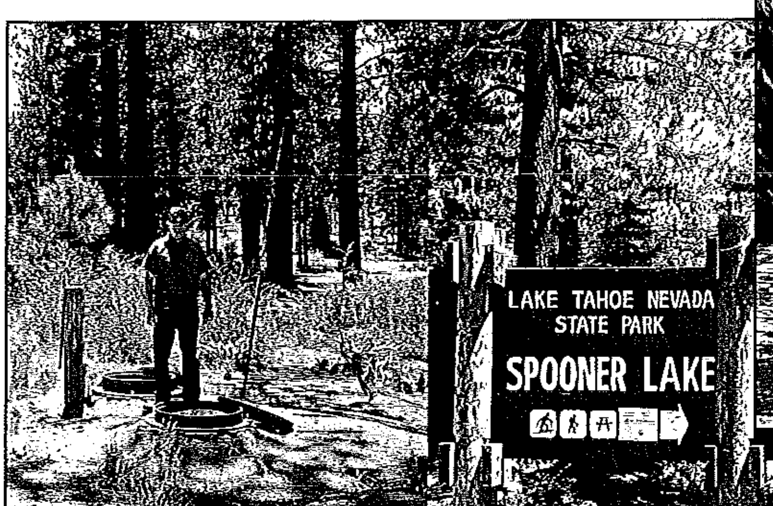
Through its Internet WebPages ***Cromaglass*** now makes possible prompt information transfer, which allows engineers, and other technicians to make quicker decisions for designs used in wastewater pollution control. FAX and E-mail specs and data are provided as never before possible – *faster data translates into quicker and easier permits.*

...CONCERNS AT LAKE TAHOE *Continued from page 1*

discharge, is pumped to a community force main and transferred to a tertiary polishing system – this used to assure best possible quality to avoid any pollution of Lake Tahoe.

Geoff Hall, operator of Tahoe Park sewage plants remarked that cooperation of ***Cromaglass*** technical and service personnel for trouble-shooting was primary to his overall satisfaction with the product.

Engineer for the project was Joe Cyphers.



Geoff Hall, operator of Lake Tahoe sewage systems, observes Model CA-15 at Spooner Lake.

Treatment unit located under walkway at entrance to Visitor's Center.

CROMAGLASS PROVEN EFFECTIVE FOR DENITRIFICATION

A recent study of ***Cromaglass*** denitrification installations found ***Cromaglass*** could consistently provide effluent with less than 10mg/L total nitrogen for residential wastewater. This study covered ***Cromaglass*** installations processing 300-11,400gpd of wastewater with a typical influent total nitrogen of 50mg/L. The average total effluent nitrogen was 6mg/L as shown in the table below.

INSTALLATION	FLOW mg/L	TOTAL N gpd
Jack Watters	300	7.6
Christ Wesleyan	1,900	5.6
Cozy Lake School	4,830	3.8
Sacred Heart of Mary	5,000	8.0
Sunrise	10,500	3.4
Greenview Court	11,400	7.5
AVERAGE		6.0

Greenview Court is a senior luxury rental community located in Suffolk County, Long Island, NY. (see ***Cromaglass*** *Digest* for Fall 1997) ***Cromaglass*** was specified as a wastewater treatment system because of its ability to provide denitrification to <10mg/L total nitrogen. In summer 1998 the Suffolk County Department of Public Works (SCDPW) wished to verify the denitrification performance of the Greenview Court ***Cromaglass System***. A one-week study was done by the SCDPW that tested every discharge (one every four hours) of the ***Cromaglass System***. The SCDPW study found the ***Cromaglass System*** highly effective at denitrification with effluent averaging 2.7mg/L total nitrogen.

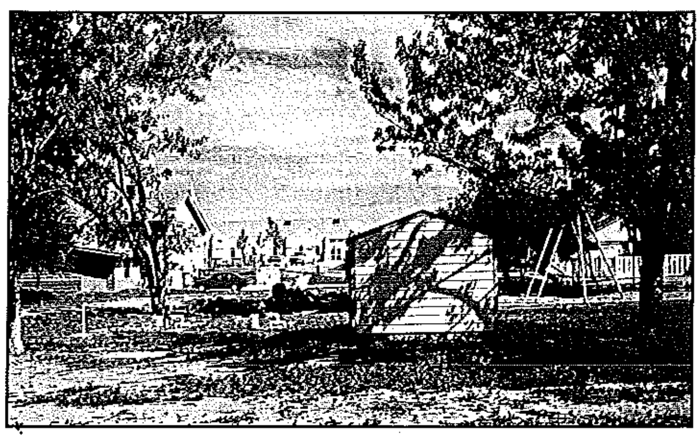
Cromaglass provides denitrification using a patented process. With this, effective denitrification first requires proper aerobic treatment of the wastewater to convert wastewater ammonia and nitrogen to nitrate called nitrification. Nitrate is then converted into harmless nitrogen gas during the denitrification cycle in the ***Cromaglass Batch Treatment*** process. ***Cromaglass Treatment Systems*** are effective in both nitrification and denitrification because of controlled process conditions in the ***Cromaglass*** reactor. This reactor provides excellent mixing and a more constant temperature environment for the bacterial nitrification and denitrification action to occur.

Denitrification or nutrient removal is the need in densely developed areas served by both onsite wastewater treatment and drinking water wells. Many engineers specify ***Cromaglass*** when they have a need for denitrification.

PROCESS BENEFITS COLORADO CHURCH PROPERTY

After researching several wastewater treatment systems, their effectiveness, ease of operations, and other assets the project engineer decided upon the design using two (2) Model CA-50 modules treating 7,500gpd modified and programmed for the denitrification option. Denite was a major requirement to meet groundwater limits that have been placed on the location for total nitrogen content. As a result of higher quality effluent than available from conventional sewage systems the subsurface drainage field could be of a smaller square footage than normally required. This created not only a cost savings, but use of a smaller property. Choice for design of ***Cromaglass*** was important also to decrease in noise and eliminate odors normally associated with conventional sewage plants (due to closeness to building and on campus playground the area had to be noise and odor free). The addition of a ***CromaWatch*** monitoring component was another important factor in choice for the overall system. Bill Young of ***Cromaglass*** handled the start-up of the system in early December 1998. The ***CromaWatch*** monitoring has alerted personnel on two occasions in August and September 1999. On both occasions a high water alarm revealed leaking valves in restroom fixtures.

Consulting Engineers: Drexell Barrell Co., Boulder, CO; Prime Contractor: Calcon Constructors, Englewood, CO; Sub-Contractor: Tierdael Construction Co., Denver, CO; ***Cromaglass*** Representative: Dick Conant, Rucon Enterprises, Albuquerque, NM; Treatment System: ***Cromaglass Sequential Batch Reactor***.



Two 5,000gpd - Cromaglass Denite Systems at Sacred Heart of Mary Church, Boulder, CO.

NEW INSTALLATION AND OPERATIONS VIDEO

Just received from our Video Department is an "onsite" production of recommended procedures to follow for Installation and Operation of ***Cromaglass Systems***.

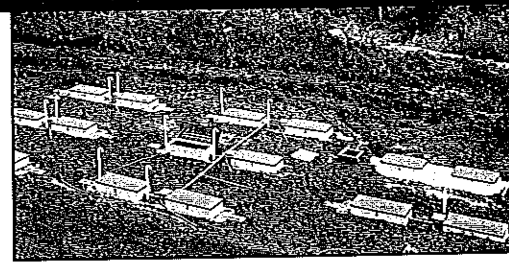
Please contact the ***Cromaglass*** Central Office in Williamsport, PA for initial copy.

CENTRAL AMERICAN HOSPITAL AND *CROMAGLASS*

Bordering Panama in Central America is the lush country of Costa Rica. Known for its banana and coffee crops, Costa Rica's economy is highly dependent on sugar and exotic hardwoods.

The government of Costa Rica is quite progressive and as such has encouraged, among other matters, their medical care. Construction of facilities such as CIMA Hospital in the capital city of San Jose is part of this process.

HOSPITAL CIMA SAN JOSE



CIMA Hospital is a seven-story private hospital with 230 beds. Requirement for a wastewater treatment system led to ***Cromaglass*** distributor, Tempest Environmental, and its representative Gonzalo Monge Rodriquez who provided most of the technical and engineering needs. ***Cromaglass*** representative, Richard Kaari, and ***Cromaglass*** engineering staff assisted with sales and specification details.

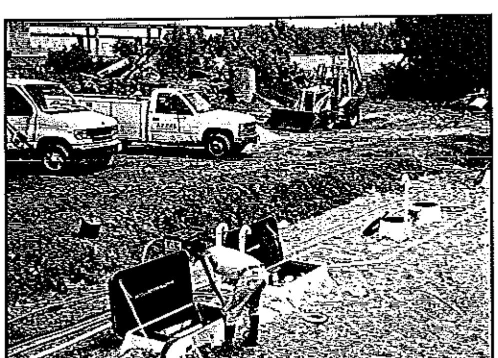
A 45,000gpd (170.5 cu.m.) ***Cromaglass*** SBR processing system was designed consisting of three Model CA-150 (15,000gpd) modules, one 5,000 gal. Sludge Processing Tank and one 3,000 gal. Chlorine Contact Tank.

This total system was installed and tanks interconnected in time for the arrival in October 1999 of Vice President, Bill Young, to make a final inspection and start-up. Included was the Program Logic Control unit (PLC) and operator interface that is used for easier more efficient processing. Young commented that due to a hillside location the site required extensive excavation and a retaining wall. Final water discharge is directed after disinfection to an existing river course.

BALTIMORE, MD MUNITIONS SITE RESTORATION

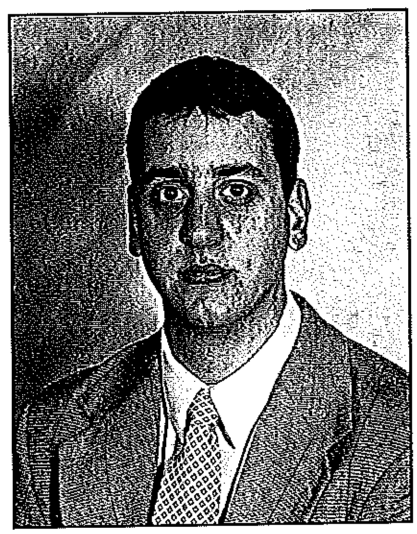
Wastewater equipment supplier, Shafer Troxell Howe of Gaithersburg, MD was asked to provide a treatment system for a manufacturing plant located in Curtis Bay, MD. Bordering the Chesapeake Bay and in eyesight of the Key Bridge this property required remediation from extreme soil pollution.

Contractors, Appel Construction Company, installed a ***Cromaglass Wastewater Batch Reactor System*** including process tank, sludge wasting unit and chlorine disinfection tank for discharge to the bay. Commissioning was assisted by ***Cromaglass*** factory technicians to assure regulatory compliance. This is another example of how the ***Cromaglass*** marketing program enables its distributors to make pollution abatement possible on land believed to have no value.



Cromaglass 3,000gpd system, 1,300 gal. Sludge Processing Tank, 750 gal. Chlorine Contact Tank. Note: Chesapeake Bay and Key Bridge in background.

ENGINEERING AND SALES STAFF ADDITION



Joshua Gliptis joined ***Cromaglass*** in July 1999 after receiving a Bachelor of Science degree in Geo-Environmental Engineering from Pennsylvania State University. The Geo-Environmental Engineering program was created in 1993 at Penn State to meet the increasing demand for qualified engineers in the field of pollution control and abatement. While majoring in Geo-Environmental Engineering, Josh focused on wastewater and land remediation. Josh wrote his thesis on remediation of acid mine drainage using Successive Alkalinity Producing Systems (SAPS).

Primary responsibilities of Josh within the ***Cromaglass*** organization will be for increased technical support in an expanding computer capability and significantly the realm of sales marketing.

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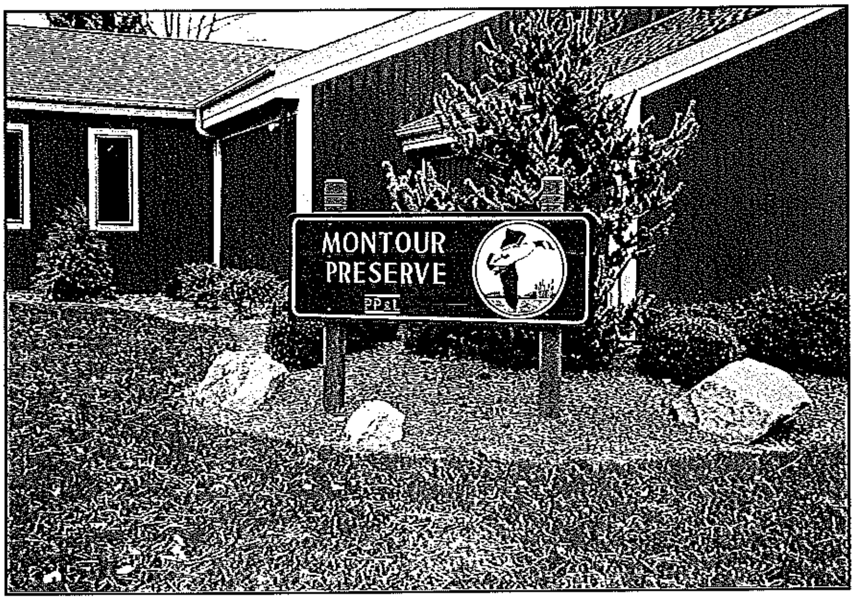
Vol. 13 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL JANUARY 1999

ENVIRONMENTAL CENTER COMBINES NATURE WITH *CROMAGLASS*

Montour Preserve is a wildlife habitat established by PP&L, Inc. to demonstrate for the public how nature's animals, plants, and water interact to complement one of our nation's most efficient electric power producers.



Among over 200,000 visitors a year are groups of children from 20 school districts, clubs, and others of the public who are invited by PP&L, Inc. to tour this environmental center located in North Central Pennsylvania near the town of Turbotville and within eyesight of the large coal fired electric generation plant.

Officials from the Pennsylvania Department of Conservation and Natural Resources joined with PP&L, Inc. to dedicate a major addition to the Preserve's visitor's center. Expansion was made possible through a $186,000 grant from the State assisted by Montour County, which also funds programs at the center. Included with the expansion is office space for the North Central Pennsylvania Conservancy, a key element to natural conservation in the State. Operations of the center are directed by Kevin Drewencki, Land Management Superintendent.

An adjunct to the environmental demonstrations is a new wastewater treatment and recycling system. Designed in conjunction with ***Cromaglass Corporation*** engineering staff; this system, based on sequential batch reactor processes, is able to overcome the varying wastewater flows found in a facility such as the Montour Preserve whereby large groups of people attend two or three times per week. This type of use generates biological as well as hydraulic surges that have been proven to be processed efficiently through the use of ***Cromaglass Systems***.

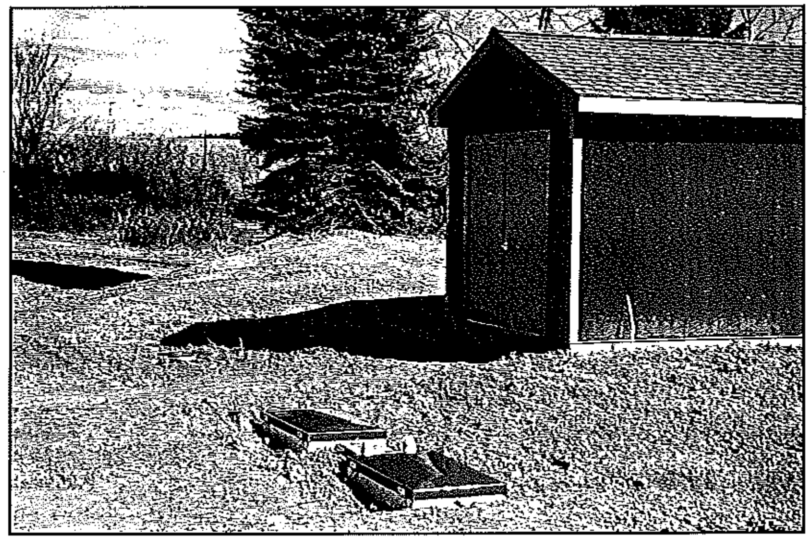
PP&L, Inc. purchased a ***Cromaglass*** 3,000 gpd capacity system following design by the PP&L, Inc. engineering and technical services group directed by Mr. Paul LeMenager, P.E., Senior Engineer, Civil and Environmental Programs with offices at corporate headquarters in Allentown, Pennsylvania. This total wastewater recycling process includes special automatic

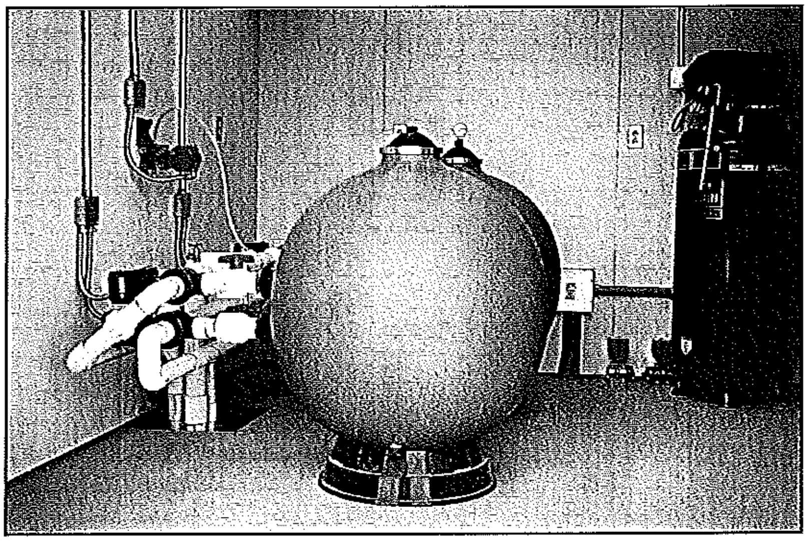
Continued on page 2

Treated water is directed throughout the cells via 2" PVC perforated laterals and included with the computerized network utilizing PLC (Program Logic Controls) are water level sensors located within vertical 8" PVC access ports (pneumatically operated to sense water levels in the cells).

ENVIRONMENTAL CENTER COMBINES NATURE WITH CROMAGLASS _Continued from Page 1_

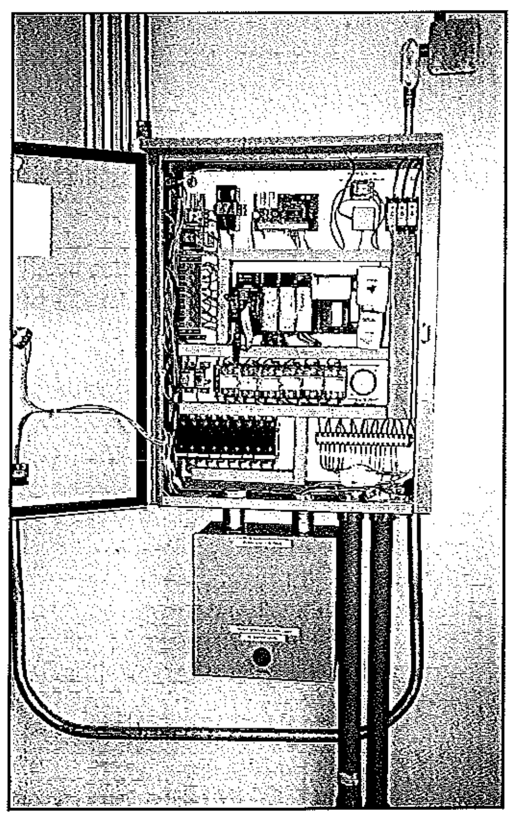
backwash filters, disinfection, and final discharge to constructed artificial wetlands. The artificial wetlands consist of three cells of 18 ft. x 48 ft. each. Two of the cells contain crushed limestone obtained from the local area and the third is filled with bottom ash from the Montour power generating plant. Final design of the artificial wetlands specified several types of plant species transplanted from wetlands nearby. These are utilized to provide maximum nutrient uptake and final polishing of the treated effluent prior to release. Effluent volume will be substantially reduced by evapo-transpiration activity. From the wetlands water percolates to the existing ground-water table. A large reservoir, Lake Chillisquaque, located nearby is a manmade recreational lake built by PP&L, Inc. to supply emergency backup water for the coal-fired steam generating plant.

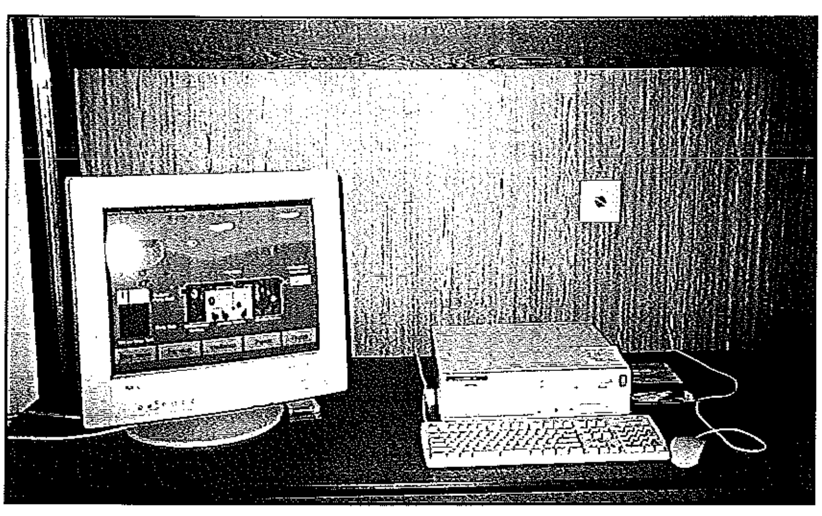




One of the more interesting features of the Montour Preserve wastewater recycling system is a "state-of-the-art" remote monitoring unit by which most aspects of water quality and performance integrity can be determined "at will" by engineering staff. Frank Lyter, senior engineer, PP&L's technical services group, designed the wastewater treatment plant remote monitoring system. This system is used as an educational display for the general public during their visits to the Montour Preserve Environmental Center. The remote monitoring system is also used operationally to monitor, and in some instances, control the treatment system from about 100 miles away at company headquarters. Finally, it has the ability to historically track water levels, pump operation and alarms to permit remote monitoring and troubleshooting.

These factors of design for the treatment system supplemented by effluent recycling through an artificial wetland were carefully considered by PA DEP when reviewing application for the required permit.





MT. PLEASANT MILLS REVISITED

Expansion Made Easy

Contractor/developer Carl Schaffer desired to provide new homes for a rural community in North Central Pennsylvania where septic systems were not acceptable due to poor soils. Fortunately, his property location was close enough to the Village of Mt. Pleasant Mills that a sewer line extension could be made to the ***Cromaglass Wastewater Treatment System*** the community had designed and constructed back in 1988. (See ***Cromaglass Digest*** Vol. 5 #2, Winter 1989.) The local Perry Township sewer authority agreed to the addition to their facilities if Mr. Schaffer would assume responsibility for having the engineering and state permitting accomplished plus paying costs for the treatment plant addition.

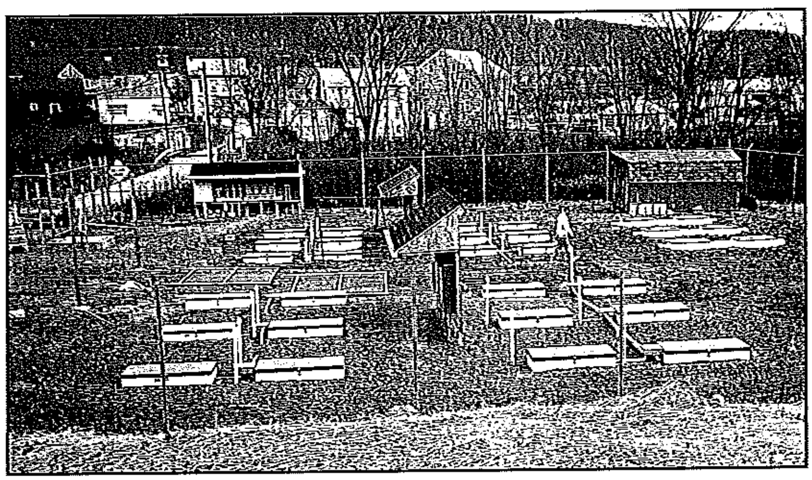
This latter requirement was not difficult due to basic design of a ***Cromaglass*** Modular Sequential Batch Reactor System, which enables easy addition and connection of tanks and controls for more capacity.

The sewer authority's 10-year experience with the initial ***Cromaglass*** installation proved the reliability, performance and relative ease of operation. This plus the approval of PA DEP based on this project's performance history, convinced all parties that expansion with additional ***Cromaglass*** modules was the obvious solution.

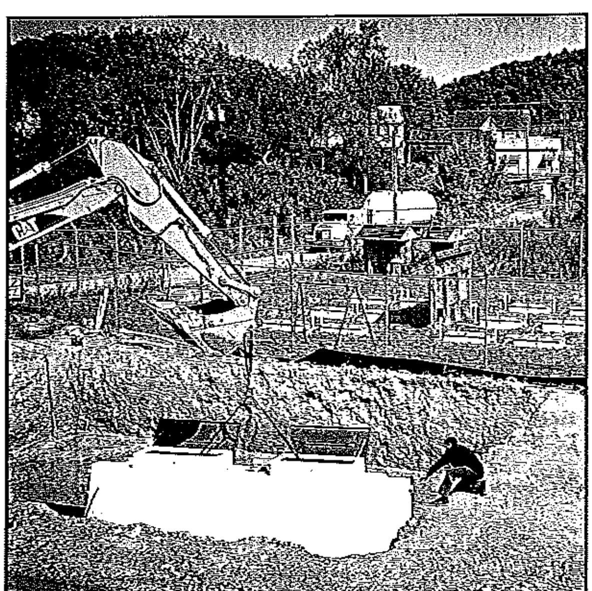
Timely response by ***Cromaglass*** manufacturing and the ease of installation of the treatment system modules met the installation schedule set by the contractor.

John Bickhart, Engineer, designed the required system and submitted the application to PA DEP who promptly issued the permit for expansion. Included were two ***Cromaglass*** CA-120 modules - additional disinfection capacity was not required since the original system built in 1988 had adequate capacity. Disinfection is required since treated effluent is discharged to a small stream, which flows through the property. Provisions to add one additional CA-120 module have also been provided, to be utilized when needed.

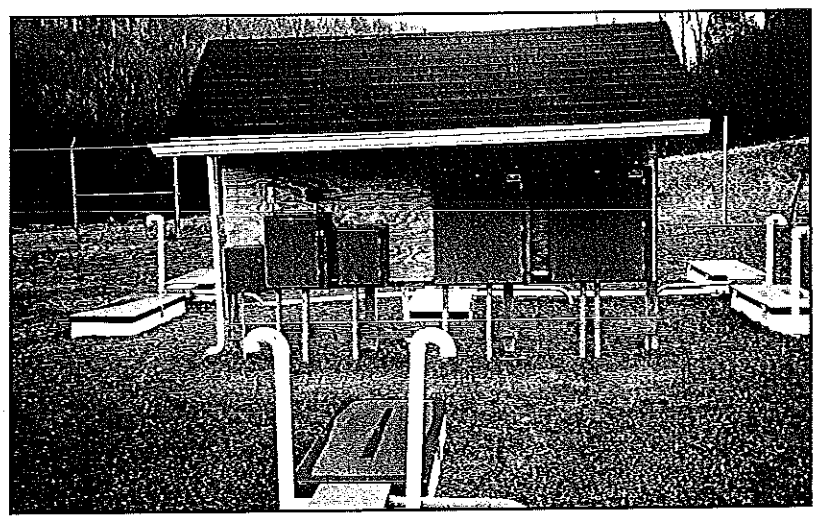
An important item for the speedy DEP review was the familiarity of the agency staff engineers with ***Cromaglass*** design performance history, and reliability. Several permitted installations of varying capacities have had frequent monitoring by DEP over many previous years.



***Mt. Pleasant Mills** - the old - and new. System installed in 1988 (shown in background) has capacity of 36,000 gpd. New capacity of 24,000 gpd has been installed in October 1998 and includes a 5,000 gal. each sludge processing tank and equalization tank.*



Tank modules being delivered and lowered into excavation. (Note: lifting device)



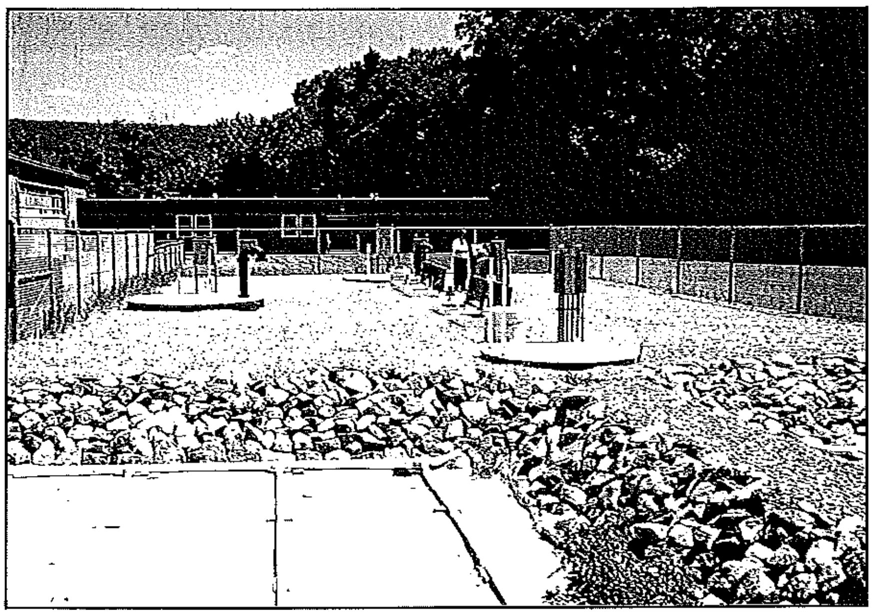
***Control System** - new 24,000 gpd modules*

RURAL N.J. SCHOOL OVERCOMES ENVIRONMENTAL RESTRICTIONS WITH *CROMAGLASS* DENITRIFICATION SYSTEM

For many years ***Cromaglass*** has been providing wastewater treatment systems to meet the very strict environmental standards prevailing in the State of New Jersey.

Particularly sensitive have been the locations with many small lakes such as found in rural areas of North Central New Jersey. One of the biggest factors involved is the reduction of pollution for the lakes and drinking water supplies for the area. Previous newsletters have detailed several engineered systems utilized in projects of Central and Northern New Jersey.

One of the more recent ones is located at a rural school in the Oak Ridge area just west of Interstate 287. Cozy Lake Elementary School utilized the engineering services of Stetler & Guldin Engineering, Inc. to design a sewage treatment system, which would most satisfactorily meet requirements of the New Jersey regulatory agencies.



Cozy Lake School with Model CA-100 batch treat denitrification system, influent pump station, supplemented by surface type sand filter used to meet groundwater standards.

As a result, Mr. Tom Guldin, P.E., worked with the ***Cromaglass*** distributor, American Pump Systems, Inc. to meet the specifications and install a ***Cromaglass*** denitrification system with sequential batch reactor process. Joe Poster of American Pump cooperated carefully with P & H Construction Company who was chosen to install the system.

The difficult factor involved with the system design reflected wastewater flows in actuality which were much lower than those for which the equipment was originally designed per NJ DEP requirement (4,800 gpd design and actual of 1,000-1,500 gpd).

A ***Cromaglass*** Model CA-100 denitrification system as installed has been operated by Bigler Associates of Ridgefield Park, New Jersey. Careful monitoring of the operation has been made by Dan Alesandro who has been operating the system with results on efficiencies as found on this chart.

Typical Influent Value for Total Nitrogen is 50 mg/l.

Cromaglass **equipment is one (1) Model CA-100 with denitrification**

Date	Avg. Daily Flow Rate gpd	Max Daily Flow Rate gpd	Total Nitrogen mg/L
Aug. 97	491	2190	3.8
Sep. 97	694	2383	4.3
Oct. 97	857	3493	2.1
Nov. 97	1233	1638	3.1
Dec. 97	951	1394	3.3
Jan. 98	1171	1625	2.9
Feb. 98	1140	1718	2.0
Mar. 98	1432	1532	2.0
Apr. 98	1000	2356	2.7
May 98	1565	1743	8.2
Jun. 98	1014	1855	6.7
Jul. 98	591	1284	1.9
Sep. 98	491	2190	3.8
Oct. 98	857	3493	2.1

With total nitrogen averaging on a monthly basis of 1.9mg/L low to a high of 8.2mg/L this is a substantial reduction from the influent averages of 50mg/L.

It should be understood that the ***Cromaglass*** denitrification process operates in a modular tank system without the use of any supplementary tanks or hazardous chemicals.

Technical consultants have advised that the ***Cromaglass System*** has performed extremely well under the prevailing type of flows and can be favorably compared to any other process available.

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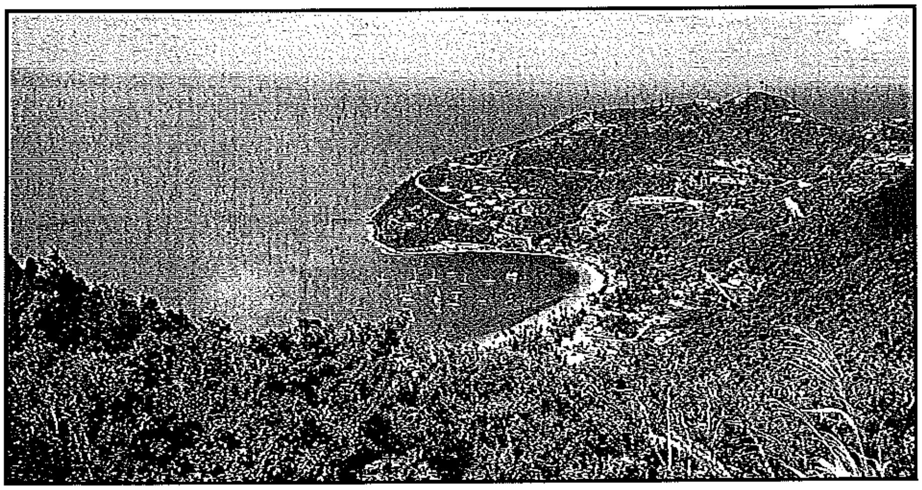
Vol. 12 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL JANUARY 1998

COST EFFECTIVE WASTEWATER COLLECTION AND TREATMENT COMBINED FOR SMALL COMMUNITY POLLUTION PROBLEMS



Cromaglass Corporation and ***Myers Wastewater Pump Systems*** have cooperated on design and supply of a total sewerage system that will utilize both firm's technical capabilities for collection and treatment of wastewater where topographical and environmental conditions make large municipal type wastewater treatment facilities not feasible.

CANE GARDEN BAY

The ***Cromaglass*** and ***Myers*** alternative provides a solution for wastewater management problems in small communities such as Cane Garden Bay in the beautiful British Virgin Islands.

Installation has been made where a pollution free environment is critical to the businesses and livelihood of the area's population.

Over many years several hotels, restaurants, and residential housing structures utilized septic tank/drainfields for sewage disposal. However, in the peak tourist season of February 1997 beachgoers and tourists were diverted to other beaches due to high bacterial count of the naturally pristine blue waters of the Bay off the Caribbean Sea.

To provide a response for this sanitary and health compromising situation a Washington, D.C./ British Virgin Islands based company, Caribbean Basin Enterprises, combined the expertise of ***Cromaglass*** and Joe Poster of American Pump Systems, Inc., ***Myers*** pump distributor, for the processes necessary to complete the collection and treatment programs.

Projects of this type have three main components – the collection equipment, the pump stations, and the wastewater treatment equipment. Overall the plan for this small community wastewater collection and treatment program was to initially calculate necessary grade levels to enable best possible placement of the wastewater collection lines and pump stations which is determined by high groundwater conditions found along a flat expanse of beach area surrounded by suddenly rising hills and mountains.

Engineering personnel from ***Cromaglass***, ***Myers***, and the contractor determined on site grade readings and this information was communicated to the ***Myers Pump Company*** offices where a complex computerized program permitted fast design for the collection and pumping system.

A special feature of this Virgin Islands project was the speed with which the design, equipment delivery, and installation was accomplished.

Time limits were mandatory due to the seasonal conditions for peak tourist arrivals. Accordingly, the British Virgin Islands government issued the contract fixing March 31, 1998 as the completion date.

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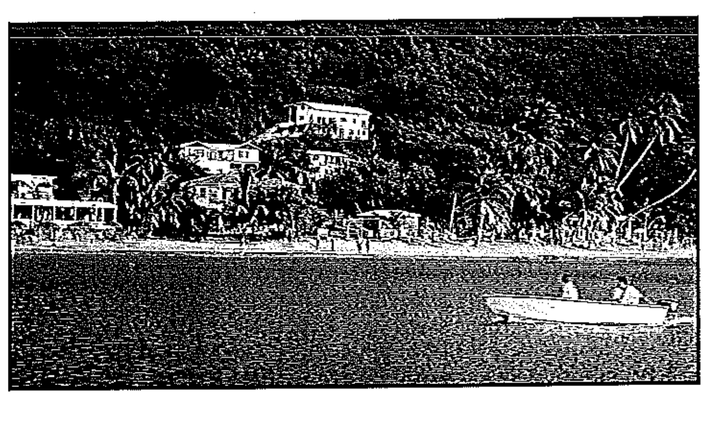


CANE GARDEN BAY

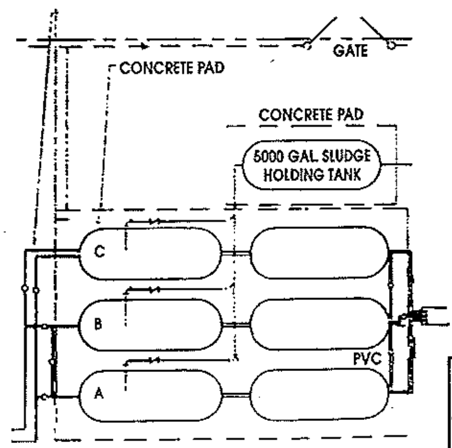
Continued from Page 1

Site preparations were initiated with excavation and pouring of concrete base pads on which the ***Cromaglass*** Batch Treat Tanks would be located.

DESIGN FLOW:
40,000 GPD

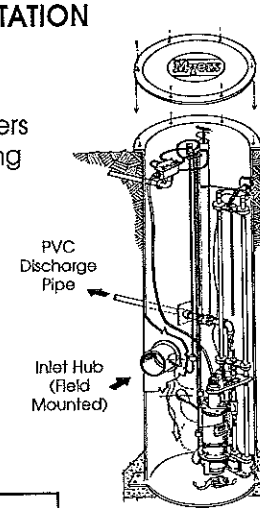
TREATMENT SYSTEMS:
Three (3) ***Cromaglass Modules***

DISINFECTION PROCESS:
One (1) FRP Chlorine Contact Tank each with 5000 gallons capacity erosion feed – solid Chlorine



PUMP STATION

As a result of a cooperative effort between manufacturers of wastewater handling and treatment componentry and a well established contactor, this small community has obtained a cost effective, environmentally proven system for pollution abatement.

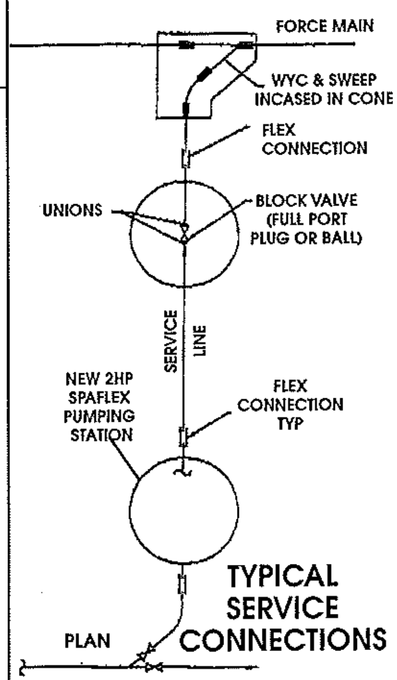


The ***Myers*** wastewater collection system, as supplied by American Pump Systems, Inc., is a low pressure collection process including gravity sewer lines from the buildings to each of 34 fiberglass pump stations. From here, 3" force mains transport wastewater to a splitter box located in front of the ***Cromaglass*** treatment modules, which divides the wastewater flow evenly among the three 15,000 gallons per day treatment modules.

Next step was to transport tanks from port to the limited access beach area and the placement of tanks on location.

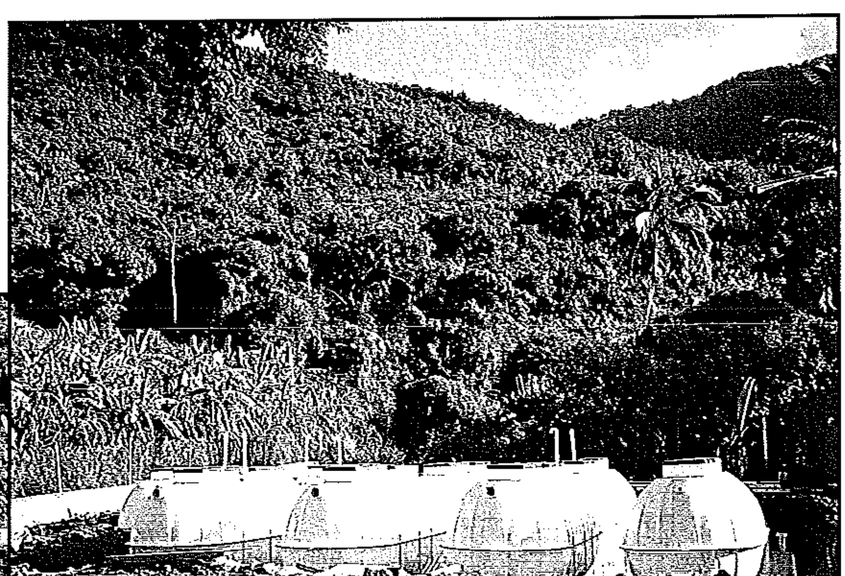
Stainless steel tiedowns are utilized to secure the systems to the concrete pads to eliminate potential flotation problems. All electrical connections are made between the control panels and the junction box. Internal system wiring is pre-installed at the factory. When the fiberglass tanks have been stabilized onto the base, connections between the tank sections are made with PVC piping – 6" size for the bottom of the tanks and 2" at the top which are used for water flow between tanks. Finally, backfilling of the tanks is made utilizing select local materials.

Since the ***Cromaglass*** treatment systems, by government choice, are located on public school property it was a pre-requisite that there be no distracting noise or offensive odors.

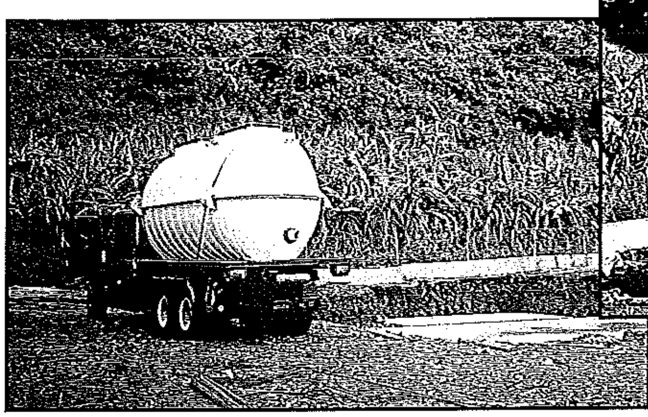


Treated wastewater effluent from ***Cromaglass*** systems can be pumped through a filter system and disinfection componentry to provide recycle or reuse capability and quality.

For the Cane Garden Bay project local authorities have the option of recycling the treated water for irrigation in the area; distribution for reuse on neighboring community properties; or outfall to the adjacent Caribbean Sea.



Wastewater treatment system located on public school grounds.



Delivery of fiberglass module to site.

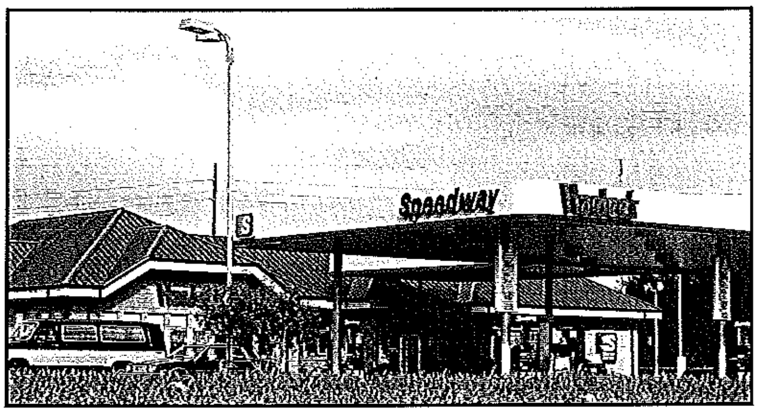
CROMAGLASS WASTEWATER PROCESS SYSTEMS SPECIFIED FOR FLORIDA COMMERCIAL PROPERTIES

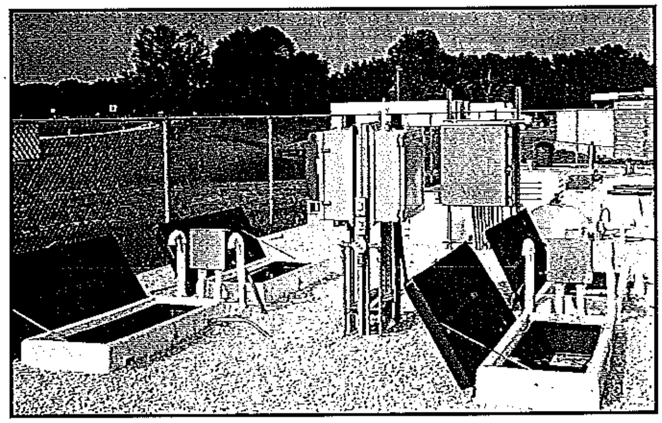
Being located outside of municipal sewage facilities in the State of Florida did not prevent commercial enterprises from meeting regulations for sewage disposal. Properties such as convenience markets and Interstate highway service plazas have found their solutions with consulting engineers specifying ***Cromaglass Batch Treat Systems.***

Their decisions were based upon the proven technology in SBR units where fluctuating hydraulic and biological loading can be controlled to provide effluent qualities to meet necessary disposal or reuse standards.

SPEEDWAY SERVICE CENTER

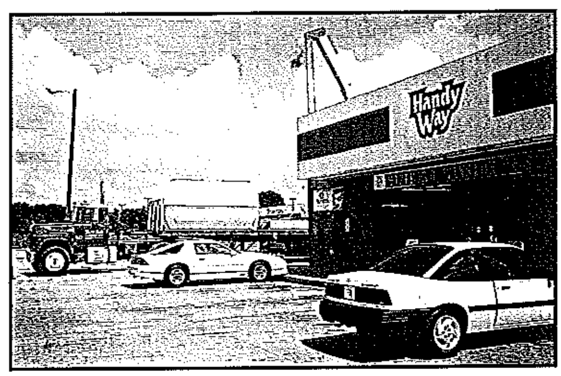
Interstate 75 is a main transport artery through Florida leading to both West and East coasts – thus car and truck traffic are heavy requiring a major refueling and service hub. *Speedway* and *Hardees* combined near Ocala for a major center which found wastewater treatment a serious concern.



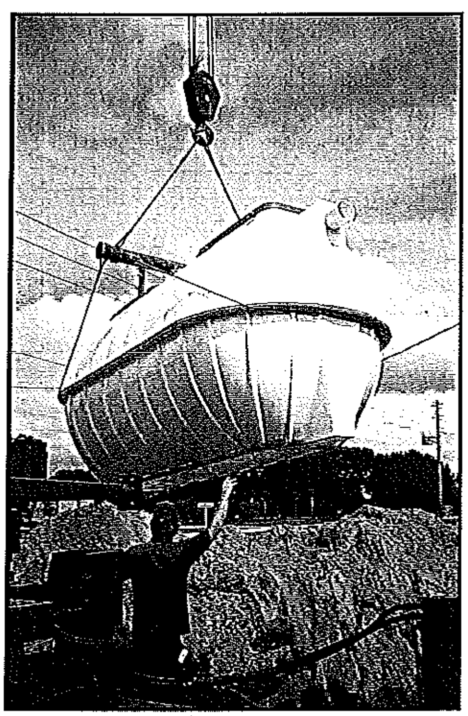


As a result their engineers, working closely with Gerber Pumps, Inc., utilized ***Cromaglass Batch Treat Systems*** as the major component in their wastewater management program. Following biological treatment and disinfection, effluent is pumped for state approved drip irrigation on a fenced grass field bordering the truck parking area.

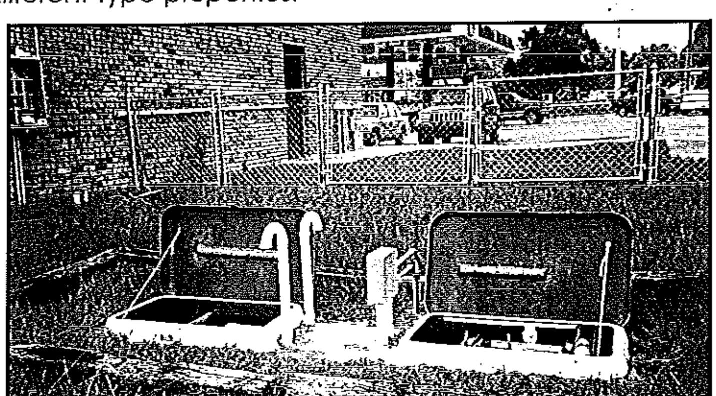
HANDY WAY



Convenience stores often find their best locations outside of cities with available sewerage facilities where wastewater is collected and treated by the millions of gallons. But, what can be done when the only options are septic tanks that won't work due to poor soils and high water table?

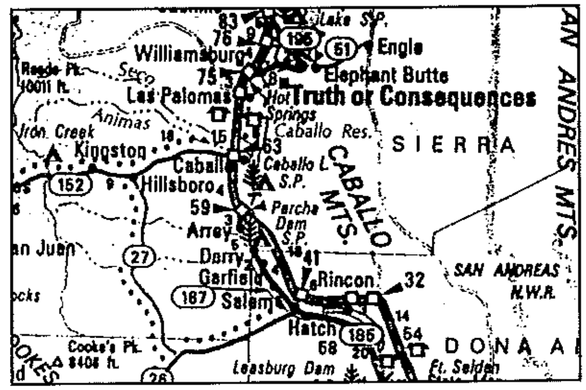


Handy Way headquartered in Crescent City, FL found their solution with Gerber Pumps, Inc. of Winter Park. A longtime ***Cromaglass*** representative, Bert Gerber, helped design a system similar to those he had provided for State Parks, hotels, and other different type properties.



Sizing on this type of use was important – thus a 3,000 gpd batch process unit was chosen. The system operator is a Mr. R. White and the effluent disposal system is by subsurface drainage using Infiltrators.

NEW MEXICO STATE PARK SELECTS CROMAGLASS



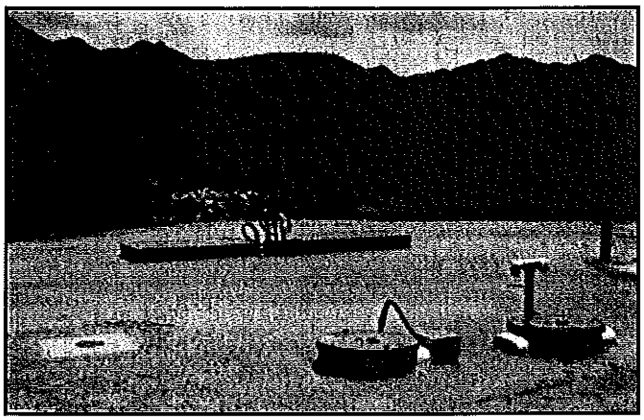
Caballo State Park chooses a ***Cromaglass CA-60 Wastewater Treatment System*** with denitrification and a 1,300 gpd Sludge Processing System for its Riverside Campground.

The system was chosen because of its ability to produce a high quality effluent with low nitrates.

Site location is in close proximity to the campground so noise and odor were considered by Earl Backenstow, Engineer for the New Mexico Parks and Recreation Division and Phil McClelland, Park Manager.

Caballo State Park borders the Rio Grande River in South Central New Mexico and Caballo Lake is a reservoir behind an earthen dam with Riverside Campground below the dam.

Influent from the campground is sent to the system via a lift station. Normal effluent discharge is to a subsurface drainfield and valving is set up to divert some of the discharge for irrigation.



Excess sludge can be diverted to the Sludge Processing System for further aeration.

Decanted sludge can then be diverted either to a holding tank for eventual hauling or returned to the comminution chamber of the CA-60 for normal processing.

This feature gives park maintenance the much needed flexibility for sewage handling and processing for the heavy load influx during long holiday periods.

Cromaglass representative, Dick Conant, through his company, Rucon Enterprises, has very diligently assured that this park treatment system has been designed, installed, and operated with the same integrity as demanded of all ***Cromaglass*** products.

TEST RESULTS PROVE *CROMAGLASS* SUPERIORITY

As described in the Fall 1997 ***"Cromaglass Digest,"*** Greenview Court, a luxury senior rental community is utilizing the patented ***Cromaglass*** Denitrification Wastewater Treatment Process. The results of the most recent monthly tests are illustrated below. These results confirm the effectiveness of this technology with reduction of total Nitrogen of 98%.

Performance evaluation programs have demonstrated the excellent efficiency of ***Cromaglass Batch Treat Systems***, but recent field operating tests prove the point, that if operated effectively these systems are difficult to match.

Analysis of standard parameters is important but the ability of the equipment process to meet special tests is exceptional. ***Cromaglass*** has met the test by obtaining better than required field results from its denitrification process.

One instance of these "on location" studies has been in Suffolk County, Long Island, New York where the county and state have carefully monitored ***Cromaglass*** systems installed nearly one year ago. Key factor of approval in the county is the ability to provide an effluent quality with a maximum total nitrogen of 10 mg/L – thereby protecting the subsurface water table and drinking water drawn from wells. Following fine tuning to program controls, on-site sampling has provided results as tabulated.

DATA: GREENVIEW COURT		**DATE: 11/30/97**
Parameter	**Influent Values**	**Effluent Values**
Ammonia as Nitrogen (N)	95.6 mg/L	2.23 mg/L
Nitrates as N	<0.01 mg/L	0.73 mg/L
Nitrite as N	<0.01 mg/L	0.30 mg/L
Organic N	12.4 mg/L	1.45 mg/L
Total Kjeldahl N	108 mg/L	3.68 mg/L
Total Nitrogen	108 mg/L	4.71 mg/L
BOD_5	302 mg/L	12 mg/L
TSS	162 mg/L	26 mg/L
Alkalinity	42 mg/L	
pH		7.1 mg/L

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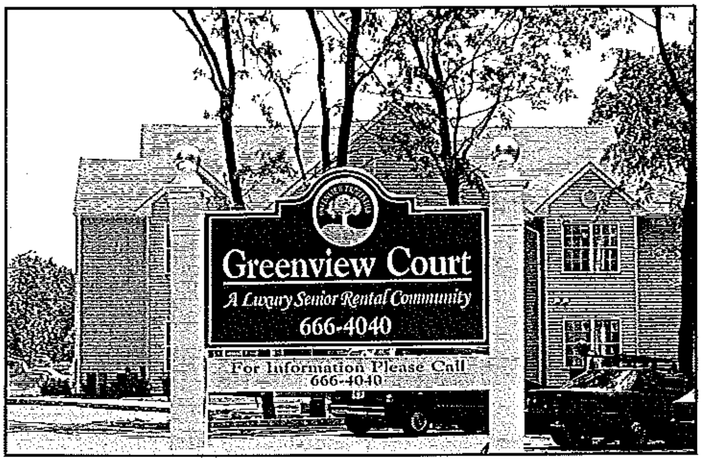
THE Cromaglass® DIGEST

Vol. 11 No. 2 ADVANCED RESEARCH FOR POLLUTION CONTROL FALL 1997



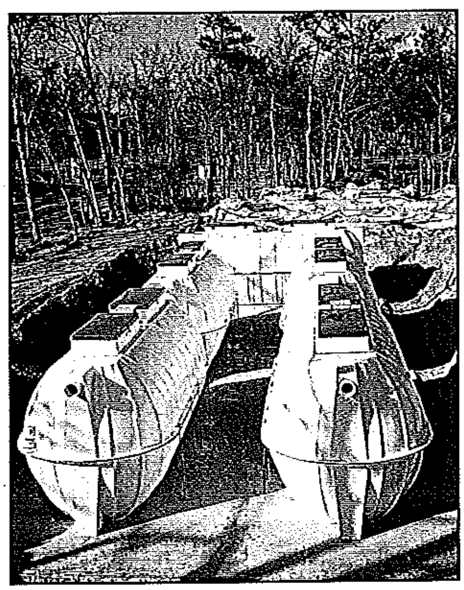
MEETING LONG ISLAND RESTRICTIVE ENVIRONMENTAL STANDARDS

A narrow strip of land stretching along the Atlantic Coast from New Jersey to Massachusetts, Long Island, NY provides a unique access to millions of residents of neighboring states, not only for permanent homes, but also vacation and recreational facilities.

This area, however, provides municipal treatment only in population centers. With low population density and flat topography, large municipal plants are not financially feasible. All drinking water for the Island's 3 million residents, and visitors, comes from underground aquifers, but because of concerns of elevated nitrogen levels in the ground water, county and state mandates have forced engineers to search for alternative wastewater solutions other than septic tanks. This was found in the form of ***Cromaglass Batch Treat Denitrification Systems.***

These patented process modules have been tested and monitored to reduce total nitrogen by up to 80%. As a result of inspecting operational systems in other New York State and Pennsylvania locations, Suffolk County and New York DEC staff personnel have now given permits for construction in their jurisdiction stretching for nearly 100 miles along an area previously served only by septic tanks or large tertiary sewage treatment plants.

The first contractor/developer to use a ***Cromaglass*** community systems program on Long Island was Larry Gargano (Greenview Properties) in his Greenview Court, a senior luxury rental community located in Oakdale, NY. Important in bringing these systems to the developer's attention was Jack Naylor, P.E. and the ***Cromaglass*** area representative, Lou Kircher and his company, E³ Environmental of Garden City, NY.



Mr. Naylor has had extensive experience with sequential batch reactor systems use in Long Island and is very well respected by regulatory offices. Due to difficulties with available treatment alternatives on previous projects, he researched the ***Cromaglass*** technology carefully by making visits to the manufacturing facilities and projects where these systems had years of proven performance. A strong advocate of solid state control systems, Engineer Naylor was impressed by the ***Cromaglass*** PLC system controller, and the ***CromaWatch*** remote monitoring program.

Specifications for the Greenview Court project included two (2) ***Cromaglass*** Model CA-120 Modules with denitrification componentry and one (1) 5,000 gallon aerated sludge processing tank.

Continued on Page 2

Cromaglass Enters the Information Age

We are proud to announce as our new home page location: **www.cromaglass.com.**

The site consists of product marketing materials, recent project descriptions, contact information, sales, and sizing details.

Please check out the site: use the Project Data Form to obtain sizing information for specific projects, or e-mail us at mailinfo@cromaglass.com to request more information or additional literature.

LONG ISLAND STANDARDS *Continued from Page 1*

On Long Island, a moratorium had been in place for projects developing less than 15,000 gpd as the technology available had proved to be inadequate to meet the nutrient removal (Total nitrogen <10 mg/L) requirement. This requirement has been in place since 1973 and the ***Cromaglass*** system was the first system deemed capable of meeting it. Approval by the state and county of these ***Cromaglass*** systems was an important element in removal of the building moratorium with limitations on nitrogen content of sub-surface groundwater having been established by water quality regulations of US EPA.

These same nitrogen regulations have led to increased ***Cromaglass*** installations in other states such as Pennsylvania, Arizona, Wisconsin, Massachusetts and Nevada. Included in the projects of these states have been state parks and several commercial/industrial properties.

This has then led to more freedom for the individual and overall construction industry, by allowing construction on sites previously closed to development.

LARGE CARIBBEAN RESORT HOTEL INSTALLS NEW BATCH TREAT SYSTEM

The Rex Halcyon Resort, rated one of the best hotels in Antigua, West Indies, made a decision to improve its sewage treatment system and as a result management contacted the ***Cromaglass*** representative for Antigua, Peggy Arrindell of Unique Water and Consolidated Services, Inc. Requesting a quotation they indicated a need for a new system that would enable them to reuse water for the large area of land that surrounds the hotel thus ensuring lush green lawns and plants.

Recognizing that this hotel which was originally built in the early 1960's had grown to the size of 210 rooms by 1994, Chief Engineer of the Rex Resorts along with the resident engineer of Halcyon, Mr. Barrymore Gordon, began talks with the ***Cromaglass*** representative and in early 1995 a decision was made to purchase the properly sized ***Cromaglass Batch Treat System.***

Equipment was ordered and delivered in the spring of 1995 and by July the installation of five (5) 12,000 gallons per day treatment modules had been completed. This provided for a total new capacity of up to 40,000 gallons per day – the flow expected from all sleeping rooms, restaurants, and laundry facilities.

Rex Halcyon Resort is located on one of the finest beaches in the Caribbean, Dickenson Bay, with not only swimming and water sports as an interest – but the guests also enjoy dining on the Warri Pier located over the beach and sea demanding an even more important pollution-free environment.

The five wastewater treatment modules were placed in a small grass field behind the hotel with the control systems mounted nearby in a utility room and set for automatic operation of the total system.

Feeding the fiberglass modular tanks is a special distribution component through which wastewater is evenly divided.

The treated water is pumped on a timed sequential basis to large concrete holding tanks for disinfection and storage. From there it is distributed into the property irrigation system with any excess water being pumped to a nursery containing fruit trees. This is another example of how a resort hotel has benefited from the ***Cromaglass*** wastewater management program.

POWERPLANT WASTEWATER TREATMENT

Cromaglass is well known for use at many public and private authorities – The Chesapeake Bay Bridge/Tunnel system and several state park installations are some examples. The largest and newest of these has been the Pagbilao electric powerplant in the Philippines. A few hours drive south of Manila, this large electric generating facility chose ***Cromaglass*** based upon knowledge of several similar type projects throughout the world.

CEPA/Slipform, contractors for many major projects in the Southeast Asia Area, contacted ***Cromaglass*** in December 1994 for costs on specifications for an estimated 60,000 gpd wastewater flow.

Cromaglass engineering staff worked closely with the purchasing group and its supporting personnel to meet specifications required of the owner/operators of the new powerplant located in an extremely rural area of the islands.

These batch treat modules were particularly well adapted to this type of project in which ease of transport and installation were significant. Fiberglass non-corrosive construction was another asset for the powerplant as protection against the nearby corrosive salt air environment.

Shipment was made from Pennsylvania to the Philippines in June 1995 by means of 40' containers – this being the most convenient and efficient means of handling products on the receiving end from port to job site. In addition, engineers indicate the ***Cromaglass*** modular concept has a special advantage in designing the total wastewater treatment system. Another benefit of going modular on the powerplant project was the ability to place a "split" sewage treatment system – locating two (2) ***Cromaglass*** 15,000 gpd modules plus the adequate sludge processing tank at the powerplant offices and shop, built on a small island, with two (2) similar modules placed at the staff housing quarters nearby.

A unique aspect of this powerplant project is that the electric source to run the treatment system is immediately available "on spot." The power is 480 volts, 3 phase, 50 cycle for which a transformer was used with the ***Cromaglass*** control system.

To assure that the treatment system is placed into optimum working condition, a ***Cromaglass*** technical representative visits the project site for training in operation and maintenance. Although some of these projects are in isolated locations around the world this service has proven to be very valuable for the ultimate customer.

PAGBILAO PERFORMANCE REQUIREMENTS

WASTEWATER CHARACTERISTICS

350 mg/L	inf.	BOD_5	eff.	30 mg/L
350 mg/L	inf.	TSS	eff.	30 mg/L

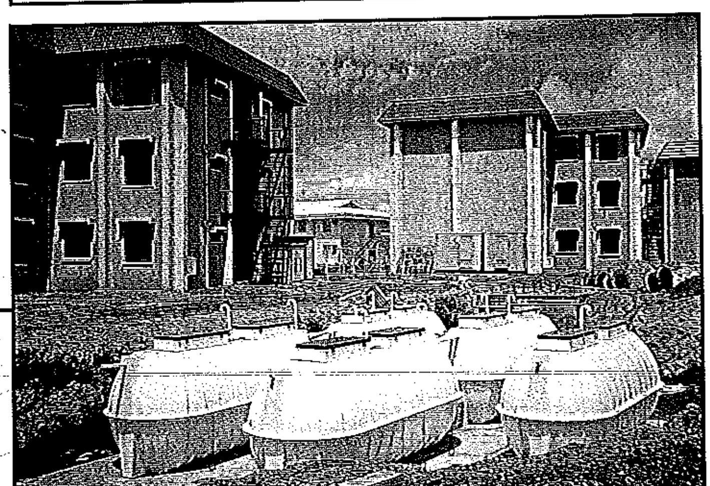
DAILY FLOW 2.7 L/S or 61,670 GPD

ENVIRONMENTAL AND CLIMATIC CONDITIONS

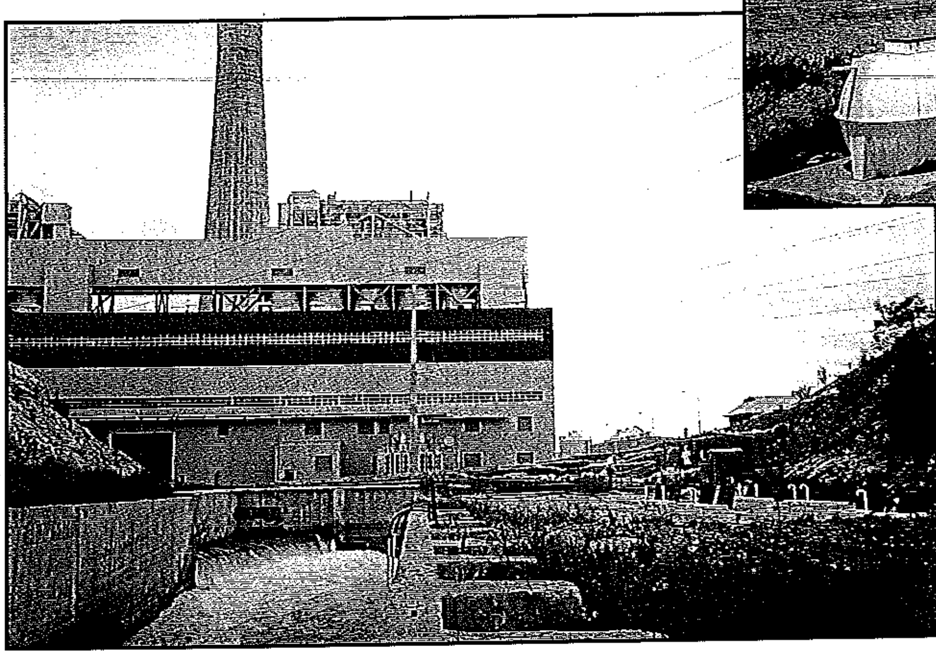
Temperature range: 10°C to 50°C
Relative humidity: 95°
Seismic conditions: Zone 4, earthquake area
Tank life: >30 years
Major parts life: 25,000 hours - 24 hr./day duty

ELECTRICAL SUPPLY

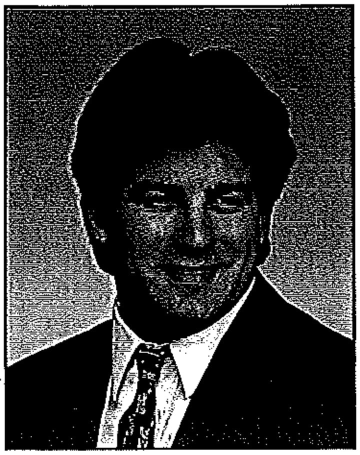
277/480v, 3 phase, 60HZ, 4 wire power supply



Pagbilao Treatment System located at Staff housing Quarters – Powerplant nearby. Two Model CA-150 Modules and 5,000 gallon sludge processing system.



An important supplement to the recent start-up of the Pagbilao plant was the efficient operation of a **Cromaglass** *batch treat system consisting of two model CA-150 modules and sludge processing system. Note treated effluent discharge to the cooling water flume (discharge pipes located on concrete wall at right).*



HIGHLIGHTING COMPANY STAFF

Quay Schappell joined Cromaglass in October 1996, following five years of cumulative engineering related work experience with two chemical and food processing manufacturers. During this time he studied for his advanced degree at Pennsylvania State University graduating as a Master of Engineering, Environmental Engineering. His thesis was written on Industrial Wastewater Pretreatment Systems. Quay received his Bachelor of Arts degree in Physics from Lycoming College in 1994. His honors included the National Physics Honor Society.

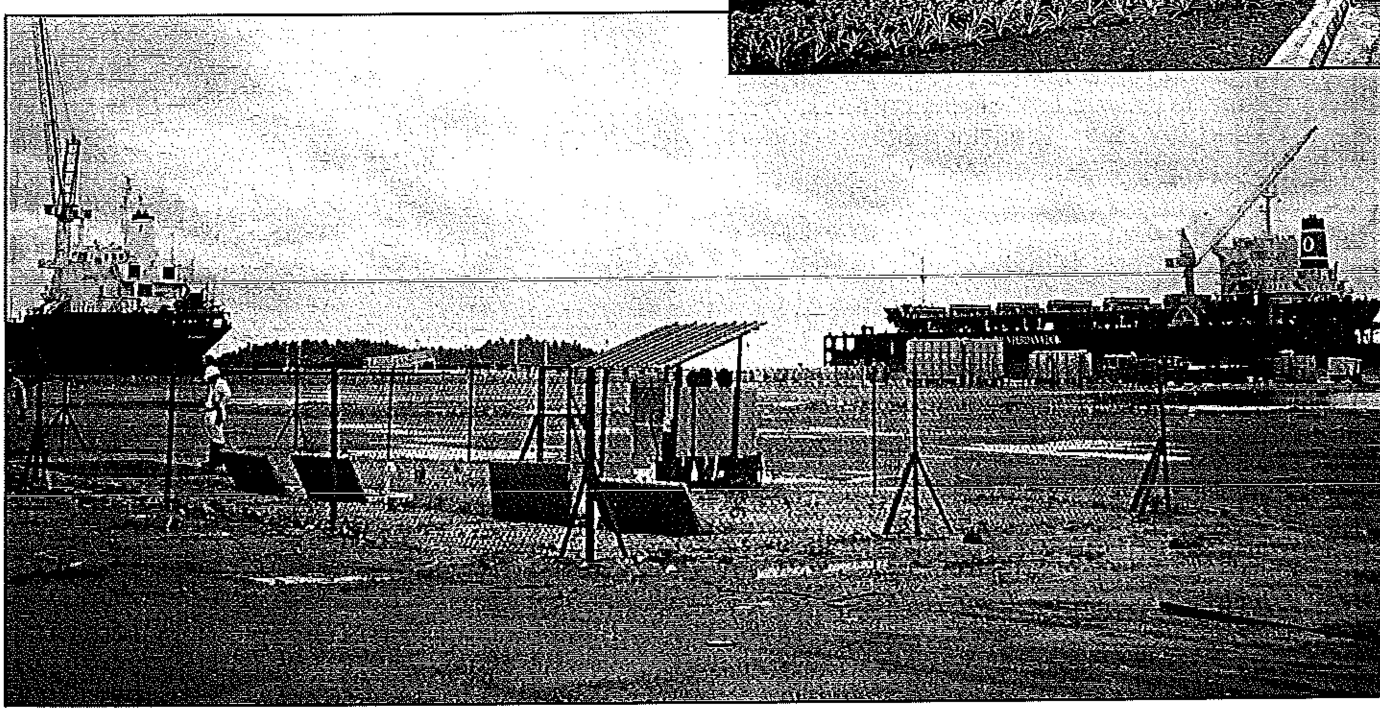
Continuing Cromaglass marketing programs for providing strong technical support to all its customers, Quay is readily available to discuss with engineers, distributors, and contractors any matters concerning specifications, installation, and particularly operation/maintenance of the company's products. Computer literacy is another strength with Quay. Please meet him through the phone, fax, or E-mail.

CROMAGLASS AT THE GATEWAY

Early world explorers made their voyages with stops for provisions at strategic locations – this need has not changed over the last two centuries.

One of the more important ports in the developing Far East is the Singapore area. In these times the principal cargo is oil – shipped in large super tankers bound for Europe, Japan, and the United States.

Naturally, these ships require service and maintenance provided by Sembawang Shipyard, a modern facility constructed on Karimun Island, Indonesia. Pollution control being important, a "state-of-the-art" ***Cromaglass Wastewater Treatment System*** was specified by the project engineers, Sam McCoy Engineering, Inc. of Singapore. This 12,000 GPD system was shipped from Pennsylvania in a 40' container with final installation and start-up by Bill Young, Vice President of ***Cromaglass*** (a service offered by the firm to all customers).



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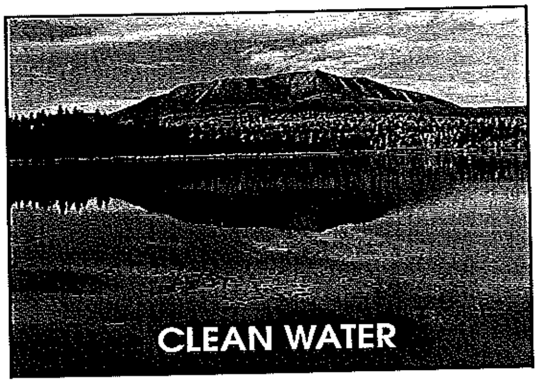
THE Cromaglass® DIGEST

Vol. 11 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL DECEMBER 1996


CLEAN WATER

WASTEWATER RECLAMATION MEANS POLLUTION ABATEMENT

With many communities throughout the world approaching or reaching the limits of their available water supplies, water reclamation and reuse has become an attractive option for conserving and extending these supplies. Water reuse may also present communities an opportunity for pollution abatement when it replaces effluent discharge to sensitive surface waters.

The U.S. Environmental Protection Agency, in recognition of the importance of water reuse, has published a manual titled "Guidelines for Water Reuse." Much of the salient information is reported in this newsletter.

Water reclamation and nonpotable reuse only require conventional water and wastewater treatment technology that is widely practiced and readily available in countries throughout the world. Furthermore, because properly implemented nonpotable reuse does not entail significant health risks, it has generally been accepted and endorsed by the public in the urban and agricultural areas where it has been introduced.

GUIDELINES FOR REUSE

Water reclamation for nonpotable reuse has been adopted in the United States and elsewhere without the benefit of national or international guidelines or standards. However, in recent years, many states in the U.S. have adopted standards or guidelines, and the World Health Organization (WHO) has published guidelines for reuse for agricultural irrigation.

Standards are not proposed by the U.S. Environmental Protection Agency (EPA) or the U.S. Agency for International Development (AID). In the U.S., water reclamation and reuse standards are the responsibility of state agencies. The purpose of EPA's manual is to present guidelines for authorities in areas where standards do not exist.

SOURCE SUBSTITUTION

The use of reclaimed water for nonpotable purposes offers the potential for exploiting a "new" resource that can be substituted for existing sources. By "source substitution" – an increased population can be served from an existing potable water source.

Many urban residential, commercial, and industrial uses can be satisfied with water of less than potable water quality: irrigation of lawns, parks, roadway borders and medians; industrial processing; toilet and urinal flushing; construction; cleansing and maintenance, including vehicle washing; scenic waters and fountains; and environmental and recreational purposes.

POLLUTION ABATEMENT

While the need for additional water supply has indeed been the impetus for numerous water reclamation and reuse programs in arid and semi-arid areas, many programs in the U.S. are initiated in response to rigorous and costly requirements for effluent discharge to surface waters, particularly the removal of nitrogen and phosphorus. By eliminating effluent discharges for all or even a portion of the year through water reuse, the need for costly advanced wastewater treatment processes may be reduced or avoided. For most nonpotable reuse applications,

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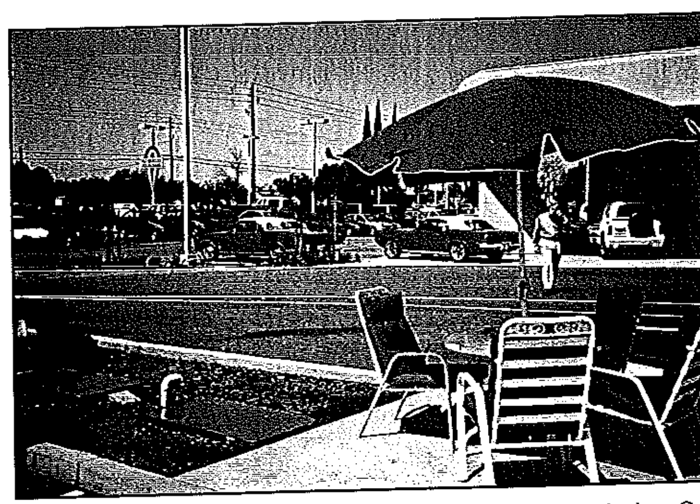


*AMERICAN CHEVROLET – Auto dealership in Modesto, CA demonstrates positioning of **Cromaglass Batch Treat System** next to eating facilities and front of building – no problems with odors or visual contact.*

POLLUTION ABATEMENT *Continued from Page 1*

nutrient removal is unnecessary and actually contraindicated for irrigation.

Naturally, a water reuse program can easily serve both water conservation and pollution abatement purposes.

TREATMENT AND WATER QUALITY CONSIDERATIONS

The overriding consideration in developing a reuse system is that the quality of the reclaimed water be appropriate for its intended use.

TREATMENT FACILITY RELIABILITY

The most common parameters for which water quality limits are imposed are biochemical oxygen demand (BOD), total suspended solids (TSS), and total or fecal coliform counts. Fecal coliform counts are generally used as indicators to determine the degree of disinfection. A limit on turbidity is usually specified to monitor the performance of the treatment facility's reliability – proof that high quality can be maintained. This was accomplished on ***Cromaglass*** recycle/reuse systems through tests of the Ben Franklin Research Program using internationally accepted standards for recycle and reuse of wastewater.

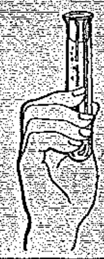
Dr. Melvin C. Zimmerman, the administrator, and his staff reviewed with NSF the protocol to be followed, including inspection of the test site and analytical laboratories. Mr. Michael Gerardi consulted on the project as a wastewater biologist.

Overall, the Ben Franklin Technology Center's evaluation covered a period from September 19, 1995 through May 14, 1996, or eight months.

Cumulative statistics over the program length (through three seasonal changes) provided data results with a mean of 2.84 mg/L BOD_5 and 2.48 mg/L total suspended solids – and total residual coliforms toxicity "neither acutely nor chronically toxic (to the ceriodaphnia dubia or the fathead minnow)."*

**This test universally utilized to determine toxicity to humans.*

In general, most states with regulations require a minimum of secondary or biological treatment followed by disinfection prior to restricted urban reuse.



CUMULATIVE STATISTICS

09/19/95 - 05/14/96

FINAL EFFLUENT AFTER FILTRATION AND DISINFECTION

BOD_5 2.84 mg/L 97.87% reduction

TSS 2.48 mg/L 98.65% reduction

Fecal Coliforms – Too few to measure

Where specified by regulation, generally limits on BOD range from 5 mg/L to 30 mg/L, limits on TSS vary from 5 mg/L to 90 mg/L. For those states that do not specify limitations on BOD or TSS, a percent reduction of contaminant removal is usually established.

Average fecal coliform limits for those states that limit fecal coliforms range from non-detectable to 1,000/100 mL, with some states allowing higher single sample fecal coliform limits.

Where water reuse regulations have been developed by many states these regulations vary considerable from state to state. Some states, such as Arizona, California, Florida, and Texas, have developed regulations that strongly encourage water reuse as a water resources conservation strategy. These states have developed comprehensive regulations specifying water quality requirements, treatment processes, or both for the full spectrum of reuse applications. The objective in these states is to derive the maximum resource benefits of the reclaimed water while protecting the environment and pubic health. Some states have developed water reuse regulations with the primary intent of providing a disposal alternative to discharge to surface waters, also considering the management of reclaimed water as a resource.

The following excerpt is from the Pennsylvania Department of Environmental Protection Internet Website:

Pennsylvania Environmental Technology Investment through the Ben Franklin Technology Centers

Cromaglass Corporation manufactures a variety of models of wastewater treatment systems which are designed as Sequencing Batch Reactors (SBR). This allows all incoming wastes to be treated by timed sequences within a single vessel as opposed to the conventional continuous flow activated sludge systems which require several treatment vessels. ***Cromaglass*** is currently marketing a recycle/reuse system which is approved for use where other methods are not acceptable. This is possible due to the ability of the system to reduce BOD and Suspended Solids over 96%, producing an effluent which can be used for landscape irrigation and as a toilet flushing medium. This technology provides a solution for failed septic systems and also allows development of land where conventional septic systems cannot be used.

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

JOCKEY

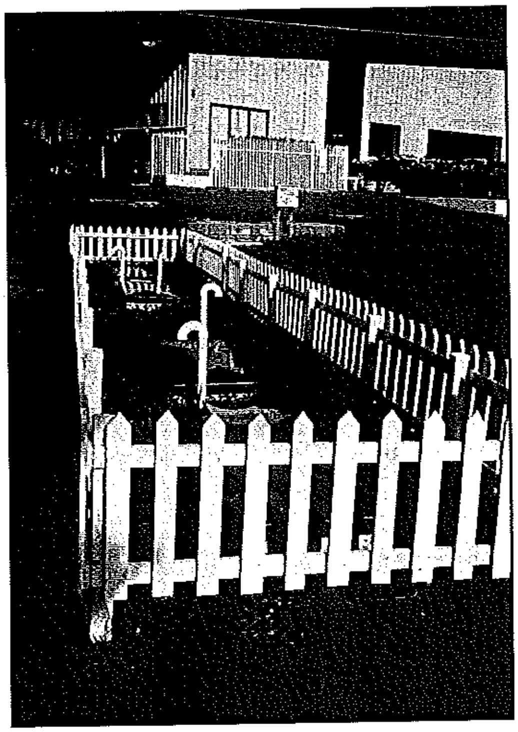
As a world leader in manufacturing clothing apparel Jockey has constructed plants in developing countries, one of which is Jamaica. With increasing awareness of pollution control, management and its consulting engineers turned to the ***Cromaglass*** area distributor, Harper & O'Callaghan of Montego Bay, for their wastewater treatment needs.

Since plant facilities are located near the ocean shoreline and protection of the delicate reef biology is necessary, a wastewater treatment system with high quality effluent discharge capability was required. Several ***Cromaglass*** systems were in use nearby that demonstrated these values – thus it was not difficult to provide the design needed for this Jockey site.

Due to the periodic heavy flows encountered on this type of production facility a Batch Process System was of significance, and ***Cromaglass*** has that design capability.

Two 12,000 GPD modules were installed with controls that enable modification of aeration and other biological parameters, to respond to changes in flow strength and hydraulic loading.

Treated effluent flows to an artificial pond where it is stored and used for irrigation of vegetation on the premises.



One of two 12,000 gallon batch treat systems serving the Jockey plant and offices.

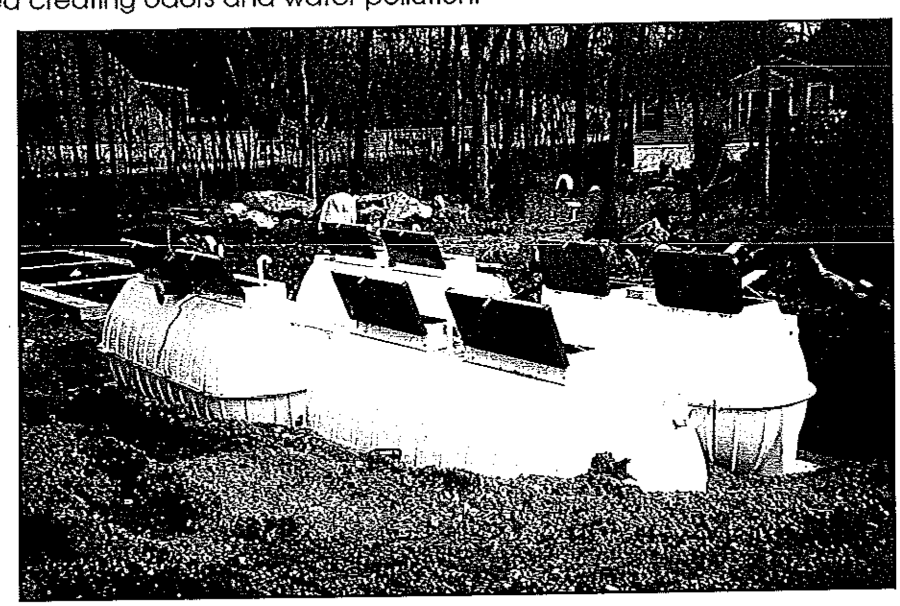
MOBILE HOME PARK SEPTIC PROBLEM

Green Top Mobile Home Park of Sellersville, PA owned by George Roeder, faced a situation which has burdened others in his business – what to do if municipal type sewerage is unavailable, your septic tanks malfunction, and the State Pollution Control Agency threatens penalties.

The problem with the old septic tanks has been poor biological treatment, and the inability of existing soils to absorb the septic water, which surfaced creating odors and water pollution.

In response, Mr. Roeder turned to the consulting engineering firm of Daniel R. Hendricks and its associate, Paul Dietz, P.E. Engineer Dietz knew ***Cromaglass*** from other projects, and expected high quality treatment acceptable to PA DEP for discharge to a nearby stream.

Their solution was the design for modular 12,000 GPD and 6,000 GPD systems treating the flow from the mobile homes located in the park.



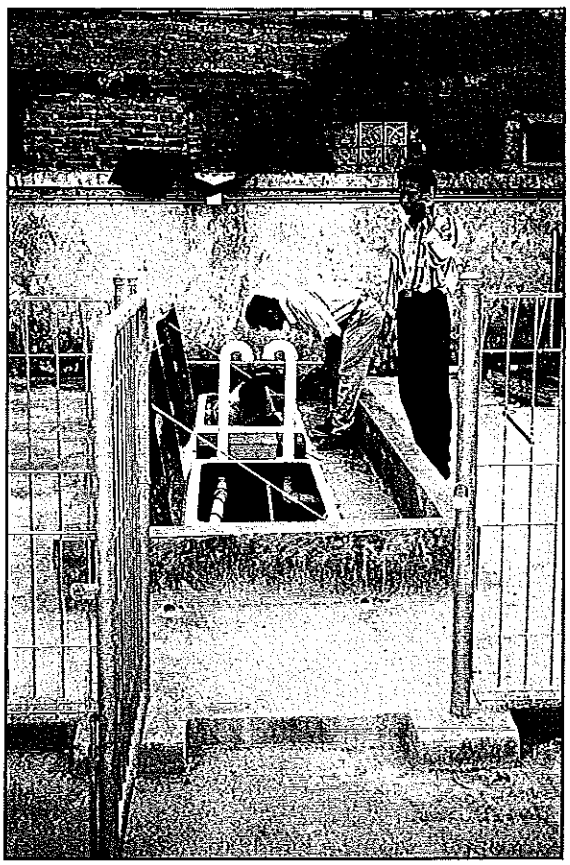
GREEN TOP MOBILE HOME PARK
1 - Model CA-120 (12,000 gal.)
1 - Model CA-60 (6,000 gal.)
1 - 3,000 gal. Chlorine Contact Tank
1 - 5,000 gal. Sludge Wasting Tank
Built-in-place gravity flow sand filters. (left background)

FEDERAL GOVERNMENT – U.S. EMBASSIES

Having its wastewater treatment systems used throughout the world has been very important to ***Cromaglass,*** but none more gratifying than those for U.S. Embassies in foreign countries.

One of these was for the Consulate in Curacao, capital of the Netherlands Antilles. Water Treatment International, a ***Cromaglass*** Representative, owned and managed by Gert Rusch of Curacao, sold and installed a ***Cromaglass Batch Treat System*** for connection to the U.S. Consular facilities. Treated effluent is used for irrigation of plantings and flowers in the very arid location.

More recent has been the purchase of a 3000 GPD Batch Treat System for the U.S. Embassy in Jakarta, Indonesia by the U.S. State Department. This system was installed by the Embassy contractor, P. T. Karya Titan of Jakarta, who provided details for all purchasing and shipping from the factory in the U.S. to the site.



Final inspection and startup of Model CA-30 by contractor. (U.S./Indonesian Embassy)

U.S. Consulate in Curacao, Netherlands Antilles served by ***Cromaglass Batch Treat System.***

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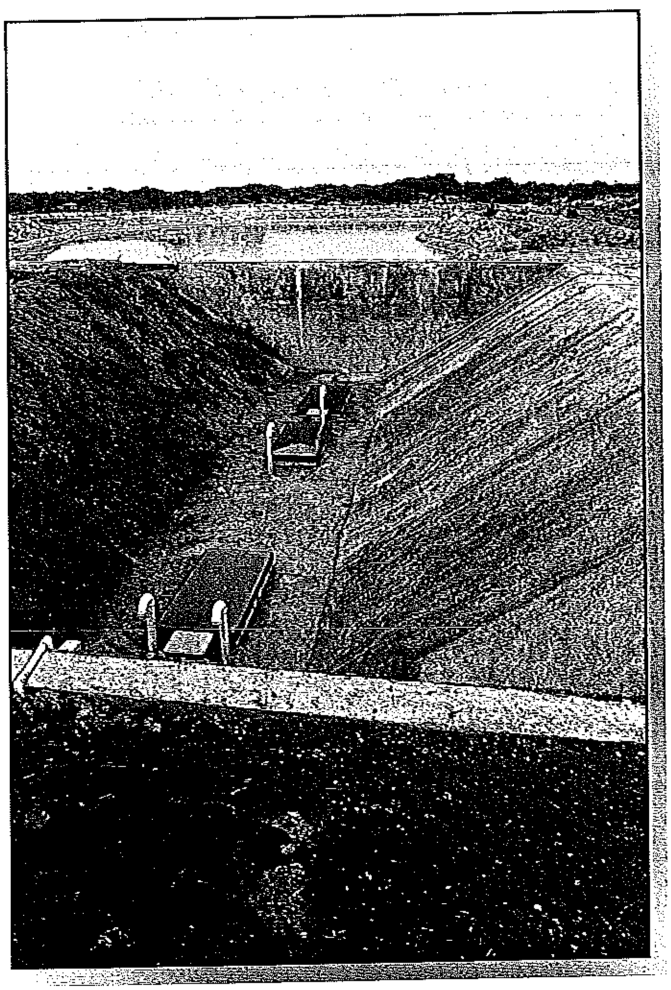
Vol. 10 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL JANUARY 1996

WASTEWATER TREATMENT AT THE HEART OF WORLD COMMERCE

Pollution control has been made a priority for advancing countries and ***Cromaglass*** most recently supplied batch treat systems for an electric power plant in the Philippines, a shipyard in the Singapore area, and industrial-office parks in Mexico.

Mexico's business community surrounding Monterrey has been extremely sensitive to pollution control. This is very visible in their design and use of cost-effective wastewater treatment systems. The ***Cromaglass*** distributor, Aquaser S.A. de C.V., has been very active in this growing market.

Aquaser is a complete service-oriented Mexican company specializing in design and start up engineering for water and wastewater customers. Jose F. Garcia and his son, Gerardo, are highly respected for their engineering talents and commitment to the best possible operation and maintenance of each and every treatment system sold.



INTERAMERICAN INDUSTRIAL & BUSINESS PARKS

This large developer of industrial office parks has used Aquaser and its ***Cromaglass*** product for very definitive reasons. They liked the long lasting non-corrosive properties of fiberglass tanks and the modular concept which allows addition of modules as the park expands.

InterAmerican also liked the low cost operation as compared with competitive equipment. Lastly, tied to low operating costs is the fact that addition of bacteria and chemicals is not needed with ***Cromaglass*** batch reactor systems.

Gerardo Garcia has commented that on industrial park applications, they reviewed past experience on these types of projects. It was necessary to research known standards and estimate effluent flow per site, as well as to consider developer's master plan. Also to be determined was water quality coming into the park, the ground acceptance and rain slopes of the project (since in a multi-acre development storm water run off might flood the system) and the number of industrial sites being planned.

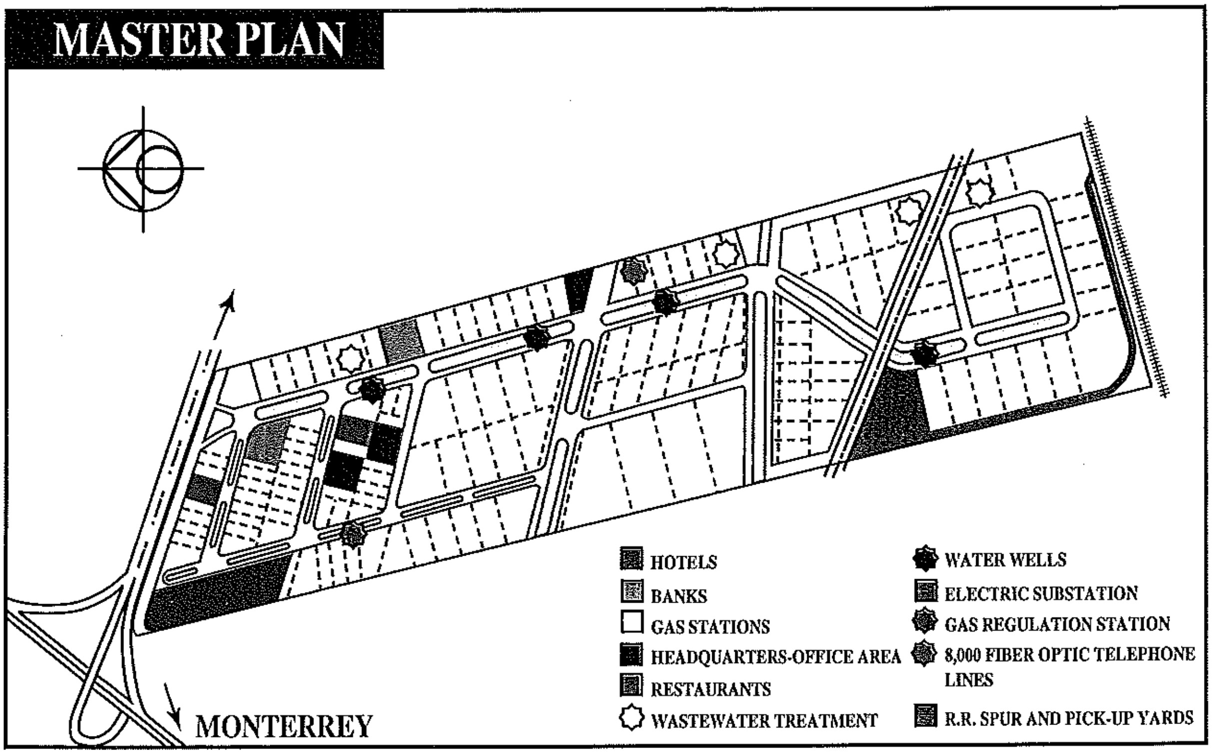
Continued on Page 2

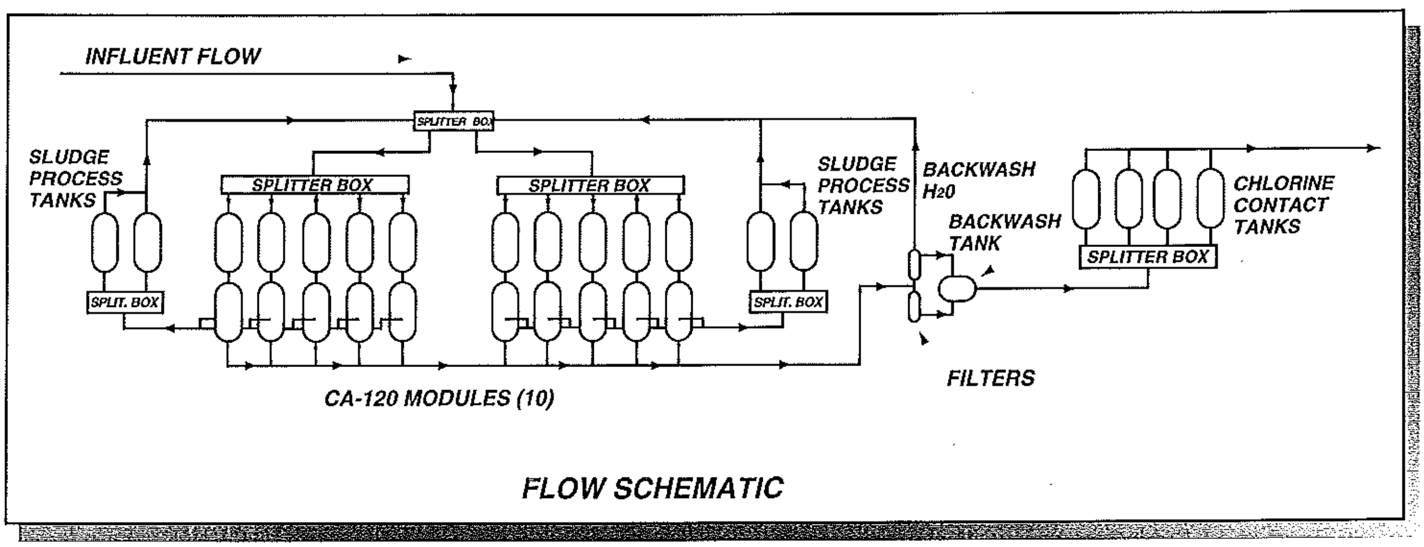
INTERAMERICAN INDUSTRIAL & BUSINESS PARKS

Continued from Page 1

Developing the project took Aquaser thirteen months of meetings with electricians, civil engineers, gas engineers, telephone line installers, Pemex (fuel) people, National Water Commission personnel, architects and industrial park owners. They found new alternatives and problems for the installation and operation of the units in every meeting.

Even though Aquaser now knows the market, owners of most of the parks in the country, and how to service them, every single project has proven to be unique in its needs and specifications.

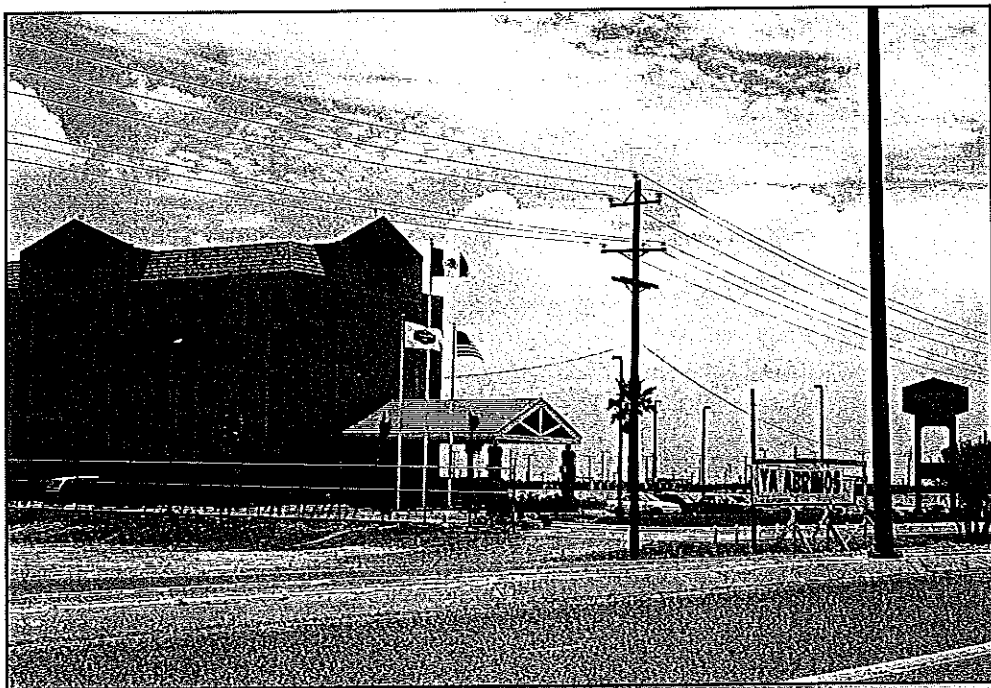




WHY MODULAR IS SMARTER

When land and space are at a premium, ***Cromaglass*** modular designs enable engineers to utilize available property most efficiently. Noiseless, enclosed tank structures with no offensive odors can be located as close to buildings as desired - thereby reducing the need for expensive long collector lines and pump stations. Treatment units can be located throughout the project and be installed as the project expands - cash flow is greatly improved. Contracting costs are decreased as the same small equipment used for excavating accomplishes tank placement. Sludge handling and disinfection components can be located and sized to provide optimum treatment efficiency, reducing costs further.

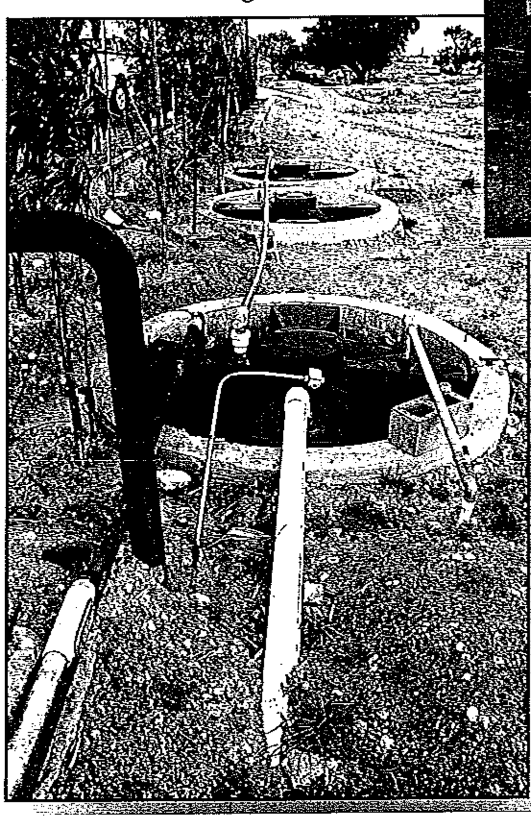
CASE STUDY: CROMAGLASS INSTALLATION



HAMPTON INN HOTEL

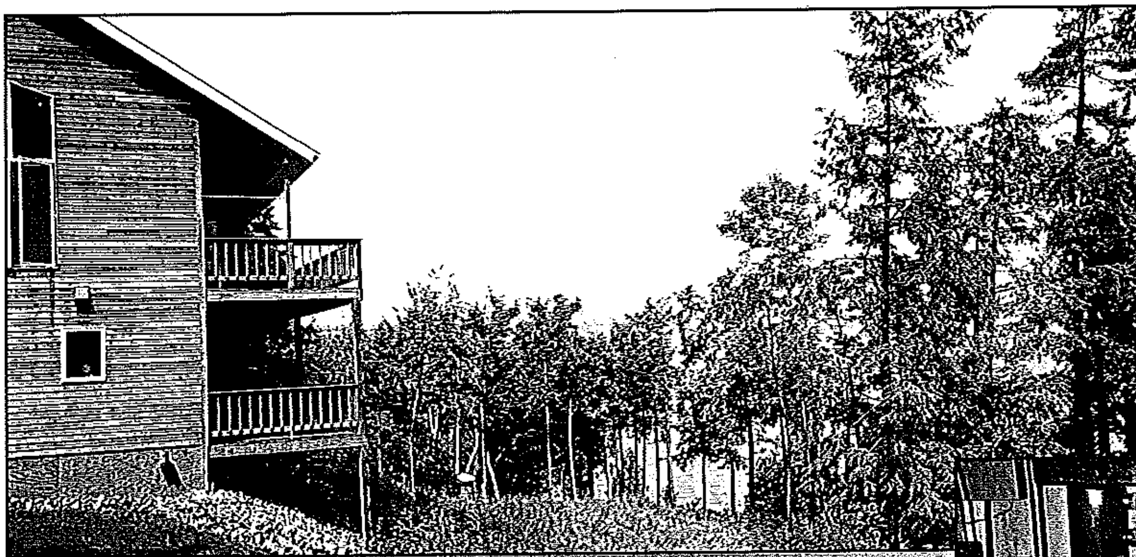
Known as Hampton Inn Airport in Monterrey, Mexico, the hotel was opened in July 1995. There are 86 rooms and a hotel staff of 12 persons. Wastewater from these sources are fed into a CA-120 unit installed at the rear of the parking lot. Installation was covered with roofing to prevent rain water from flooding installation area, since sewage line slope made the top of the system 7 inches below ground level. Treated effluent is fed into three plastic holding tanks for irrigation, or if needed, to supply the fire system.

Installation of CA-120 Module



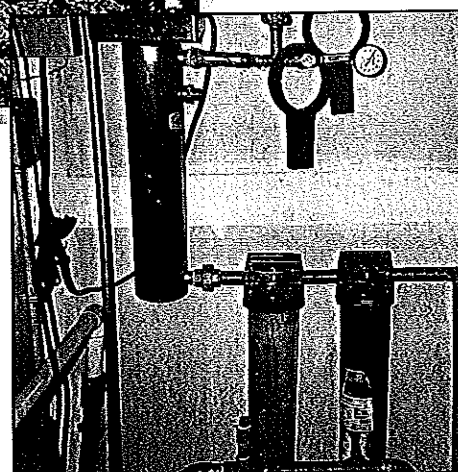
Treated Effluent Holding Tanks

Sprinkler Heads



House and Lake

Filter System



WASTEWATER RECYCLING GENERATES HIGHER LAND VALUES - ADDS TO LOCAL INCOME

Bottle of effluent used for toilet flushing and irrigation

Lake Champlain is one of the most beautiful and environmentally well-protected freshwater lakes in North America.

Forming the border between the states of Vermont and New York, this lake quality has regulatory bodies carefully governing waste-water disposal around its shores. As a result, this has escalated the value of properties which can utilize community sewerage connections or smaller treatment equipment offering state of the art technology.

One such product is the ***Cromaglass*** Batch Treat recycle process. This system enabled a property owner in the town of Colchester, VT on the eastern shore of the lake just south of Canada to recover a nearly valueless property.

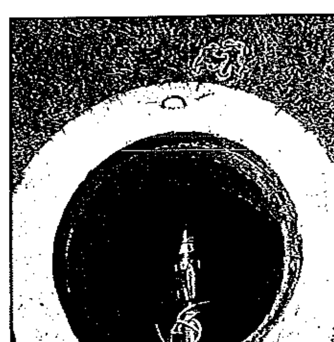
The approved conventional on-lot treatment method was a septic tank and sand mound – but the size required would not fit on this lot.

However, ***Cromaglass*** distributor Bundy Sewer & Drain Service of South Burlington, VT, approached the town engineers with an alternative which was acceptable. This consisted of a remotely monitored recycle system with the highly treated effluent being used year round for toilet flushing, as this is the best mode for water use reduction.

The effluent is also used for irrigation of plants and flowers during temperate seasons. During freezing weather, a valve must be activated by the inspector, and verified in writing to the town engineer, changing flow of the treated water from irrigation to a reduced size sand mound.

This reduction of disposable effluent allowed the nonconforming lot to be developed into a very valuable property. From the standpoint of the local government, this now returns five times the taxes than during its previous evaluation.

Disposal mound used in freezing weather



Effluent valve box

CGD196

Cromaglass Corporation

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THE *Cromaglass®* DIGEST

Vol. 8 No. 3 ADVANCED RESEARCH FOR POLLUTION CONTROL SPRING 1994

"PARTNERS IN PROGRESS"

CROMAGLASS WASTEWATER TREATMENT SYSTEM SOLVES McDONALD'S SITE CHALLENGE

McDonald's Corporation, the world's largest restaurant chain, continues its program of offering for the public low cost, high quality, fast food. They have determined that one method to supplement this policy and increase the number of restaurants, is to decrease the size and therefore the cost of their restaurants.

In conjunction with this decision, they are building new restaurants in suburban and rural locations where central municipal-type sewerage is not available.

This has not been easy since increased regulations and environmental concerns have rendered a significant number of properties throughout the country unacceptable for on-site systems such as septic tanks and drainfields.

One such property is located on heavily traveled Interstate 80 at a fast developing interchange midway between the New Jersey and Ohio borders. At Lamar, Pennsylvania, McDonald's purchased this property and anticipated prompt construction of its new concept in smaller restaurants. There was no community collection and treatment facility available and the Pennsylvania DER had placed restrictions on wastewater treatment and disposal due to high nitrate levels in the ground water.

At this point, McDonald's regional construction manager, Ken Shaw, learned of a ***Cromaglass*** wastewater treatment system which could not only reduce pollutants to meet U.S. EPA and PA DER requirements, but also lower total nitrogen to the required limits, and be cost effective.

McDonald's and their consulting engineers, Bohler Engineering Inc. of Whatchung, New Jersey, designed and had permitted a ***Cromaglass Batch Treat System*** to meet effluent specifications of the site involved.

Joseph Jaworski, P.E. of Bohler, worked closely with ***Cromaglass,*** to prepare the permit obtained from Pennsylvania DER.

Construction of the new McDonald's restaurant at Lamar began in April 1993 with the ***Cromaglass Treatment System*** installed on May 20, 1993.

A concrete slab was poured to assure rigidity and nonflotation of the tanks involved. Fiberglass modules were transported to the site and placed into the excavation simply by using a hydraulic excavator. Ease of placement enabled timely completion within three hours, including the installation of tiedowns, backfilling and minor piping.

Total design included a ***Cromaglass Model CA-50*** incorporating the patented ***Cromaglass*** nitrogen reduction componentry. For the occasional wasting of sludge by the plant operator, an aerated sludge wasting tank was placed adjacent to the ***CA-50*** module.

Wastewater flows from the McDonald's restaurant building by gravity; the restroom waste going directly to the ***Cromaglass*** aeration system and the kitchen wastewater containing grease, detergents and other chemicals to a separate interceptor tank for grease removal and chemical neutralizing, then to the treatment tank.

Cromaglass batch treat controls are located in the utility area of the restaurant, as is a monitoring and metering device to control the pH and alkalinity of the treatment system — thereby assuring efficiency of the biological treatment.

Finally, treated water from the ***Cromaglass*** batch system can be sampled by the operator prior to discharge into a mound-type disposal system designed to PA DER specifications.

Continued on Page 2

Partners In Progress

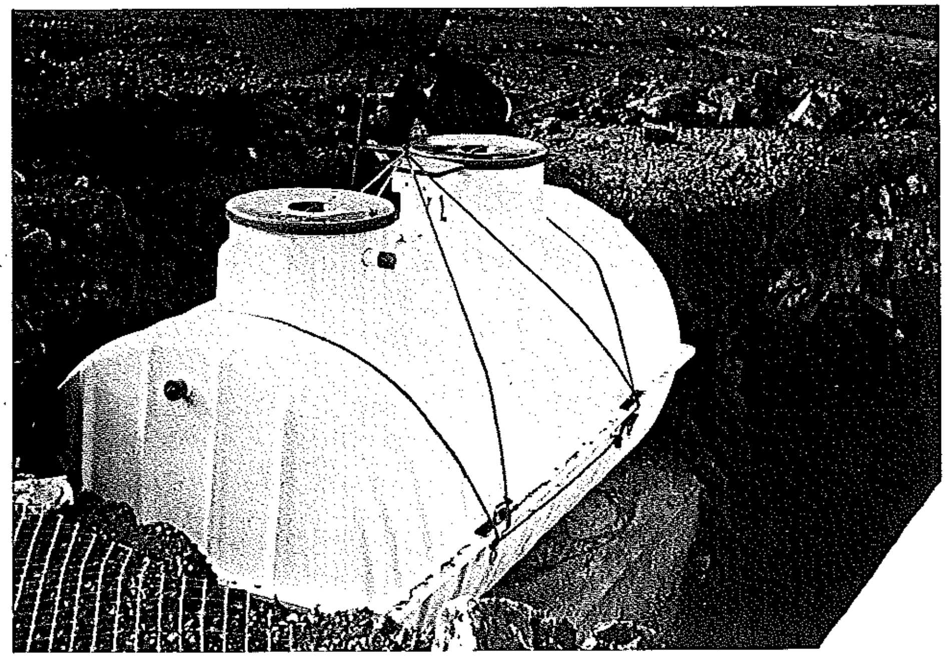
Continued from Page 1

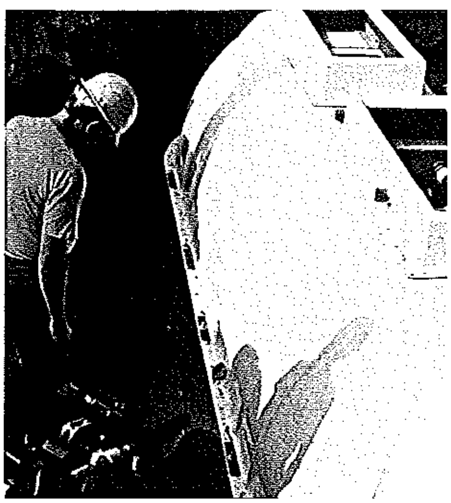
McDonald's representatives have indicated that this ***Cromaglass*** wastewater treatment concept including denitrification capabilities is comparable in cost to a conventional system utilizing subsurface drainfield disposal.

Operation and maintenance of this ***Cromaglass*** type treatment process over many years of actual experience have shown cost to be well within budgetary restraints of the owners.

Finally, as stated by the Owner/Operator of this McDonald franchise, Mr. Ken Parker, "Because of the ***Cromaglass*** Batch Treat/Denitrification System, McDonald's was able to construct this facility at Lamar, Pennsylvania.

Another McDonald's restaurant using a ***Cromaglass*** on-site system has recently opened in Central California with other systems currently in the planning and design phase by these "Partners in Progress."





DENITE SYSTEMS SPECIFIED BY ARIZONA ENGINEERING CONSULTANTS

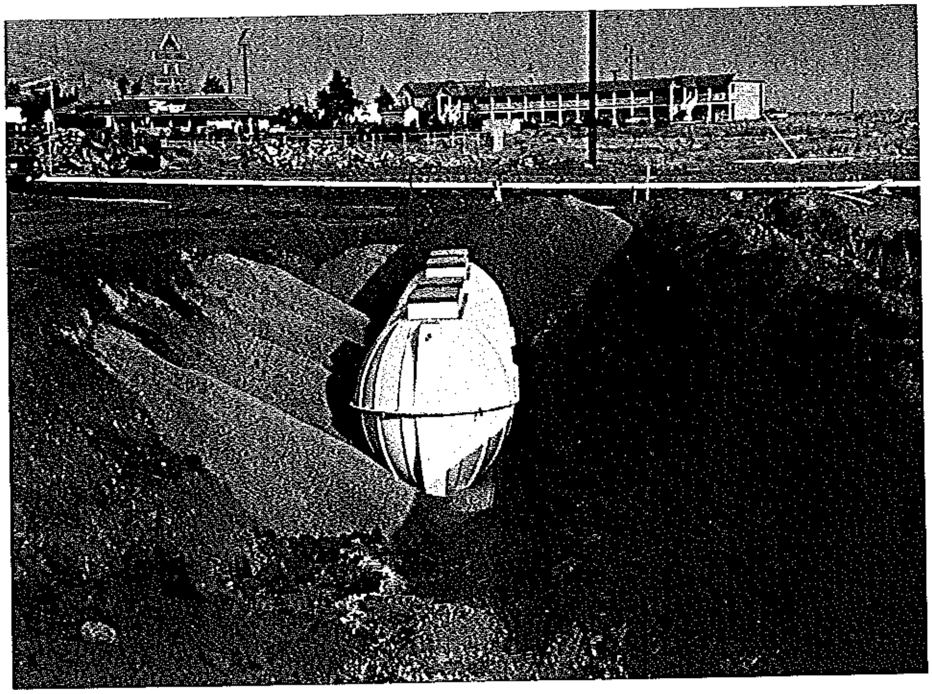
Considering state and local restrictions for ground water pollution from nitrate sources in the Sedona, Arizona area, professional engineering consultants, Fred Goldman & Associates were seeking a cost-effective alternative for their client's construction needs. The property owners wanted to build a new home in an area adjacent to Oak Creek, a unique waterway — 80% of nitrogen removal was required for the on-site system use, which was too restrictive for conventional septic tanks or other aerobic units.

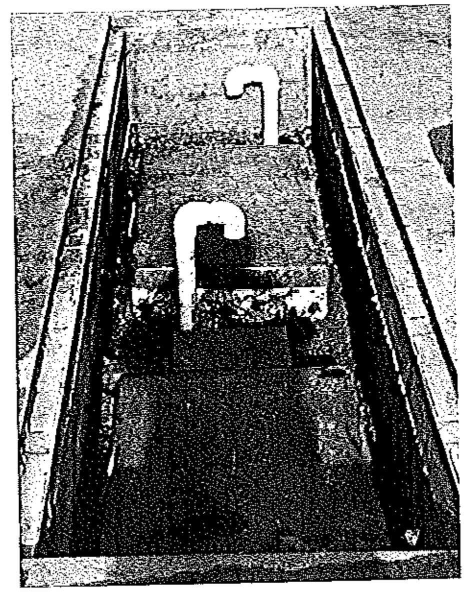
They learned of the ***Cromaglass Batch Process*** and requested the state to not only review research reports but also monitor data collected from their client's initial ***Cromaglass*** denitrification system. After one year of this evaluation, the Arizona Department of Environmental Quality began to issue additional permits for ***Cromaglass*** equipment to be used in areas of highly sensitive ground water conditions.

The state summary of inspections had found "no deficiencies in operation, maintenance or management of the system. This system is considered to be in compliance with the statutes and Administrative Codes of the Arizona Department of Environmental Quality."

This is only one of many examples of engineering consultants joining ranks with the environmental equipment industry to meet much needed environmental standards.

IMPRESSIVE McDONALD'S INSTALLATION IN CALIFORNIA USES BATCH PROCESS SYSTEM



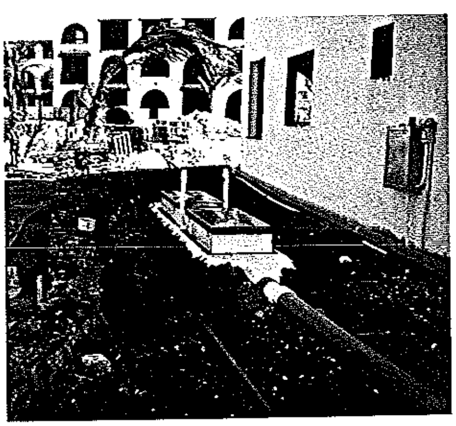


Working closely with Mr. Keith Munroe of the Stanislaus County Health Department, ***Cromaglass*** servicing distributor, George Cunha of Modesto, California, provided the initial and continuing liaison work for purchase, installation and startup of the ***Wastewater Treatment System*** for a new McDonald's restaurant on Interstate 5.

The valuable site would not easily support a typical septic tank drainfield design due to its limited lot size. With advice from the McDonald's national office, their consultants worked with Mr. Mike Maynard of the organization's Northern California real estate office to engineer the batch treat system for treated effluent discharge to a property perimeter drainfield and supplementary irrigation design.

Cromaglass Corporation, as offered in all orders, provided a certified operator to assist with initial operation and maintenance procedures. Following several months of use, this McDonald's ***Cromaglass Treatment System*** is performing well to meet all McDonald's corporate requirements.

ANTIGUA AUTHORITIES MANDATE TREATMENT QUALITY



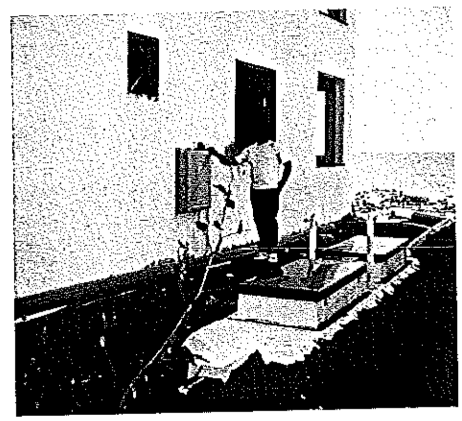
Buildings in final construction.

Construction of their condominium resort and restaurant by an Italian owner has progressed with the help of ***Cromaglass*** and its representative, *Water Treatment Systems,* of St. John, Antigua.

Complementing beautiful "Old World" style architecture, *Colonna Resort* was designed with consideration for maximum environmental concerns, including wastewater processing.

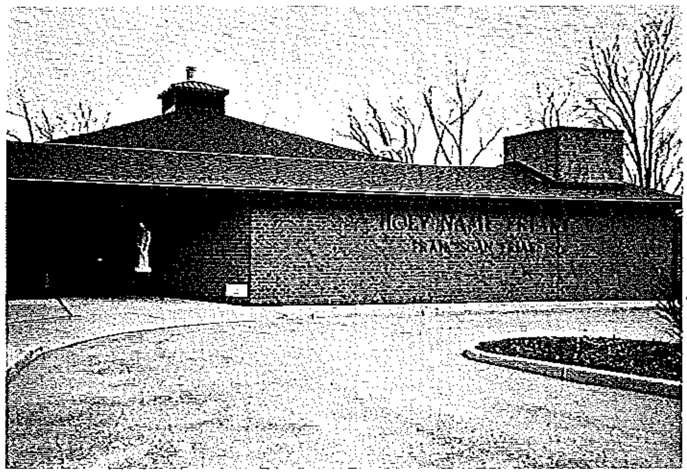
Located on the island's beautiful northeast coast, Colonna had very limited space for its wide expanse of buildings; thus the need for a compact treatment concept as provided by ***Cromaglass*** with its corrosion resistant components.

A mixture of 12,000 GPD and 6,000 GPD modules were placed at locations relative to the adjacent buildings.



Steven Boucher of Water Treatment Systems *with* ***Cromaglass*** *controls — note proximity of treatment unit to condominium rooms.*

NEW JERSEY RELIGIOUS HABITAT PROTECTED BY SBR TREATMENT EQUIPMENT



PSS Engineering Consultants of Rutherford, NJ were hired by Holy Name Friary to design and upgrade their wastewater treatment process. This was mandated by the New Jersey Department of Environmental Protection as the client was given only until February 2, 1994 to install their new treatment facility. Rene Schneider was the contact staff person working between the client and ***Cromaglass*** for obtaining the state permit.

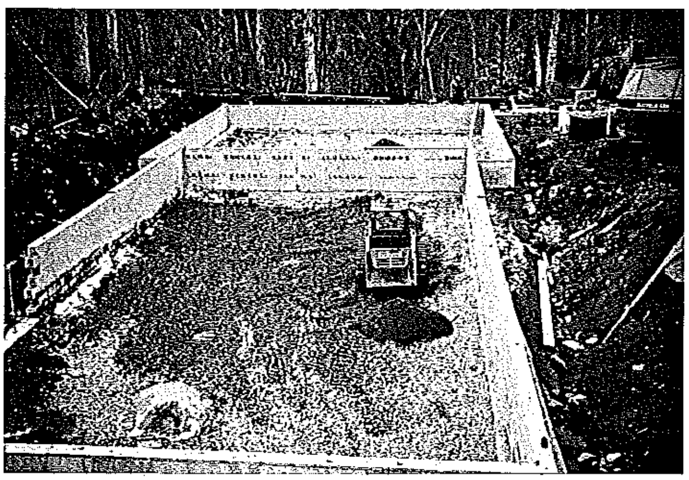
American Pump Systems, Joseph Poster, ***Cromaglass*** Servicing Distributor of Pecks Ponds, PA, worked closely between all parties to assure that details for design, ordering and connection of the system went without problems.

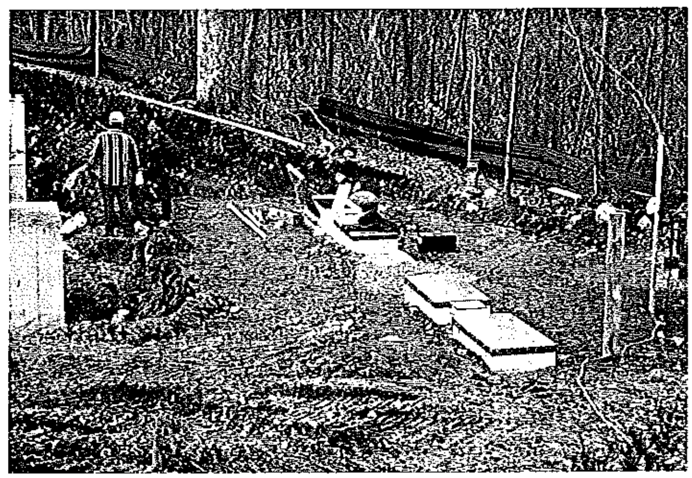
The installation contractor was P & H Construction of Ringwood, NJ, with the only special problem involving the extreme cold climatic conditions. This was the only obstacle to an otherwise simple project. The Friary, as it is known, had a very cost-effective solution to what could have been an expensive environmental situation.

Using a ***Cromaglass Batch Treat System*** of 12,000 gallons per day capacity proved to meet the state requirements along with treated effluent disposal to a two stage artificial wetland. Design for the first stage consists of a retaining wall with stone bed sand filter overlayed with straw and peat moss.

Section two is another wall making a lagoon in which more filter materials and water plants are located.

Finally, the water passes through an ultraviolet disinfection device with the outlet valved to flow to a stream, old subsurface bed, or a new one. This process involves nitrate reduction.





CROMAGLASS GRANTED NEW PATENT

After intensive review by the U.S. Patent office, ***Cromaglass Corporation*** has recently been granted rights to a new process patent covering its modified sequential batch reactor system — U.S. Patent No. 5,268,094.

Developed over years of laboratory and field research this new process has enabled the company to sell its ***Wastewater Treatment Systems*** for use on properties previously considered of little or no value.

Regulatory agencies in states including Arizona, California, Nevada, New Jersey, New York, Pennsylvania and Wisconsin have accepted or permitted ***Cromaglass Systems*** to be used on residential and commercial construction with more cost-effective results than conventional methods including septic tanks or secondary treatment plants.

CGD594

Cromaglass Corporation

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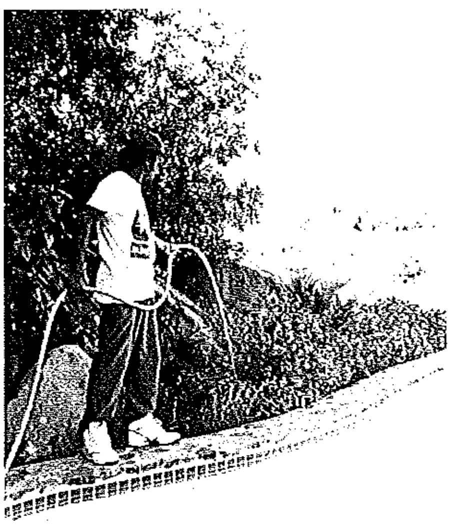
Vol. 8 No. 2 ADVANCED RESEARCH FOR POLLUTION CONTROL FEBRUARY 1993

MANY U.S. COMMUNITIES TURNING TO WATER RECYCLING AND REUSE

Known for its pioneering efforts, the United States has, however, fallen behind other areas of the world in efforts to save precious water by utilizing recycling or reuse methodology. With recent advancements and modified regulatory attitudes, this may be changing around the country.

INDIVIDUAL HOMES



Watering of plants around pool is enabled by reuse of treated wastewater. This home is located in an area where potable water must be collected from rooftops into cisterns — thus water use must be carefully monitored. The water collection capacity here amounts to a total of 32,000 gallons which would not normally allow for much on a per person daily use (house often occupied by six people).

Many homeowners are now enjoying benefits from using ***Cromaglass*** recycle or reuse systems to conserve available water. Another important benefit results because less water is discharged, with about 30% of the treated wastewater being reused for toilet flushing. This reduces the amount of property needed for a discharge field — very important for relatively small residential lots.

One example, located in an area with extreme temperature variations, is near Burlington, Vermont, fronting Lake Cham-

Continued on Page 2

CROMAGLASS WASTEWATER TREATMENT AND PROPERTY RIGHTS

For years property owners nationwide have encountered bureaucratic restrictions limiting the use of their land. Usually the intended use is for residential or commercial building. Due to regulatory restrictions approval is denied, thus denying them legitimate use of their property. This creates a hardship by greatly reducing the value of their asset.

Recent legal decisions appear to provide more protection for owner's rights. A Supreme Court decision has directed that the public authority must compensate a property owner for fair value of his/her land. Even if a regulation addresses a serious harm, the government must compensate a property owner denied "all economically viable use of his land," Justice Scalia wrote in an opinion for the majority.[1]

Sales and use of ***Cromaglass Treatment Systems*** can benefit from this new opinion. Already there is evidence that many states are now either approving or seriously considering application for "alternative treatment systems" that would have been refused previously.

As required, action should be initiated with hiring a professional engineer to design a system using properly sized ***Cromaglass*** model(s)

Continued on Page 2

RESORT HOTELS

Recycling or reuse of wastewater has become a necessity for many hotels around the world. One, the Princess Beach Hotel in Curacoa, Netherland Antilles, is actually connected to central sewage collection lines, but has intercepted the wastewater on its property to treat by ***Cromaglass*** processing with effluent stored and reused for flowering plant irrigation in lieu of expensive public water.

Aeration system used for highly efficient treatment of wastewater. Special note should be made that potable water is only derived from cisterns collecting water off rooftops.

Others like the Bitter End Yacht Club reuse 15,000 gallons per day to water plantings throughout its vast property secluded on an island peninsula.

Continued on Page 3

Individual Homes *Continued from Page 1*

plain. ***Cromaglass*** distributor, Bundy Sewer & Drain Service, was consulted by property owners to design a wastewater treatment system that could be used on property containing difficult subsurface bedrock conditions.

Working with the local town engineer, Warren Bundy designed a series of components consisting of ***Cromaglass Batch Treat unit,*** backflushing filter, and disinfection device. To reduce the volume of water to be discharged, highly treated water is reused for toilet flushing year-around. Excess water is used in the spring and summer months for irrigation of plantings and diverted in the winter to a modified mound-type disposal area.

Operating for nearly two years, this system has enabled construction of a home on valuable lakefront property. Previously building permits were denied due to land that was unsuitable for a conventional septic system.

Still other recycle/reuse systems are being used in more mild or tropic locations, with most using treated water for irrigation of vegetation year-around. A few are even providing treated effluent used for chores such as car and truck washing.

Precedent for this concept of wastewater reuse was established nearly 20 years ago with demonstration projects either cosponsored or funded by the U.S. EPA. One was by the Appalachian Regional Commission, a federal/state agency charged with improving living conditions in 13 eastern states. This project in Kentucky was to show how new nonpolluting technology could improve home sanitation.

After aerobic treatment, water was dissipated in several different ways, one of which was "right back to the house for reuse in the toilet tanks." (This allowed one homeowner to stop hauling water for household use.) Results showed excellent and healthy capabilities for reuse including low pathogenic and bacterial content.

The second significant demonstration, funded by U.S. EPA, was performed at North Carolina State University under administration of Dr. Robert Carlisle and Robert Rubin. Principal portion of this project consisted of drip irrigation to cultivated vegetation by treated wastewater effluent. Monitoring data showed excellent results with low, if any, bacterial measurements.

Cromaglass Wastewater Treatment and Property Rights

Continued from Page 1

coupled with disinfection and filtration (if necessary) and an effluent disposal method to meet required effluent characteristics.

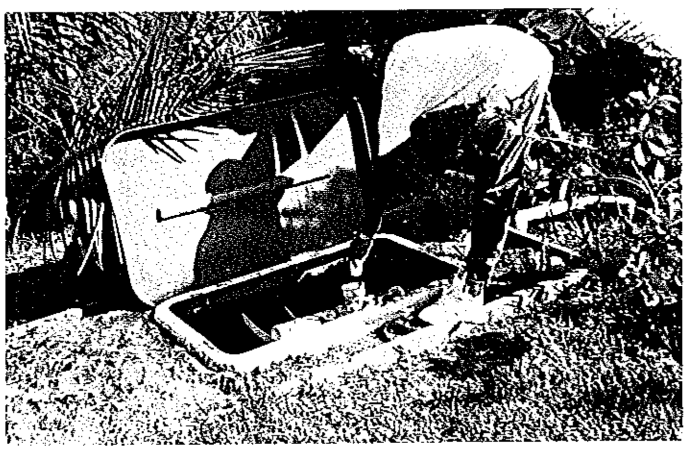
This means treatment of wastewater to the extent that it can be safely contacted by humans. Assured quality treatment is accomplished by ***Cromaglass*** with components including basic aeration system, filtration, and disinfection. The best available technology is used for the monitoring system, ***CromaWatch***, which is capable of not only shutting down a malfunctioning system, but remotely monitoring operating data and providing it to any recipient requesting this data.

Treated water can be used for toilet flushing and/or vegetation irrigation. Since toilet flushing consumes 30% to 40% of household water use, reduction in land area used to receive the remaining effluent can be reduced proportionately.

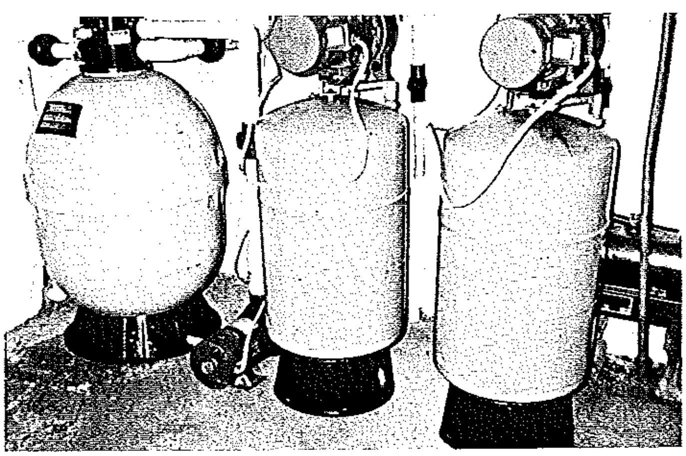
Many alternative means of water absorption can be utilized including raised plant and flower beds, trees and shrubs chosen for maximum water uptake, lawn irrigation, etc. Cold weather environments would utilize evergreen plants that transpire or uptake water even in winter.

These forms of water reuse are increasingly being accepted in many diverse areas of the United States. Proven in other parts of the world, examples range from exclusive resort hotels and rental villas in the Caribbean to the palaces of princes in the Middle East. In areas such as these, water is either of very short supply or ground conditions do not support septic system usage.

[1]Paul M. Barret, *Wall Street Journal*, 30 June 1992.

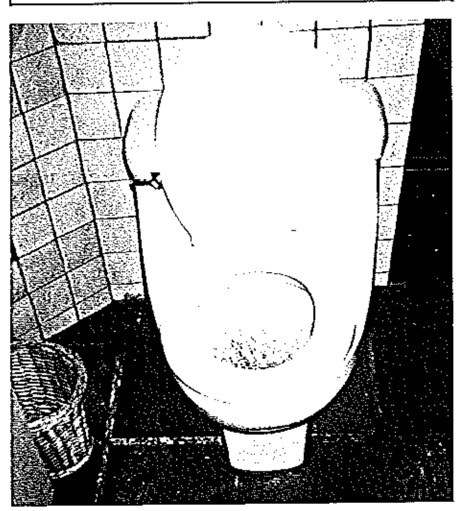


Disinfection system and treated effluent holding tank.



Backflushing filter and pressure tanks (for grey and fresh water), note ultra violet unit on right for potable water disinfection.

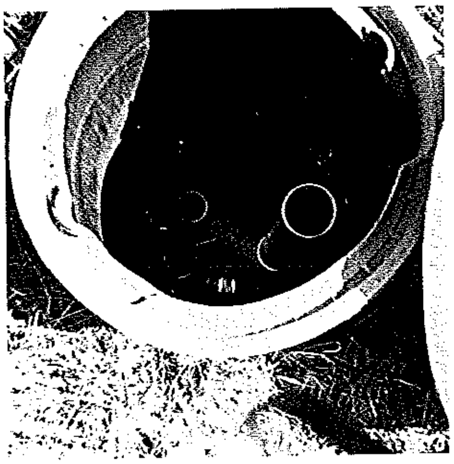
(Photo, right) Backflushing with treated effluent means excellent water savings.



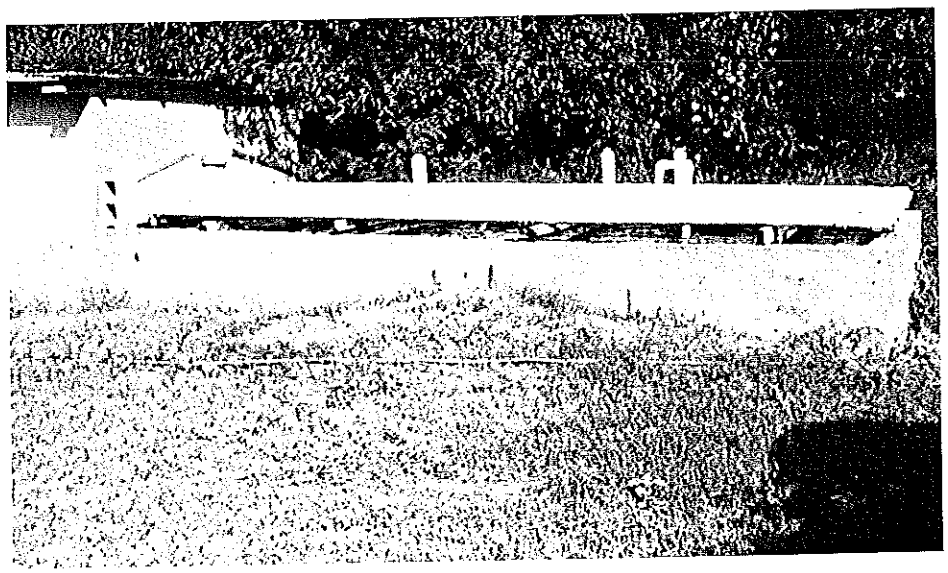
Resort Hotels *Continued from Page 1*

Ultimate type reuse is accomplished at Guavaberry Estates where treated filtered wastewater effluent is recycled for toilet flushing as well as flower irrigation. In a case such as Guavaberry, septic tanks had originally been utilized but soil conditions would not support necessary drain fields. The owners were introduced to ***Cromaglass Wastewater programs*** and have been reusing water for over 20 years. They have literally stated that they "would not know what to do in their water-scarce location without their ***Cromaglass process***."

Cromaglass Batch Treat System *serves several hotel resort cottages.*

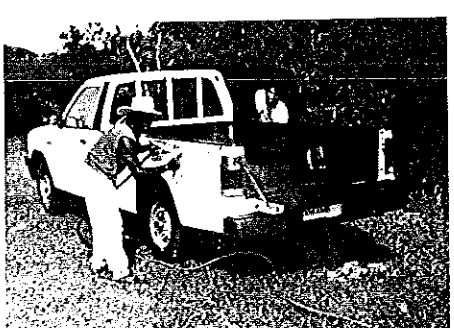


Treated filtered effluent is disinfected in this "solid state" chlorine contact tank.



Gravity flow sand filter.

Treated effluent used for irrigation of plants in resort's nursery.



Maintenance crew keeps equipment, such as this truck, in "tip-top" condition by washing with treated effluent.

Treated effluent drip irrigation system automatically waters beautiful tropical plantings.

FLORIDA'S WALT DISNEY WORLD RESORT COMPLEX IS A LEADER IN WASTEWATER RECYCLING/REUSE

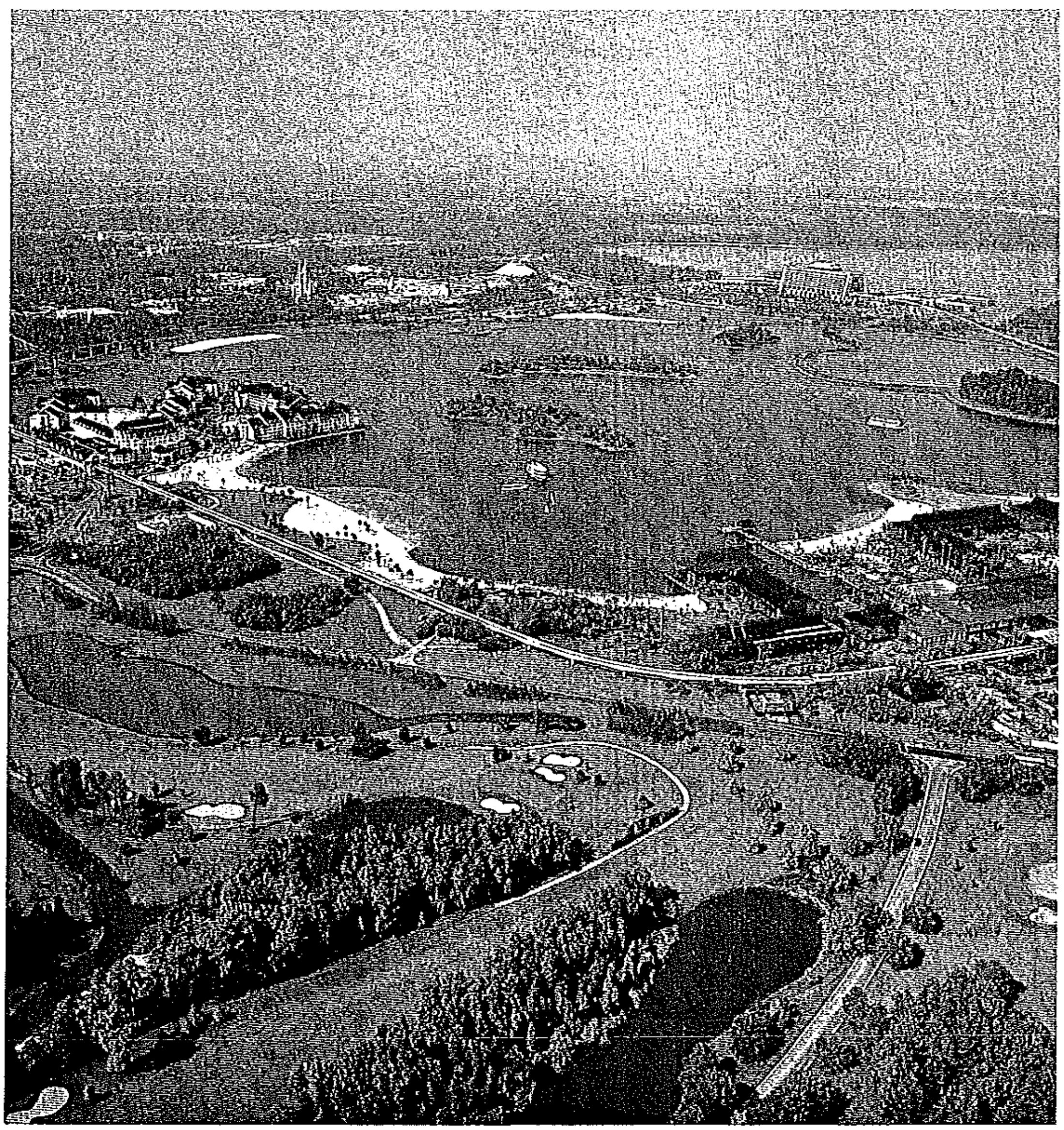
The State of Florida is promoting reuse and "zero discharge" of wastewater effluent. At a recent meeting of the National Onsite Wastewater Recycling Association, a featured presentation was that by the Chief Engineer, Ted McKim, of Reedy Creek Energy Services, water and wastewater department of Disney World, Orlando, Florida.

Their presentation showed progress over the years which is currently to the point of reusing eight million gallons of water per day through their advanced Eimco process designed treatment system with an effluent quality of 1.2 PPM BOD and SS.

One important goal for 1993 is that of zero discharge to Reedy Creek with three million gallons per day reused for irrigation of golf courses, roadways, and landscaping of the resort complex. They have a five million gallon concrete tank for reclaimed water storage. With this excellent program of recycling/reuse the engineers are able to support their environmentally sensitive operations.

Disney hosted a bus and walking tour of "behind the scenes" and the tunnel complex under the Magic Kingdom for the wastewater industry attendees.

It was very impressive that this recycling/reuse can be done by private industry. ***Cromaglass*** representative Ed Wilson, who attended the seminar, states that recycling is a "must" goal for our industry.



Courtesy of Walt Disney World™

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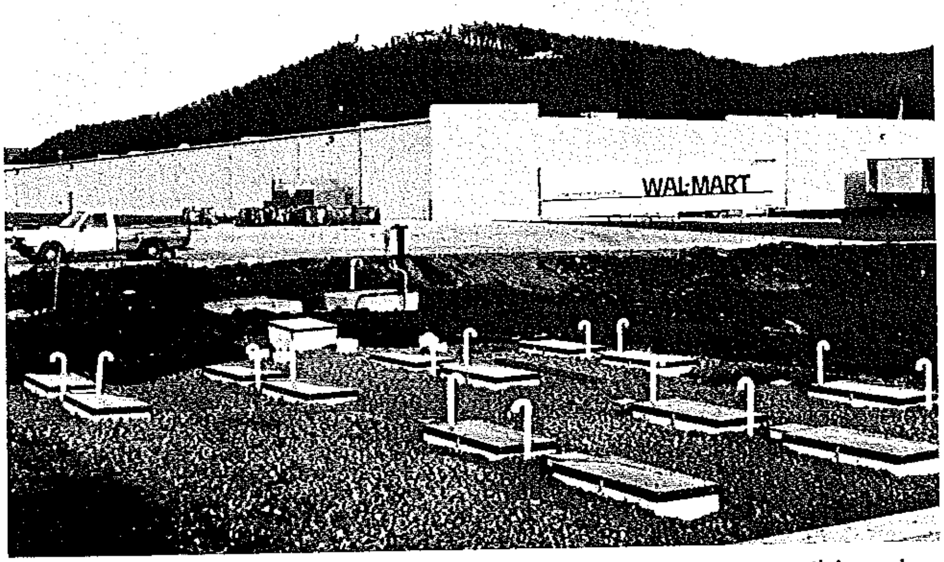
THE *Cromaglass*™ DIGEST

Vol. 8 No. 1 ADVANCED RESEARCH FOR POLLUTION CONTROL JANUARY 1993

FOCUS ON SHOPPING CENTER WASTEWATER TREATMENT

Large and small shopping plazas are often located outside of central or municipal type sewerage facilities. Under current regulations in most states and other parts of the world, septic tank systems cannot provide the required treatment in the limited space available. As a result, consulting engineers have worked with ***Cromaglass*** representatives and distributors to design systems acceptable for the locations involved.

CROMAGLASS PREFERRED



Cromaglass System was chosen in preference to the engineer's originally recommended treatment plant. When the borough council traveled to inspect various sewage treatment options, they determined that ***Cromaglass*** would receive their approval.

A new shopping center complex was to be located in the Borough of Montoursville adjacent to the town park and a large residential area. The fact that ***Cromaglass Systems*** are installed underground and are odor-free, competing systems were ruled as unacceptable. Many summer picnics in the park would be spoiled by unappetizing odors coming from an exposed wastewater treatment system.

A major installation problem was encountered due to the site's location — in an old riverbed-type soil whose water was in continual movement and a threat to excavation techniques. Use of special shoring and pumping helped to overcome this obstacle.

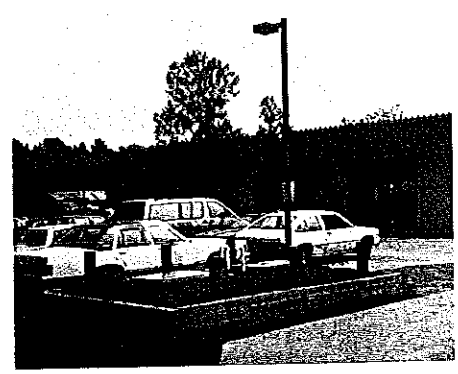
Since the buildings being served are a Wal-Mart store, a super market and a home center, the surge flow required use of equalization tanks. Important

Continued on Page 2

FLEXIBILITY — *CROMAGLASS SYSTEMS* REQUIRED MINIMUM SPACE FOR AREA RESTRICTED SHOPPING CENTER

Recently completed in the town of Beekman, New York, the Town Plaza consists of several retail stores and small food establishments including a pharmacy, a deli, a pizzeria, a Chinese restaurant, a dental office, an ice cream shop and a baby furniture store.

Designed by engineer Lawrence Paggi of Fishkill, this 2500 GPD ***Cromaglass Batch Treat System*** was permitted by the Duchess County, New York Health Department.



It was designed to treat the wastewater being pumped from an old septic tank which had been malfunctioning. A new 1000 gallon grease trap was installed primarily to intercept grease generated by the Chinese restaurant.

Continued on Page 3

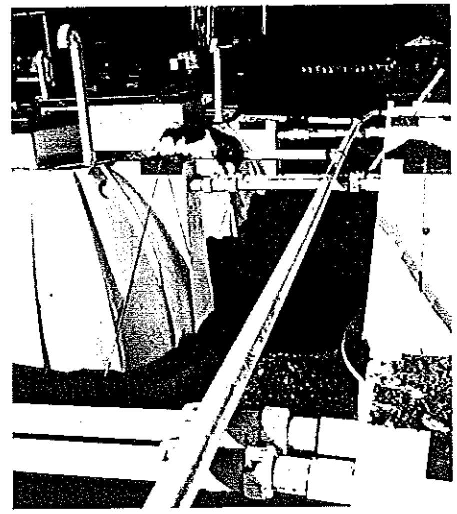
Cromaglass Preferred *Continued from Page 1*

also were the high quality limits placed on the discharged effluent. The receiving water, a very picturesque free-stone stream, is used for fishing and swimming. PA Department of Environmental Resources required tertiary treatment to be provided by an intermittent sand filter prior to effluent entering chlorine contact tanks for disinfection. An effluent pump station is then used to pump the treated water some 500 yards to the stream. Additional sand filters are not normally required of ***Cromaglass Batch Treat Systems*** for stream discharges in the State (use required on this project only in the summer months).

Wal-Mart Inc., the "anchor" store, will own and operate the treatment system. According to the town council, any facility locating in the "center" complex must connect to the wastewater treatment system and cannot use their own septic or treatment tank system.

HDC Inc. of Williamsport, PA, an experienced maintenance organization, will operate the total system including the ***Cromaglass Batch Treat Modules.***

This prestigious project provided ***Cromaglass*** and its subcontractors with valuable experience on construction details and management judgement.



MONTOURSVILLE PROJECT

Design Flow .... 27,000 GPD

Pump Station .... 48,000 GPD
Precast Concrete designed for future expansion
Six (6) Foot Diameter

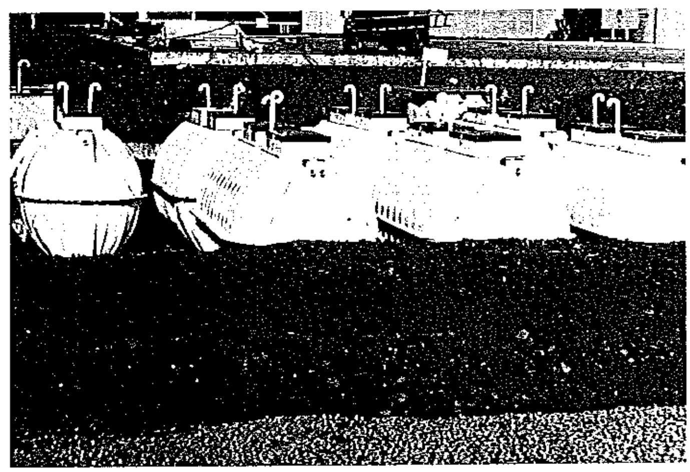
Equalization Tanks .... 27,000 GPD
Three (3) Precast Concrete

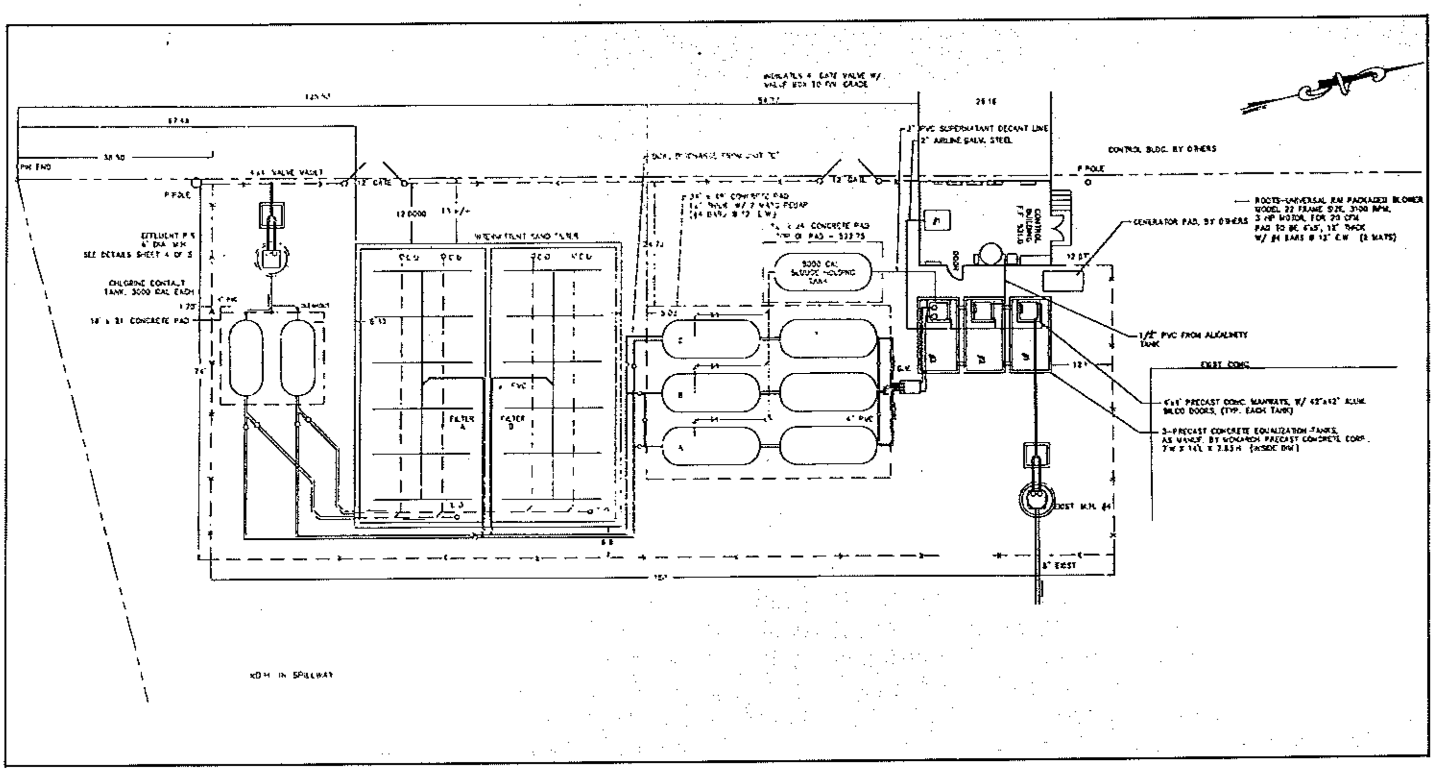
Treatment Systems
Three (3) ***Cromaglass Modules***

Disinfection Process
Two (2) FRP Chlorine Contact Tanks each with 3000 gallons capacity erosion feed — solid Chlorine

Effluent Requirements

$CBOD_5$	15.0 mg/L	
TSS	30.0 mg/L	
NH_3-N	2.0 mg/L	May to October
NH_3-N	6.0 mg/L	November to April





NEW YORK CITY HEALTH DEPARTMENT APPROVAL
WEST SHORE PLAZA, STATEN ISLAND

Consulting engineers, Carpenter Environmental Associates of Northvale, New Jersey, were hired by Meredith Avenue Associates of Staten Island, New York, to design a wastewater treatment system for their proposed shopping center serving this busy eastern metropolitan area.

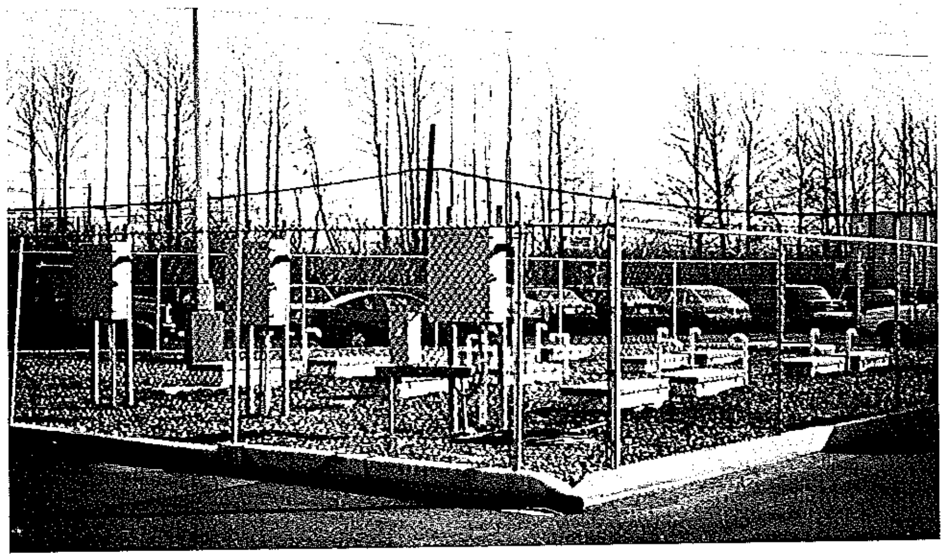
Having had good experience with designing ***Cromaglass Batch Treat Systems*** for previous projects in New York City, Carpenter Assoc. specified a 36,000 gallon per day sequential batch reactor system where concern with this type of facility was for peak or surge wastewater loadings.

The permit process had to pass through not only New York State DEC but also the New York City Health Department. An important aspect of this permitting process was the credibility of Carpenter Assoc. with the regulatory agencies.

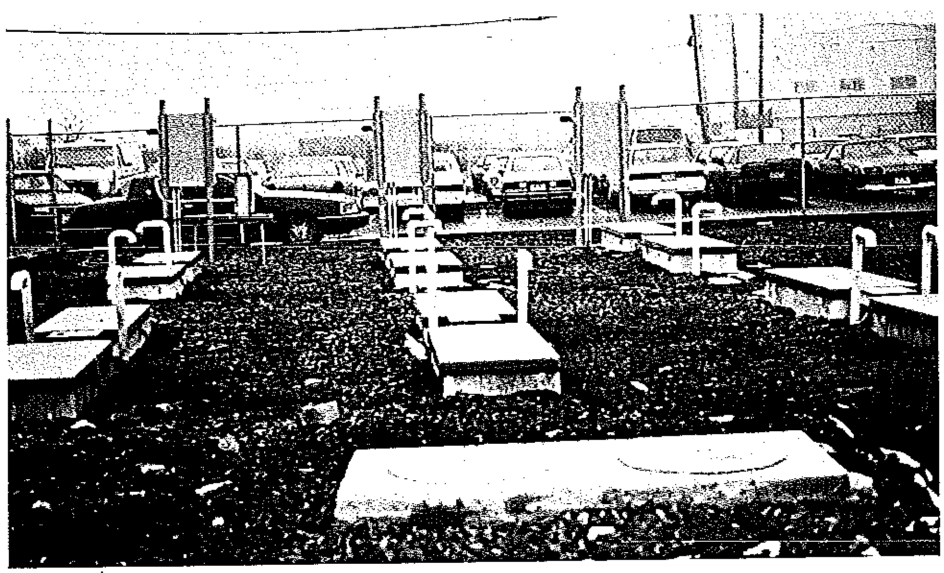
Since land space and property values were of critical importance, the treatment system was placed directly behind the buildings encompassing the largest plaza occupant and therefore a covered noiseless treatment plant was desirable. Installation was completed in March of 1991 and with Operation and Maintenance inspections provided by ***Cromaglass*** servicing representative, Environmental Disposal Systems of Staten Island, this total system has operated most successfully since the initial start.

Cromaglass consulting representative, D&D Maintenance, worked with Hamlin Construction Company and the owners, Meredith Avenue Associates, to complete construction on the original treatment system complex in a timely fashion.

Busy Staten Island Shopping Center



Little valuable space required for ***Cromaglass System.***



No odors and no noise to distract shoppers.

Flexibility

Continued from Page 1

Due to space limitations, the ***Cromaglass*** fiberglass tank was placed in the parking lot in front of stores with a retaining area protected by treated wooden posts and horizontal segments. This allows for easy access so that optimum operation and maintenance can be assured, supported by the ***CromaWatch*** remote monitoring program. Any mechanical malfunction would promptly be communicated through telephone lines to the central headquarters and advice would immediately be given to the local ***Cromaglass*** servicing distributor and central offices.

CROMAGLASS WORLDWIDE

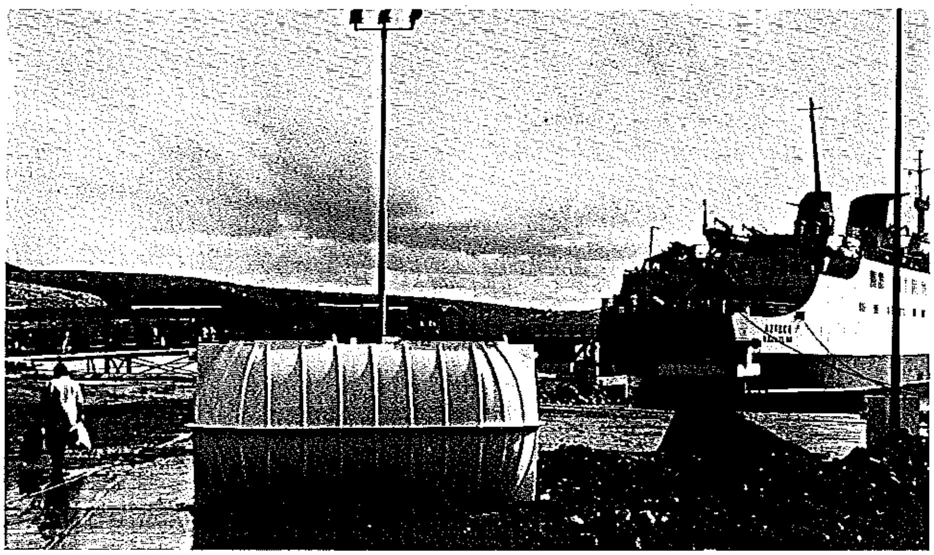
Environmental concerns increase around our globe and ***Cromaglass*** has placed special marketing emphasis on this sector for its treatment systems growth.

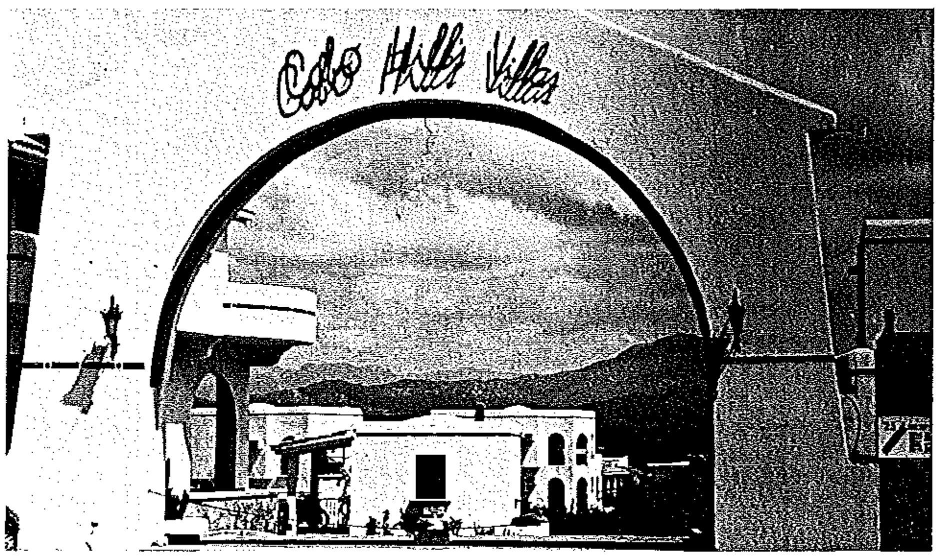
One such area showing heavy construction and the need for modern wastewater treatment technology is the Mexican Baja Peninsula.

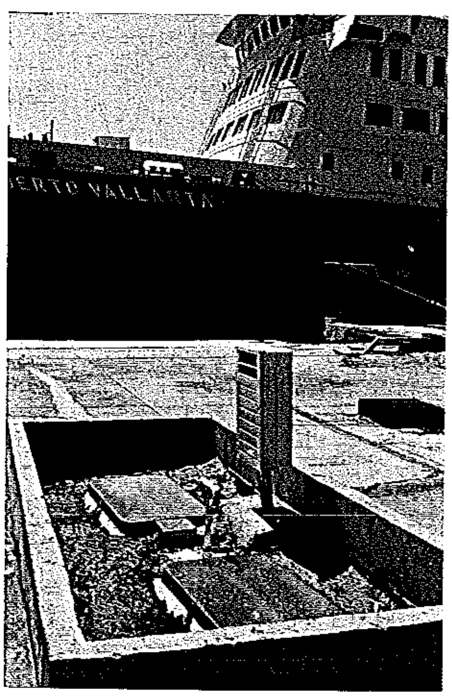
Cromaglass representative, Bioingenieria with offices in La Paz and Los Cabos, has found good success working with professional engineers in design of wastewater treatment and recycle systems for single homes, condominiums, commercial and industrial facilities. Bioingenieria is owned and operated by Dr. Juan Trasvina whose experience includes work as a professor of engineering at La Paz University.

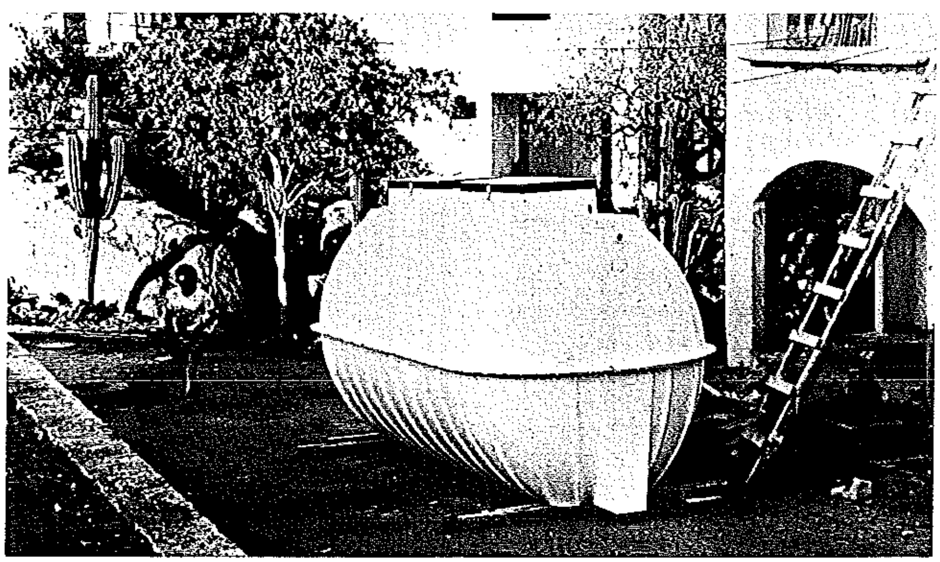
One of his installations services the Pichilingue ship and dock facilities of the La Paz port.

Los Cabos is an expansive area at the tip of the peninsula where extensive tourism has developed from attraction to unusually good deep-sea fishing and overall good tropical weather. Cabo Villas Hills is one condominium group utilizing ***Cromaglass Systems*** (picture of CA-50) with effluent recycling to a waterfall and landscaping ponds.









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LYCOMING
BIOLOGY

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Evaluation of an SBR Sewage Treatment System for Wastewater Recycle/Reuse

(Cromaglass Model CA-5)

Ben Franklin Project # 1176

Project Manager: Dr. Mel Zimmerman

October, 1996

Evaluation for an SBR Sewage Treatment System for Wastewater Recycle/Reuse

Ben Franklin Project # 1176
Project Manager: Dr. Mel Zimmerman

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Evaluation of an SBR Sewage Treatment System for Wastewater Recycle/Reuse

Preface/Background.

The purpose of this project was to evaluate the performance of an aerobic wastewater treatment system, developed by *Cromaglass Corporation*, following guidelines of NSF (National Sanitation Foundation) Standards 40/41 for wastewater recycle/reuse.

Currently being publicized as the world's second most critical resource, clean water is in ever increasing demand. Many areas of the United States, including Pennsylvania, have experienced contamination of surface and groundwater supplies because of subsurface disposal of domestic wastewater. The ability to treat and recycle/reuse domestic wastewater will be a significant benefit in not only extending water supplies but also in reducing discharge fields. Treated water can be recycled and reused for toilet flushing and/or vegetation irrigation.

Cromaglass Corporation has manufactured and marketed wastewater treatment systems for individual residences, commercial establishments and small communities since 1965. These systems employ recognized principles of biological science, as well as an exclusive oxidation and settling process. Operating by the introduction of free oxygen, aerobic microorganisms oxidize the organic matter, the *Cromaglass Batch Treat* process allows the treatment steps of react, settle and discharge to occur on a time sequence in a single reactor while containing peak surges. The current market for *Cromaglass* Systems is for domestic wastewater flows ranging from 400 GPD to 100,000 GPD. Generally systems of this size rely upon subsurface drain fields. Since toilet flushing consumes 30-40% of household water use, an important benefit results with less water being discharged because about 30% of the treated wastewater can be reused for toilet flushing. This reduces the amount of overall water use and drainage area required for treatment.

Sequencing Batch Reactor (SBR) technology is the treatment of wastewater on a batch basis, as opposed to continuous flow, and is no more than an activated sludge system which operates in time rather than space, i.e., all steps of the process take place, one after the other, in the same tank instead of moving to a second tank for the continuation of treatment. Typical SBR operation involves filling a tank with raw wastewater/influent while aerating to convert the organics to microbial mass (FMR-period), providing a period for settling (S-period) and decanting (D-period). Depending on SBR model, this cycle is repeated several times in a 24 hour period. For example, the *Cromaglass* Model CA-5 (see Figure 1), which was used in this study, repeats the same cycle for six discharges per day with a 500 gal. per day rated capacity. A key element in the SBR process is that a tank is never completely emptied, but rather a portion of settled solids is left in the tank for the next cycle. The retention of sludge within the tank establishes a population of microorganisms suited to treating the waste.

During the first eight months of the study (October 1994 - May, 1995) a total of four designs of a wastewater recycle/reuse system, were tested at the Jersey Shore, PA Wastewater Treatment Plant test site. All designs, using combinations of filter types, an artificial pond clarifier and ozone disinfection, failed to approach any effluent requirements for wastewater recycle/reuse. During June-July 1995, a new design was developed that took effluent from the CA-5 and further treated it with a combination CER filter system with UV disinfection. Because of problems with backflushing the cartridge filters, they were phased out in steps beginning in January 1996 and replaced with a second sandfilter. Figure 2 is a schematic of the system design tested from Sept. 1995 - May 1996. NSF made an inspection visit of the site in August and September, 1995 and design loading began on Sept. 19, 1995.

The following report contains results of the testing program from Sept. 1995 - May 1996. The basic loading and testing followed NSF Standard 40/41 protocols but also included additional chemical and biological evaluations. The report includes a description of the plant, its operation and key process control equipment, a narrative summary of test program, results and significance. Some phases of the analysis were performed by independent evaluations and these are briefly summarized here. These include microbiological analysis performed by Mr. Mike Gerardi, Wastewater Consultant, and stress tests performed by Seewald Laboratories and EAP Industries, Inc. Their full reports are published in separate documents.

The Project Manager, (Dr. Mel Zimmerman) wishes to acknowledge the following for contributions and support of this project:

Northern Tier Ben Franklin Technology Center
Lycoming College
Borough of Jersey Shore, PA
Cromaglass Corporation
National Sanitation Foundation (NSF)
CER Technologies
Seewald Laboratories
EAP Industries, Inc.
APG (Analytical Products Group), Inc.
Mr. Mike Gerardi
Mr. Dennis Dyroff
Lycoming College Student Assistants: Chris Wentzel, Heather Jacobs, Tom Shreck, Beth Gentile, Kathy Dziewulski, Aaron McGaw, Josh Laidacker and Adam Erdley.

Design and loading of system.

The *Cromaglass* CA-5 was loaded on September 19, 1995 with 1/3 wastewater and 2/3 water following NSF protocol. On each day following the 19th, 500 gal. per day of raw wastewater from the main sewer line at Jersey Shore, PA was fed into the system for treatment. Every morning, between 9:00 a.m. and 10:00 a.m., 500 hundred gal. of raw wastewater was added to the day storage tank (see Figure 2 for system design.) From the day tank, the 500 gal. wastewater would be pumped into the CA-5 under the following loading cycle:

a) loading cycle A is for 35% of daily load (or 175 gal.) between 6:00 - 9:00 a.m.,
b) loading cycle B is for 25% of daily load (or 125 gal.) between 11:00 a.m. -2:00 p.m., and
c) loading cycle C is for 40% of daily load (or 200 gal.) between 5:00 - 8:00 p.m.

Over the 239 possible days of loading this volume into the system (Sept. - May), only 184 days were successful (see Summary of loading log in Appendix I.) This resulted in a 77% loading efficiency. The reasons for downtime or <500 gal. per day loading varied from bad weather causing frozen lines to the sampling equipment or mechanical malfunctions in the loading pump from the main sewer line. Note that the CA-5 functioned A-5 functioned continuously through these periods.

Sample collection and analysis.

The CA-5 was set for six discharges per day. During work days (Mon. - Fri.) 24 hr. ISCO composite samples were collected during the discharge periods from the day tank (sample #1, influent); CA-5 effluent (sample #3 or effluent A); sand filter effluent (sample #4 or effluent B); and filter /UV effluent (sample #5 or effluent C.) In addition, a daily grab sample (sample #2) was taken during the aeration period from the activated sludge chamber of the Cromaglass unit (see Figure 2 for location of sample ports.) The influent (sample #1), grab (sample #2) and the three effluent samples (#3, 4, 5) were analyzed Mon. - Fri. for temperature (^{0} C), dissolved oxygen (ppm), biochemical oxygen demand ($cBOD_5$, ppm), total and volatile suspended solids (ppm TSS and VSS), pH and alkalinity (ppm $CaCO_3$). All analysis followed Standard Methods for the Examination of Water and Wastewater Vol. 18. In addition, on Tuesdays and Thursdays, the influent and effluent (at ports #3 and 5) were analyzed for nitrate (NO_3), nitrite (ppm, NO_2), ammonia (ppm, NH_3), total phosphate (ppm) and ortho phosphate (ppm). Weekly total coliform tests of the final effluent (sample #5) were also made. Complete analysis of samples occurred during 83% of the possible sample days (see Summary log in Appendix I.)

Toxicity and stress testing.

During April and May of 1996, the system was subjected to toxicity testing (both acute and chronic) and two stress tests periods. The stress tests consisted of the NSF Standard 40 Wash-day loading stress (see Figure 3) and the Power Failure stress (see Figure 4.) During the toxicity tests, samples of final effluent (sample #5) were collected and sent to Seewald Laboratories (Williamsport, PA) and EAP Industries, Inc. (Cheswick, PA.)

Analytical results.

Daily reports of the data are given in Appendix II. A monthly breakdown of sample sizes, with mean ± SD for the parameters are given in Appendix III. Table 1 summarizes the X± SD values for the parameters over the duration of the project (9/19/95 - 4/19/96) except for stress testing (4/19/96 - 5/16/96.) Mean influent $cBOD_5$ and TSS were 131 ± 34 ppm and 137 ± 39 ppm, respectively. $cBOD_5$ of effluent samples from the CA-5, after sand filter and cartridge filtration averaged 10 ± 7, 5.5 ± 4.7 and 2.79 ± 1.84 ppm, respectively. Total suspended solids (TSS) for the same effluent samples averaged 37 ± 21, 8.9 ± 5.7 and 1.9 ± 2.4 ppm, respectively. These results demonstrate a BOD reduction of the influent sample of 92% after the CA-5 treatment. Additional treatment by the sand filter followed by secondary filtration resulted in 96 and 98% BOD reduction (see Table 2). Percent total suspended solids removed was 73% after the CA-5 followed by 93 and 98% after filtration, respectively. These results are graphically shown in Figures 5, 6. Final effluent ammonia nitrogen was also reduced by >97% during the treatment process (see Tables 1, 2 and Figure 6.) A graphical representation of influent and effluent, BOD, TSS and ammonia nitrogen values are presented in Figures 7, 8 and 9 respectively. Figure 10 compares ammonia, nitrate (NO_3) and nitrite (NO_2) values for influent and effluent. All mean effluent values for nitrogen were less than 10 ppm.

Analytical summary.

These results indicate that the treatment system design can meet both Class II (60 ppm BOD and 100 ppm suspended solids as well as Class I (30 ppm BOD and 30 ppm TSS) effluent quality as outlined in the EPA Secondary Treatment Guidelines. In addition, to the 30/30, BOD/TSS mean of all effluent samples collected in a period of 30 consecutive days, the removal efficiency for Class I should be 85% and the pH of the effluent must remain between 6.0 and 9.0. During the course of the study the final effluent (i.e. following filtration and disinfection) consistently met both Class I and Class II criteria. Furthermore, the effluent directly from the CA-5 consistently met all Class II criteria and also Class I for BOD and pH.

Toxicity and stress testing.

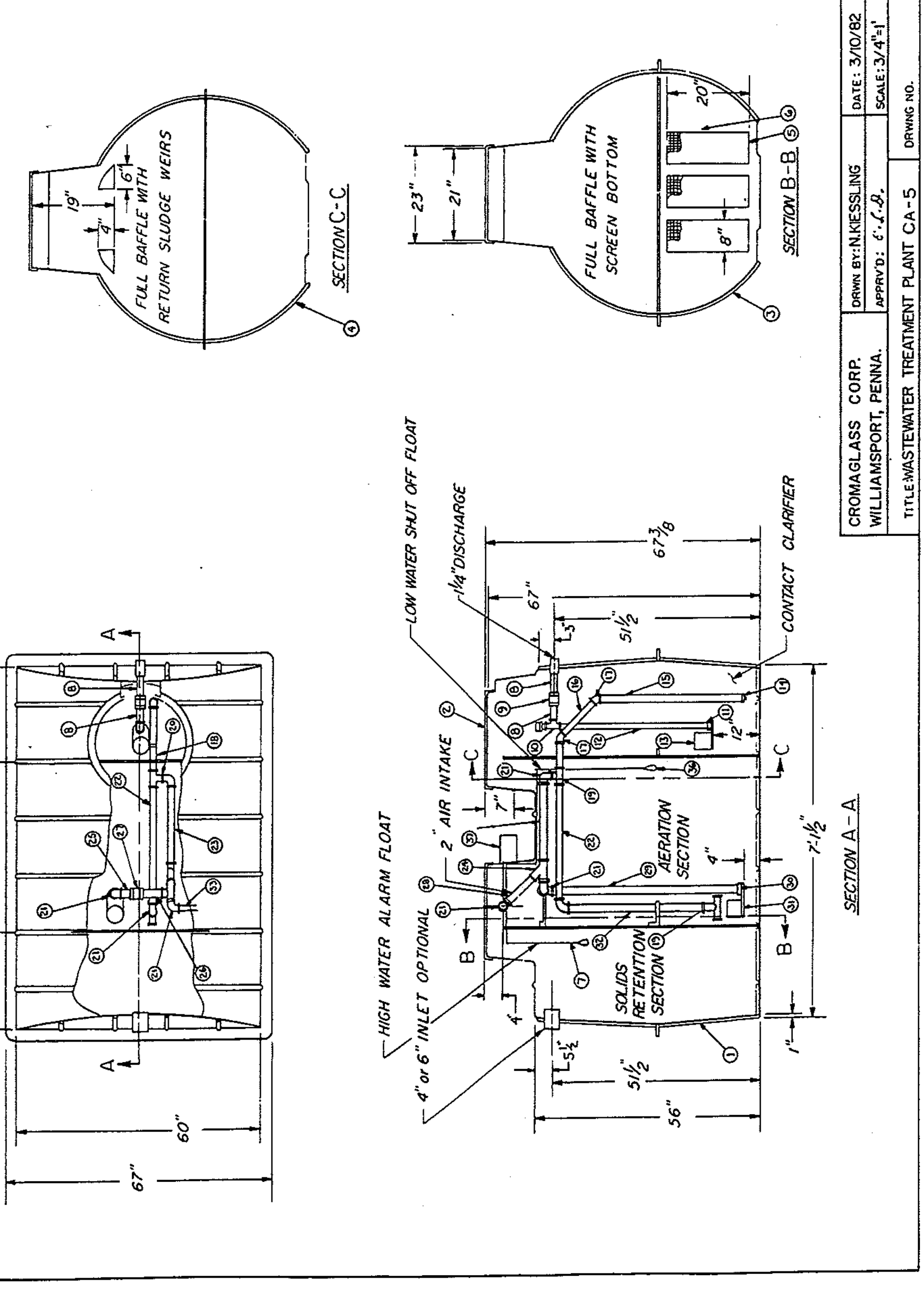
Separate 48 hr. acute toxicity tests were run on the final effluent on May 6, 1996 by Seewald Laboratories and May 8 by EAP Industries, Inc. In addition, EAP Industries performed a 7-day chronic toxicity test using final effluent and exposure of the zooplankton crustacean, *Ceriodaphnia dubia* and the flathead minnow, *Pimephales promelas*. A copy of their conclusions are attached in Appendix IV. It was concluded that the *Cromaglass* CA-5 effluent did not exhibit acute or chronic toxicity.

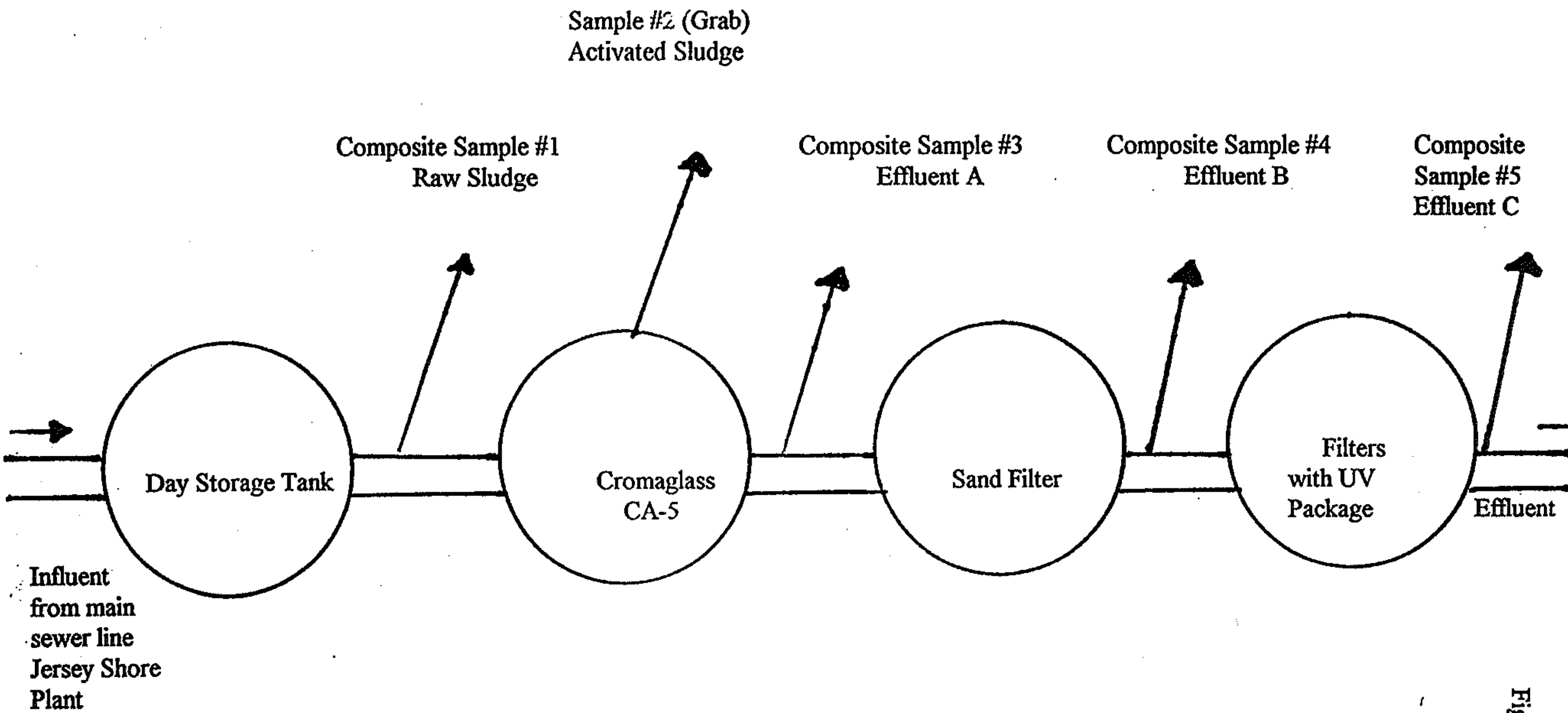
Table 3 summarizes the results of stress testing involving wash day loading (started April 15) and 48 hr. power failure (started May 4). Once again the system rebounded after stress back to Class I and II effluent.

Independent Evaluation:

Appendix V contains the written evaluation by Dr. David Long (consulting Environmental Engineer) after his review of this project. Appendix IV contains an evalutation of the microlife associated with the treatment process of the CA-5.

Figure 1 - Cromaglass CA-5





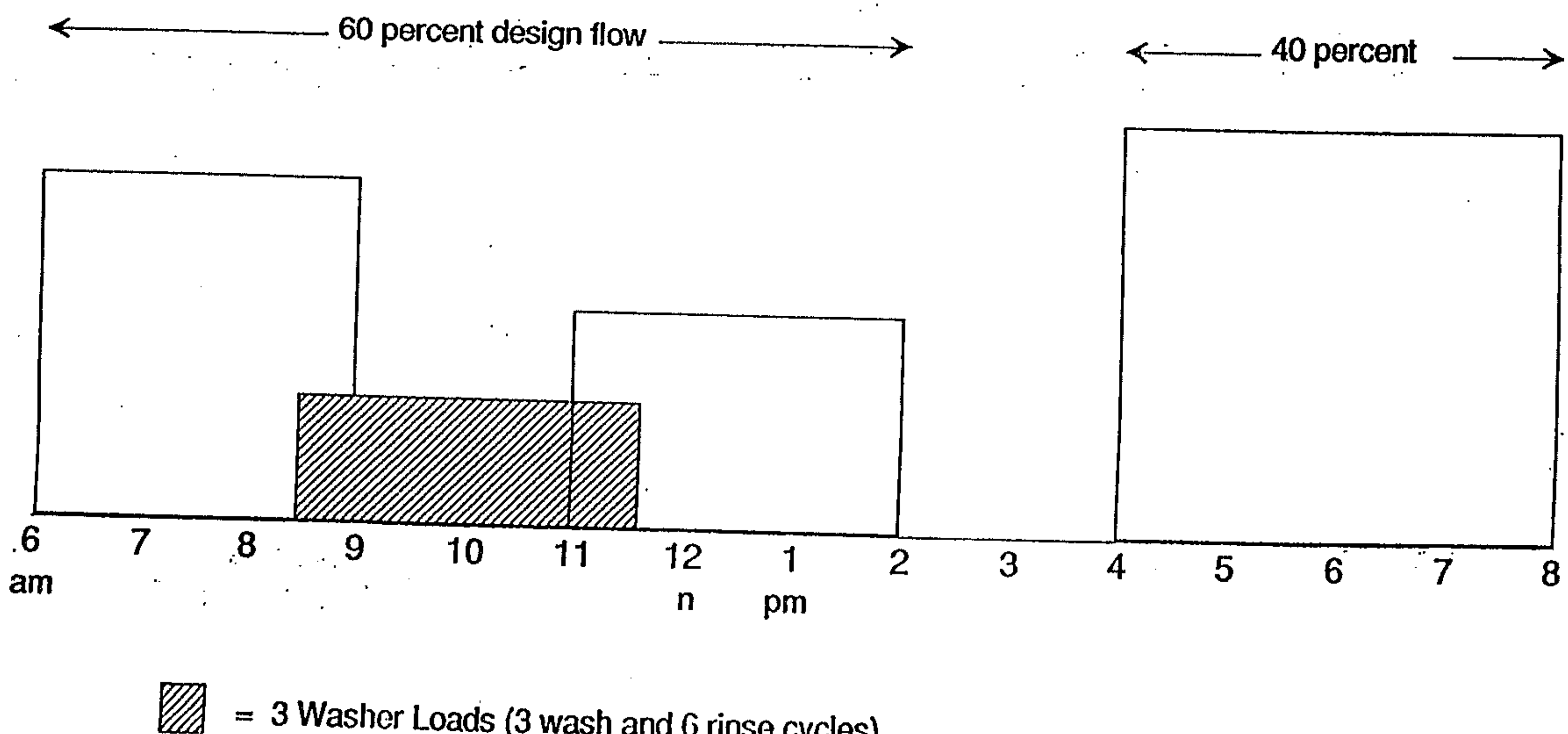
Samples # 1, 3, 4, 5 collected with ISCO composite samplers.
Samples # 2 taken with a grab bottle.

Figure 2 - System Design

Figure 3

WASH DAY LOADING

Added to plants 3 times in one 5-day week with one 24-hour period between each loading



= 3 Washer Loads (3 wash and 6 rinse cycles)

Wash cycle contains low sudsing commercially available household detergent and household bleach at manufacturer's recommended use level

EQUIPMENT OR POWER FAILURE

All power to plant off for 48 hours, 1 time only

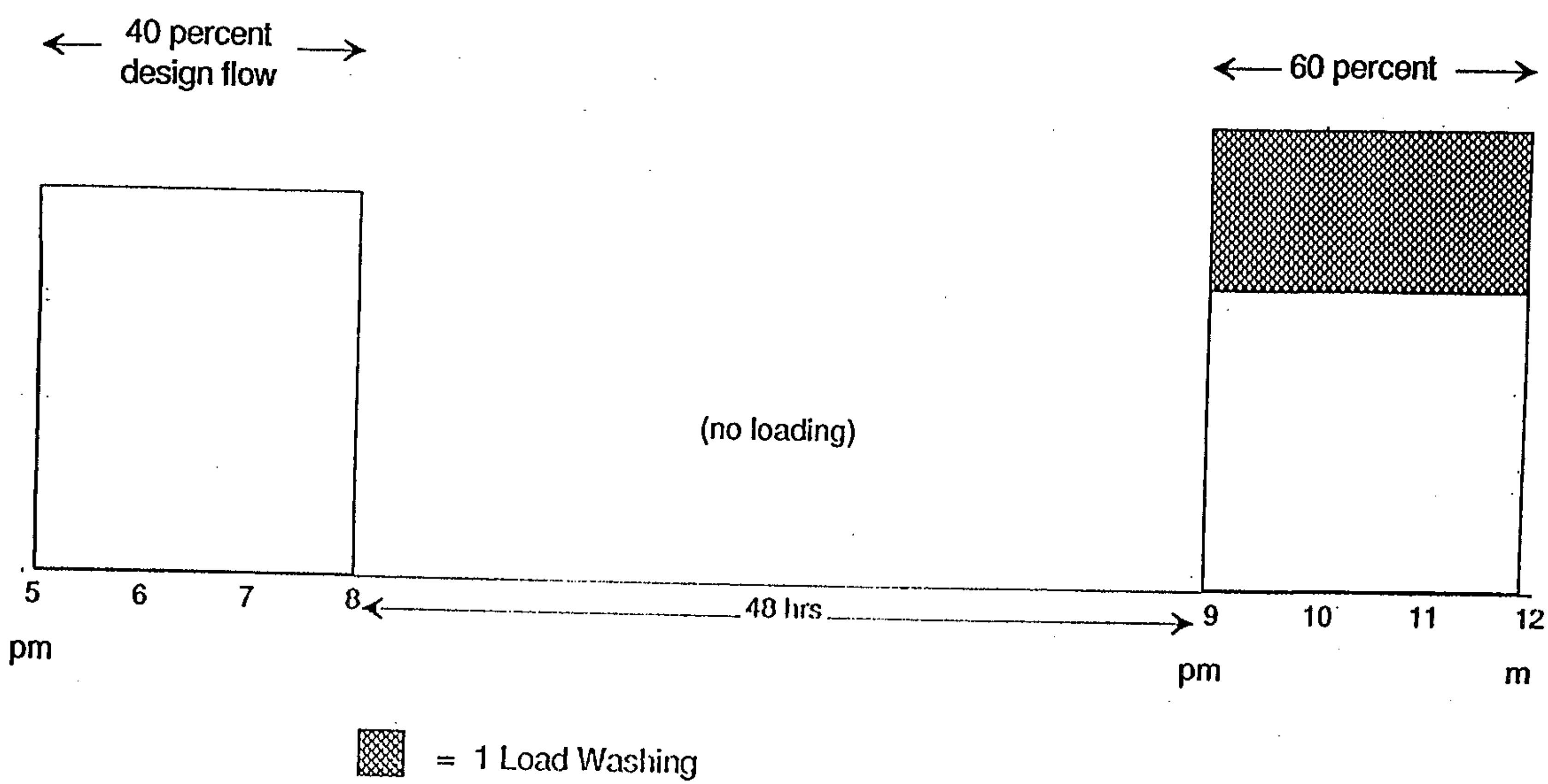


Figure 4

%-Reduction from influent
09/19/95 - 04/12/96

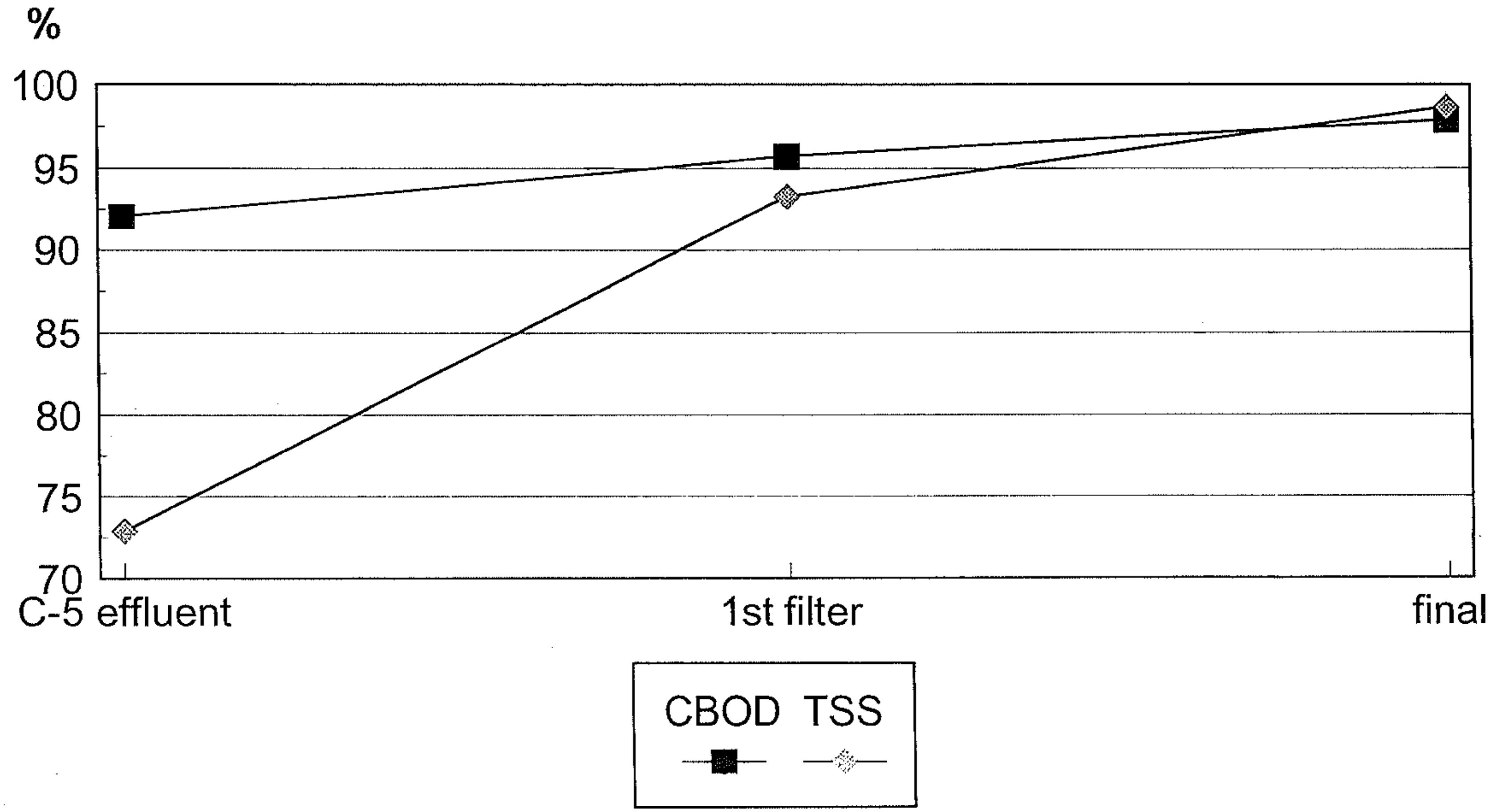


Figure 5

%-Reduction from influent
09/19/95 - 05/14/96

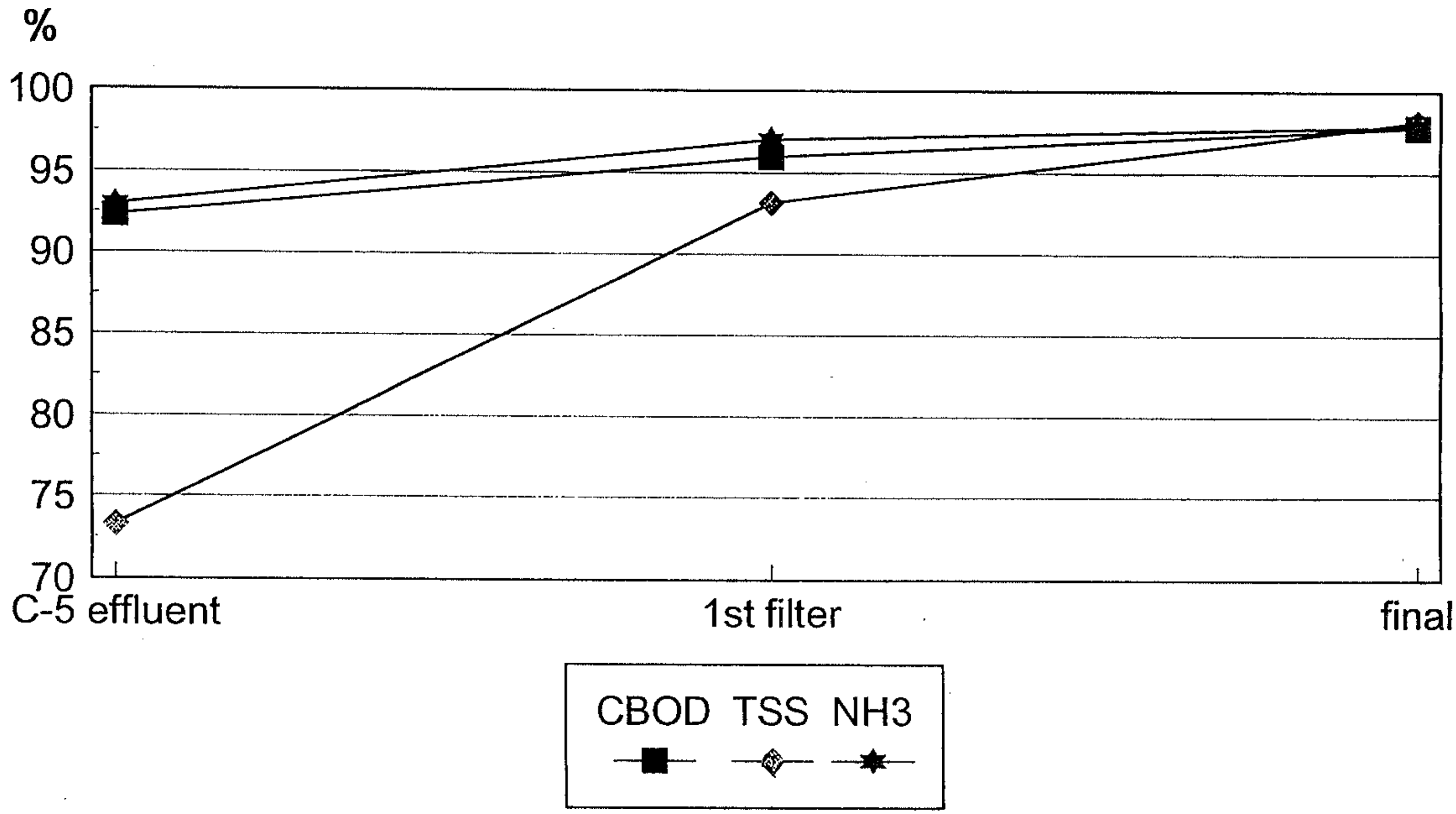


Figure 6

Figure 7

Mean CBOD
09/19/95 - 05/14/96

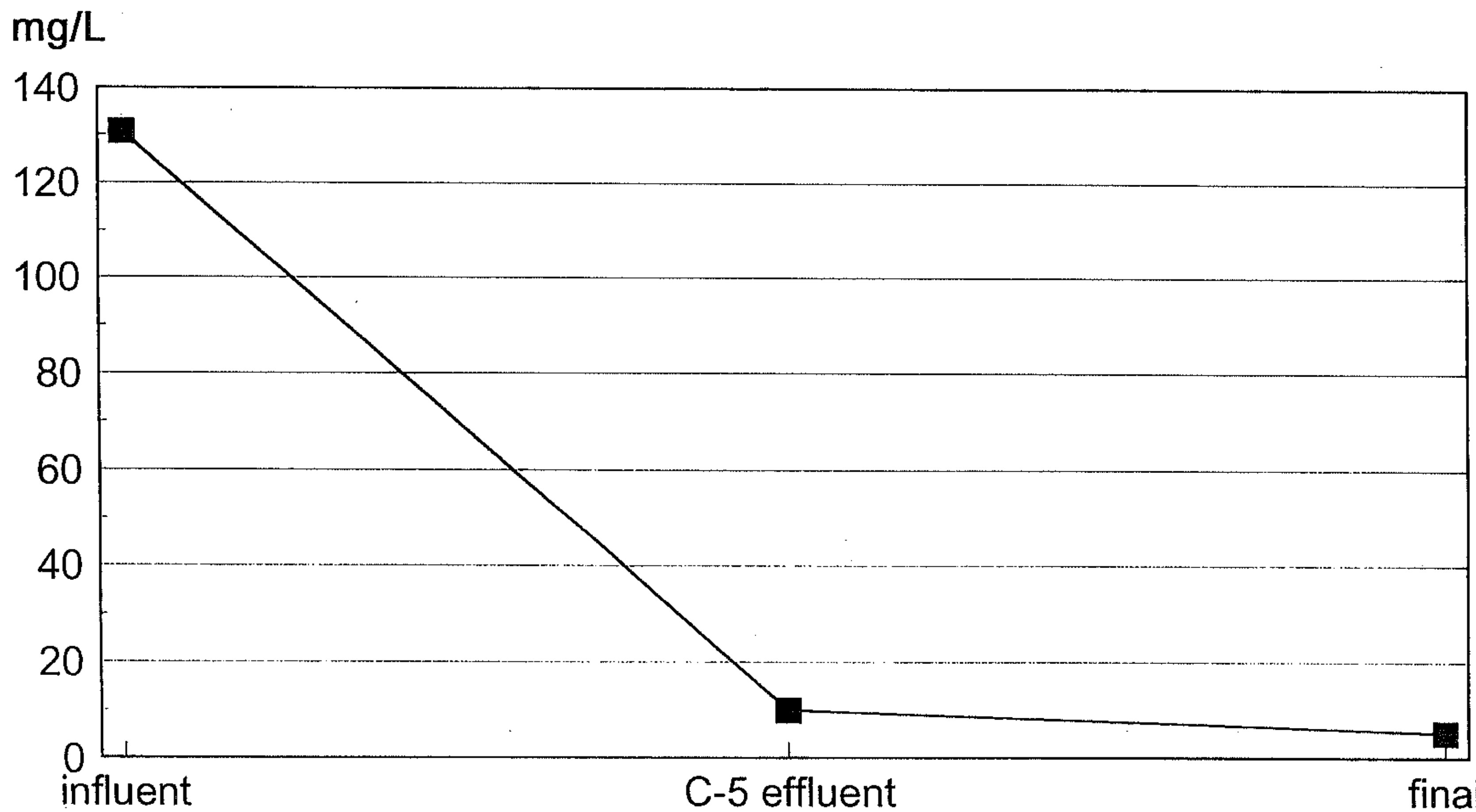


Figure 8

Mean TSS
09/19/95 - 04/12/96

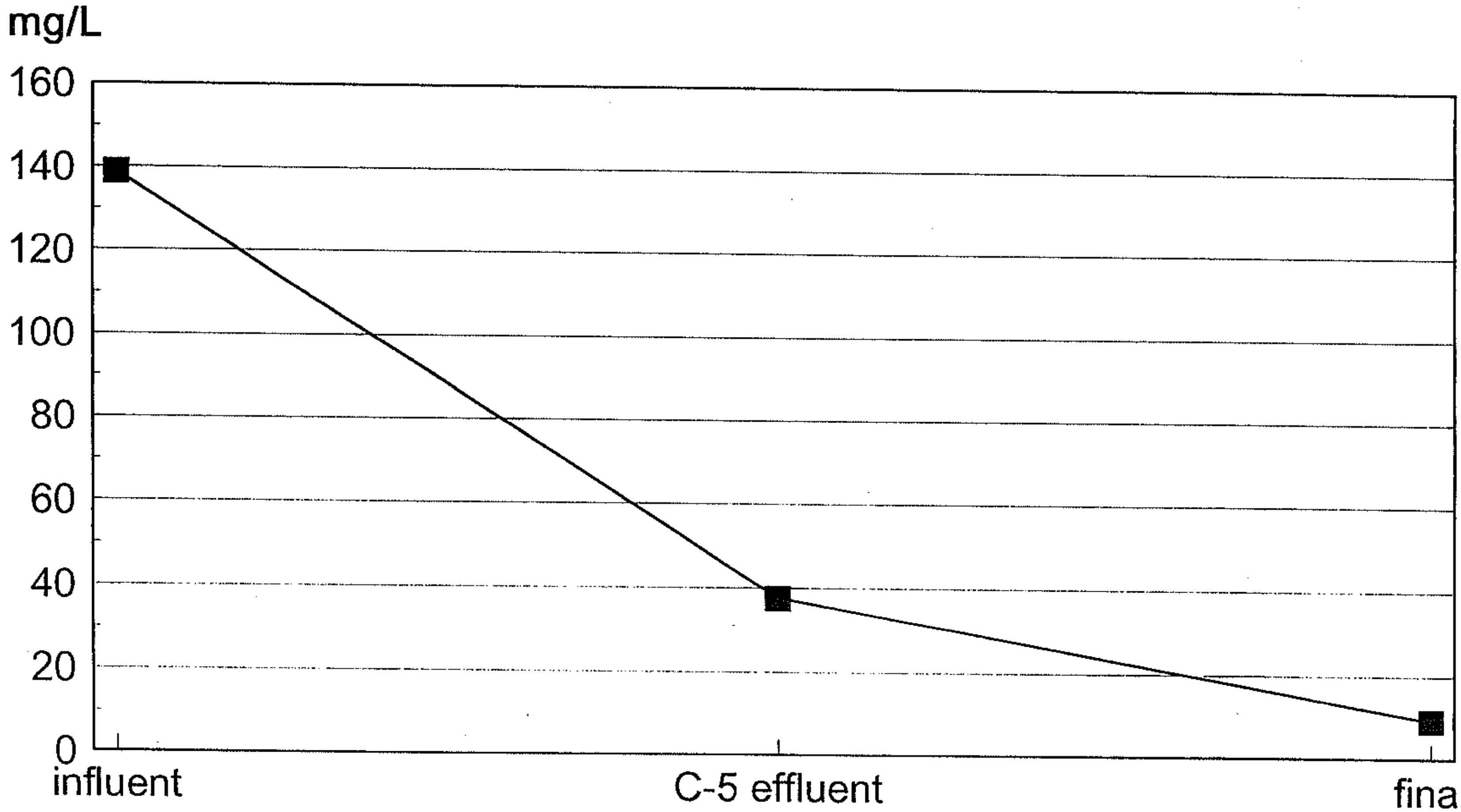


Figure 9

Mean NH3 and Alkalinity
09/19/95 - 05/14/96

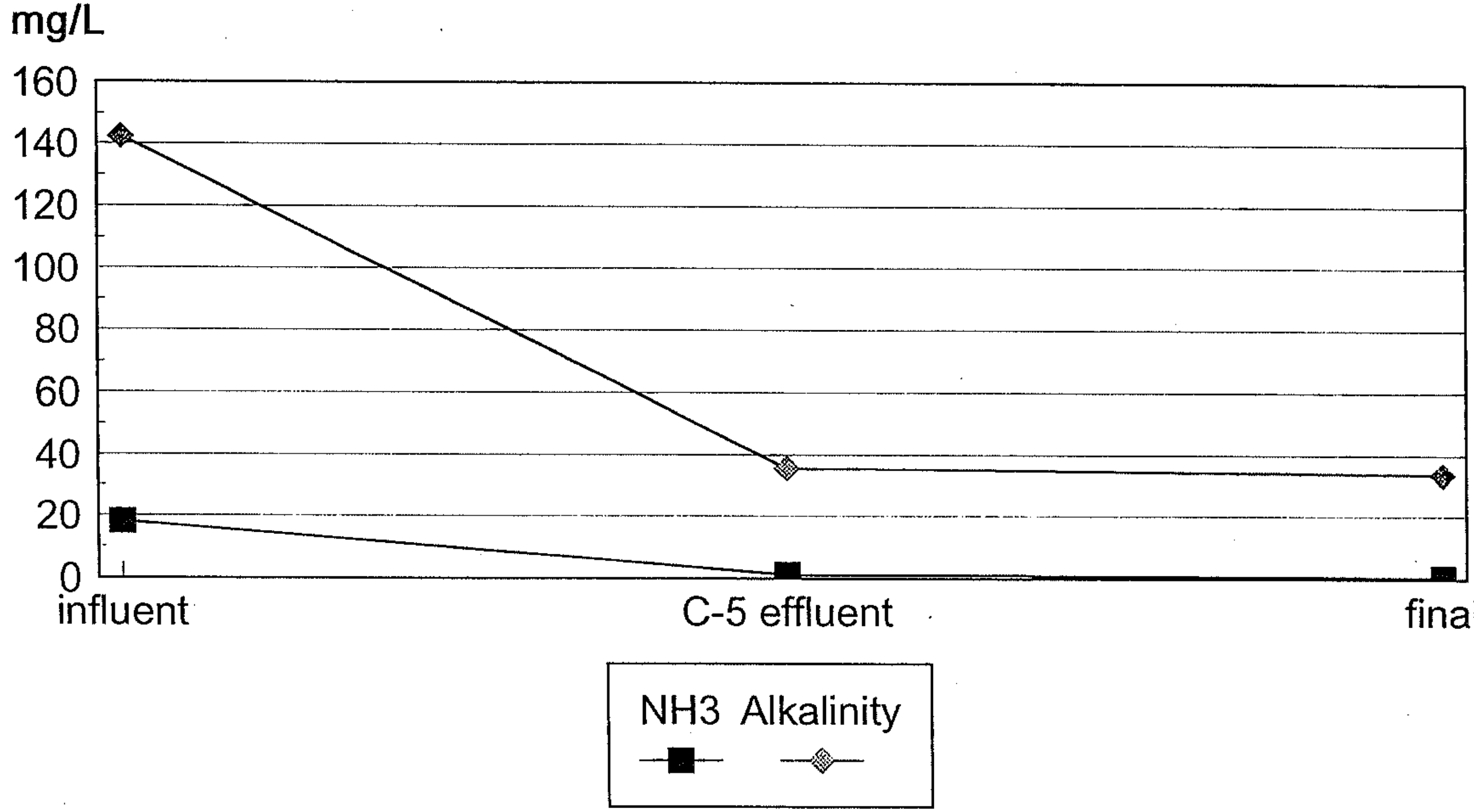


Figure 10

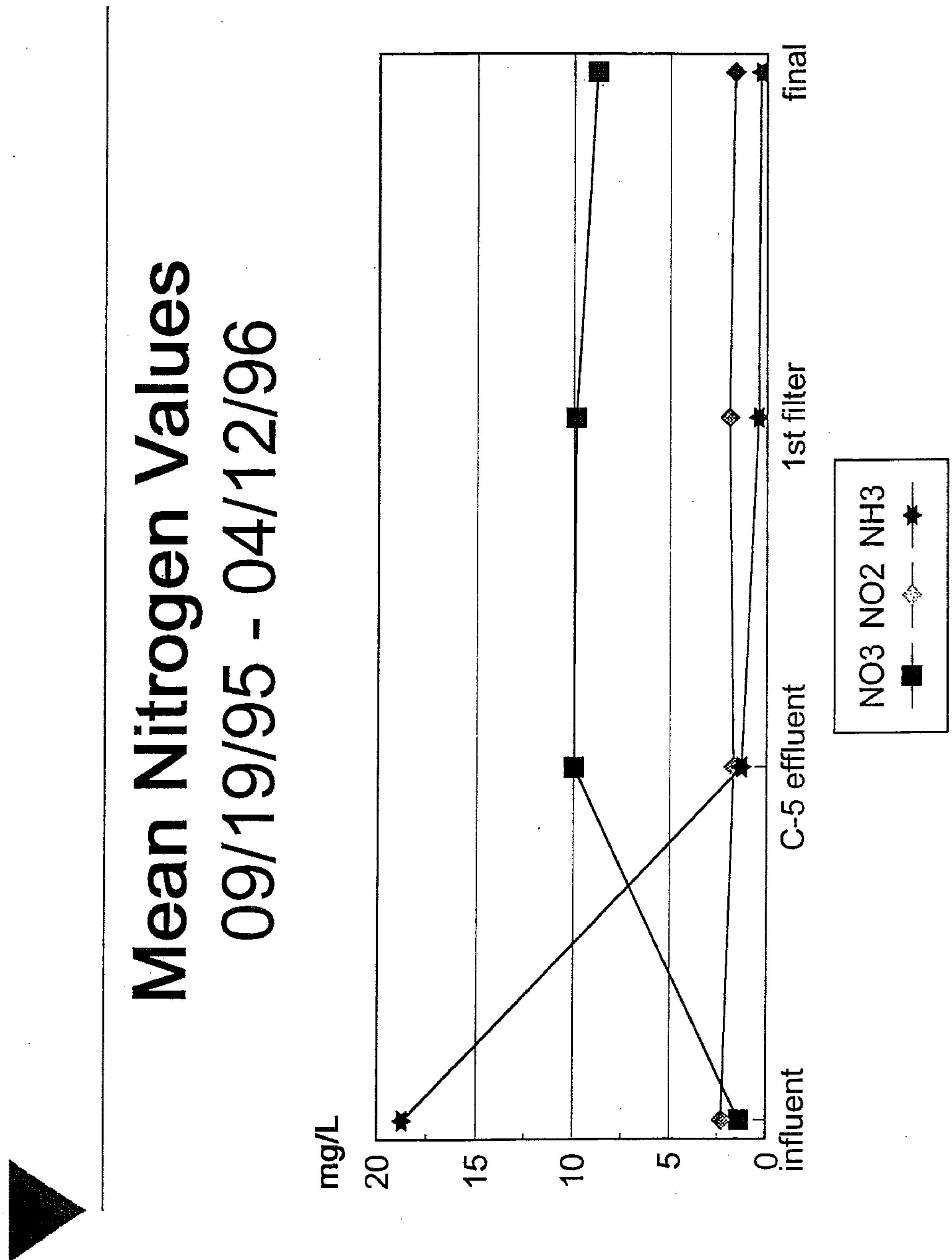

Mean Nitrogen Values
09/19/95 - 04/12/96
mg/L
20
15
10
5
0
influent
C-5 effluent
1st filter
final
NO3
NO2
NH3

Table 1

Statistics

09/19/95 - 04/19/96

number

	Sample #				
	1	2	3	4	5
TEMP	124	124	124		
O2	124	124	124		
CBOD	113		106	76	107
SETT SOL		124			
TSS	109	104	97	67	104
VSS	108	103	97	65	103
TDS					
NO3	51		48	33	47
NO2	51		48	33	47
NH3	46		43	31	42
ORTHO P	47		45	30	44
TOT P	46		44	29	43
PH	120	124	111	78	115
ALKALINITY	120	124	111	78	115
TC					43
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	19.34	21.98	22.03		
O2	1.05	5.45	5.48		
CBOD	131.41		10.38	5.53	2.79
SETT SOL		602.10			
TSS	137.17	2702.87	36.99	8.99	1.85
VSS	118.51	1977.35	30.19	7.74	1.24
TDS					
NO3	1.40		9.75	9.62	8.78
NO2	2.30		1.69	1.89	1.66
NH3	18.37		1.22	0.46	0.34
ORTHO P	9.74		8.74	9.31	9.42
TOT P	11.56		9.63	9.90	10.01
PH	7.03	6.37	6.66	6.48	6.78
ALKALINITY	142.78	72.20	33.26	29.29	34.57
TC					2.53
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	5.89	4.20	4.19		
O2	1.74	1.90	2.06		
CBOD	33.63		7.01	4.66	1.84
SETT SOL		151.01			
TSS	38.83	744.91	20.67	5.74	2.36
VSS	34.78	648.79	16.57	4.63	2.01
TDS					
NO3	0.70		4.51	3.75	3.84
NO2	2.21		1.67	0.94	1.45
NH3	7.43		3.23	0.41	0.36
ORTHO P	7.70		2.36	2.34	2.67
TOT P	8.69		2.91	2.76	3.15
PH	0.26	0.51	0.53	0.49	0.41
ALKALINITY	26.63	42.79	18.51	15.30	16.36
TC					4.84
FC					
Ec					

Table 2

%-Reduction of CBOD, TSS, and Ammonia nitrogen after C-5, 1st sand filter, and final effluent.

	CBOD	TSS	NH_3
September			
C-5	94.99	69.97	99.15
1st filter	96.32	88.37	
final	97.88	98.37	100.00
October			
C-5	94.88	73.62	84.48
1st filter	96.25	94.88	94.93
final	98.03	99.34	97.92
November			
C-5	94.60	69.89	93.08
1st filter	96.62	92.11	97.85
final	98.06	98.71	98.32
December			
C-5	94.99	71.41	98.57
1st filter	97.28	86.66	98.96
final	98.18	99.23	99.80
January			
C-5	82.60	61.75	98.62
1st filter	91.60	89.95	96.96
final	96.60	97.45	96.68
February			
C-5	88.33	73.00	95.98
1st filter	95.81	93.20	97.06
final	98.11	98.98	97.52
March			
C-5	90.18	78.24	97.35
1st filter	95.77	93.85	97.68
final	98.33	98.74	98.94
April			
C-5	94.10	75.70	97.10
1st filter	96.42	94.62	97.14
final	97.50	96.91	98.34
May			
C-5	92.81	75.06	86.10
1st filter	96.68	89.01	92.25
final	97.12	91.16	94.41
Total 9/19 - 5/14			
C-5	92.31	73.27	93.00
1st filter	95.96	93.15	97.04
final	97.83	98.15	97.89
Total 9/19 - 4/12			
C-5	92.05	72.90	93.13
1st filter	95.72	93.28	97.59
final	97.88	98.68	98.20
Total 4/15 - 5/14			
C-5	93.79	75.26	92.11
1st filter	96.84	91.96	94.55
final	97.47	94.35	95.91

Table 3

Statistics

04/15/96 - 5/14/96

number

	Sample #				
	1	2	3	4	5
TEMP	21	21	21		
O2	21	21	21		
CBOD	20		20	19	18
SETT. SOL		21			
TSS	20	19	19	19	18
VSS	20	19	19	19	18
TDS					
NO3	9		9	9	8
NO2	9		9	9	8
NH3	9		9	9	8
ORTHO P	9		9	9	8
TOT. P	9		9	9	8
PH	21	21	19	20	19
ALKALINITY	21	21	19	20	19
TC					4
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	12.67	19.98	20.10		
O2	1.41	5.22	5.00		
CBOD	117.54		7.30	3.71	2.97
SETT. SOL		602.82			
TSS	107.50	2967.05	26.59	8.65	6.08
VSS	92.40	2304.42	22.70	7.06	4.90
TDS					
NO3	1.57		4.01	4.06	3.94
NO2	1.83		1.33	1.22	0.75
NH3	14.37		1.13	0.78	0.59
ORTHO P	7.44		7.60	7.89	8.57
TOT. P	8.68		8.58	8.72	8.98
PH	6.69	6.37	6.71	6.61	6.78
ALKALINITY	140.07	85.12	48.82	49.03	50.11
TC					25.75
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	1.19	2.17	2.15		
O2	1.98	2.16	2.64		
CBOD	45.57		5.23	2.20	2.38
SETT. SOL		148.67			
TSS	28.88	318.75	20.26	9.61	8.93
VSS	26.02	278.06	16.04	7.40	6.63
TDS					
NO3	0.61		1.92	2.40	3.06
NO2	1.60		0.66	0.63	1.30
NH3	4.32		2.03	1.28	0.85
ORTHO P	2.81		1.72	1.86	2.73
TOT. P	2.97		1.19	2.03	2.59
PH	0.15	0.25	0.27	0.30	0.33
ALKALINITY	18.07	28.36	22.45	21.58	22.72
TC					25.28
FC					
Ec					

Appendix I

Cromaglass Loading Log

September 1995 - May 1996

SUMMARY CROMAGLASS LOG

1.) Total possible days for loading = 239.

2.) Total days loaded with 500 gal. = 184.

3.) % of time loaded with 500 gal. = 76.99%.

4.) Total possible days for analysis = 171.

5.) Total days analyzed = 141.

6.) % of days analyzed = 82.46% (17.54% deficient).

7.) # of days input not analyzed = 35 (20.47%).

8.) # of days grab sample not analyzed = 31 (18.13%).

9.) # of days C-5 effluent not analyzed = 45 (26.32%).

10.) # of days effluent 4 not analyzed = 78 (45.61%).

11.) # of days final effluent not analyzed = 41 (23.98%).

12.) by month: days analyzed/possible days
September: 9/9 (100%)
October: 21/22 (95.45%)
November: 20/22 (90.91%)
December: 7/21 (33.33%)
January: 11/23 (47.83%)
February: 21/21 (100%)
March: 21/21 (100%)
April: 22/22 (100%)
May: 9/10 (90.00%)

Summary of Loading Log
Cromaglass Project 95-96

Date	Amount Loaded	Remarks
11/04/95	500	
11/05/95	500	
11/06/95	500	
11/07/95	500	
11/08/95	425	
11/09/95	400	
11/10/95	200	backwash and clean filters
11/11/95	500	
11/12/95	500	
11/13/95	500	
11/14/95	500	
11/15/95	500	
11/16/95	500	
11/17/95	400	
11/18/95	300	clean filters
11/19/95	500	
11/20/95	500	backwash
11/21/95	400	clean filters
11/22/95	500	
11/23/95	500	
11/24/95	0	frozen
11/25/95	250	repairs
11/26/95	175	repairs
11/27/95	500	
11/28/95	0	timer problem; backwash and clean filters
11/29/95	500	replaced timer
11/30/95	500	backwash
12/01/95	475	clean filters
12/02/95	475	
12/03/95	500	
12/04/95	500	
12/05/95	375	
12/06/95	300	clean filters
12/07/95	500	
12/08/95	500	backwash
12/09/95	500	
12/10/95	500	
12/11/95	500	
12/13/95	0	frozen; repairs to lines
12/14/95	0	
12/15/95	400	backwash and clean filters
12/16/95	100	wash filters
12/17/95	200	backwash and clean filters
12/18/95	500	
12/19/95	500	

Summary of Loading Log
Cromaglass Project 95-96

Date	Amount Loaded	Remarks
02/03/96	0	not filled
02/04/96	0	not filled
02/05/96	500	
02/06/96	500	
02/07/96	500	
02/08/96	500	
02/09/96	500	backwash
02/10/96	500	
02/11/96	500	
02/12/96	500	
02/13/96	500	
02/14/96	500	
02/15/96	500	
02/16/96	500	backwash
02/17/96	500	
02/18/96	500	
02/19/96	500	
02/20/96	500	
02/21/96	500	
02/22/96	500	
02/23/96	500	backwash
02/24/96	500	
02/25/96	500	
02/26/96	500	
02/27/96	500	
02/28/96	500	
02/29/96	500	
03/01/96	500	backwash
03/02/96	500	
03/03/96	500	
03/04/96	500	
03/05/96	500	
03/06/96	500	
03/07/96	500	
03/08/96	500	backwash; filters washed
03/09/96	500	
03/10/96	500	
03/11/96	500	
03/12/96	500	
03/13/96	500	
03/14/96	500	
03/15/96	500	backwash; filters washed
03/16/96	500	
03/17/96	500	
03/18/96	500	

Summary of Loading Log
Cromaglass Project 95-96

Date	Amount Loaded	Remarks
05/03/96	500	backwash
05/04/96	0	stress test
05/05/96	0	stress test
05/06/96	500	
05/07/96	500	
05/08/96	500	
05/09/96	500	
05/10/96	500	
05/11/96	500	
05/12/96	500	
05/13/96	500	
05/14/96	500	

Appendix II

Daily Data Sheets for Cromaglass Project

September 1995 - May 1996

Units

Temp.	- Temperature - °C
O_2	- Dissolved Oxygen - ppm
cBOD	- 5-day Carbonaceous Biochemical Oxygen Demand - ppm
Sett. Sol.	- Setable Solids - ppm
TSS	- Total Suspended Solids - ppm
VSS	- Volatile Suspended Solids - ppm
TDS	- Total Dissolved Solids - ppm
NO_3	- Nitrate Nitrogen - ppm
NO_2	- Nitrite Nitrogen - ppm
Orthop	- Ortho Phosphate - ppm
Tot P	- Total Phosphate - ppm
pH	- pH
Alkalinity	- Buffer Capacity - ppm $CaCO_3$
TC	- Total Coliforms - no./100mL
FC	- Fecal Coliforms - no./100mL
Ec	- E. coli - no./100mL

Daily Report

Date	Sample #				
09/19/95	1	2	3	4	5
TEMP					
O2					
CBOD					
SETT SOL					
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH		6.80			
ALKALINITY		112			
TC					
FC					
Ec					

Date	Sample #				
09/20/95	1	2	3	4	5
TEMP	26	26	26		
O2	0.33	2.40	2.10		
CBOD					
SETT SOL		710			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH		6.60			
ALKALINITY		212			
TC					
FC					
Ec					

Date	Sample #				
09/21/95	1	2	3	4	5
TEMP	25	26	26.4		
O2	0.31	2.30	2.10		
CBOD					
SETT SOL		700			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH		6.60			
ALKALINITY		212			
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
09/22/95	1	2	3	4	5
TEMP	25.5	25	26		
O2	0.41	2.90	2.10		
CBOD					
SETT. SOL		700			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH		6.60			
ALKALINITY		198			
TC					
FC					
Ec					

Date:	Sample #				
09/25/95	1	2	3	4	5
TEMP	25.9	26.7	26.9		
O2	0.35	2.10	2.30		
CBOD					
SETT. SOL		650			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH		6.80			
ALKALINITY		190			
TC					
FC					
Ec					

Date:	Sample #				
09/26/95	1	2	3	4	5
TEMP	26.1	26.5	26.9		
O2	0.29	1.98	2.20		
CBOD	151		5.7	5.1	3.9
SETT. SOL		530			
TSS	233	3553	52	18.2	2
VSS	180	3081	36	17.1	0.8
TDS					
NO3	2.8		7.6		6.8
NO2	2		1		1
NH3	21.20		0.18		0.00
ORTHO P			5.50		6.60
TOT. P			6.10		6.80
PH	6.90	6.80	7.34		7.20
ALKALINITY	149	122	65		58
TC					0
FC					
Ec					

Daily Report

Date 09/27/95	Sample # 1	2	3	4	5
TEMP	26	26.5	26.4		
O2	0.15	2.10	2.10		
CBOD	184		8.3		3.1
SETT. SOL		620			
TSS	127	2210	24		2.2
VSS	107	1569	16		0.8
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	7.20	7.00	6.89		6.89
ALKALINITY	150	119	68		59
TC					
FC					
Ec					

Date 09/28/95	Sample # 1	2	3	4	5
TEMP	26.2	26.8	26.8		
O2	0.34	2.50	2.60		
CBOD	118		8.8	6.1	2.9
SETT. SOL		600			
TSS	133	2504	60		4.6
VSS	129	1818	58		3.8
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	7.10	6.90	6.90		6.90
ALKALINITY	155	100	70		65
TC					1
FC					
Ec					

Date 09/29/95	Sample # 1	2	3	4	5
TEMP	27.1	26	26		
O2	0.40	1.90	2.10		
CBOD	156		7.7		3
SETT. SOL		650			
TSS	133	1832	52		1.4
VSS	127	1332	50		1.2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	7.20	6.90	7.10		7.10
ALKALINITY	183	180	64		59
TC					
FC					
Ec					

Daily Report

Date	Sample #				
10/02/95	1	2	3	4	5
TEMP	26.8	25.9	25.9		
O2	0.40	2.80	2.80		
CBOD	176		7.8		2.6
SETT SOL		700			
TSS	195	2521	48		1.1
VSS	193	1906	45.8		0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.40	7.00	7.00		6.90
ALKALINITY	175	145	81		79
TC					
FC					
Ec					

Date	Sample #				
10/03/95	1	2	3	4	5
TEMP	25.7	28.8	28.8		
O2	0.45	3.30	3.29		
CBOD	129		8.6	5.1	2.9
SETT SOL		700			
TSS	166	2504	41	8.9	0
VSS	163	1818	38.5	8.2	0
TDS					
NO3	1.9		13.4		10.9
NO2	2		2		4
NH3	23.50		0.20		0.15
ORTHO P	6.85		11.65		11.50
TOT P	7.55		12.10		11.70
PH	7.50	6.90	7.02	7.02	7.01
ALKALINITY	183	181	66	59	55
TC					0
FC					
Ec					

Date	Sample #				
10/05/95	1	2	3	4	5
TEMP	24.9	28.2	28.3		
O2	0.50	3.90	3.90		
CBOD	155		9.2	5.5	3.1
SETT SOL		500			
TSS	138	3860	61		0
VSS	136.1	2250	58.2		0
TDS					
NO3	2.1		4.8	4.1	4.0
NO2	5		2	2	2
NH3	22.40		1.90	1.20	1.20
ORTHO P	8.50		6.50	9.40	9.10
TOT P	9.80		6.65	9.50	9.70
PH	7.10	6.95	7.20	7.20	7.20
ALKALINITY	181	145	69	66	59
TC					0
FC					
Ec					

Daily Report

Date	Sample #				
10/06/95	1	2	3	4	5
TEMP	25.8	28.9	28.9		
O2	0.57	4.54	3.29		
CBOD	183		9		3.2
SETT SOL		580			
TSS	146	3429	32		1.2
VSS	116	2060	29.9		1
TDS					
NO3	0.8		4.3		3.2
NO2	1		1		0
NH3					
ORTHO P	5.29		7.42		8.30
TOT P	6.70		8.66		8.10
PH	6.99	6.91	7.30		7.30
ALKALINITY	150	148	76		86
TC					
FC					
Ec					

Date	Sample #				
10/09/95	1	2	3	4	5
TEMP	26.9	28.7	28.8		
O2	0.69	3.90	3.20		
CBOD	168		8.8		2.9
SETT SOL		600			
TSS	155	4887	29		0.9
VSS	139	4677	26.8		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.10	6.90	7.20		7.10
ALKALINITY	160	154	43		58
TC					
FC					
Ec					

Date	Sample #				
10/10/95	1	2	3	4	5
TEMP	28.5	28.8	28.8		
O2	0.25	4.30	4.20		
CBOD	126		6.9	4.5	3.4
SETT SOL		595			
TSS	139	4987	31.1		1.9
VSS	128	4781	28.2		0
TDS					
NO3	3.6		9.3		7.8
NO2	1		1		1
NH3	29.60		0.13		0.51
ORTHO P	5.20		8.66		4.67
TOT P	7.68		4.80		3.33
PH	7.27	6.73	7.01	7.00	7.09
ALKALINITY	168	94	43	51	59
TC					0
FC					
Ec					

Daily Report

Date	Sample #				
10/11/95	1	2	3	4	5
TEMP	28	28.5	28.5		
O2	0.20	2.55	3.09		
CBOD	145		7.1		3.1
SETT SOL		450			
TSS	148.1				0
VSS	139.2				0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.21	6.99	7.00		7.02
ALKALINITY	159	92	49		51
TC					
FC					
Ec					

Date	Sample #				
10/12/95	1	2	3	4	5
TEMP	27	27.5	27.8		
O2	0.25	2.90	2.95		
CBOD	150		5.6	4.9	2.8
SETT SOL		510			
TSS	253.3	3126	87.2		2.9
VSS	133.3	3031	66.9		0.6
TDS					
NO3	2.2		6.5		5.6
NO2	6		0		1
NH3	20.90		6.40		0.45
ORTHO P	12.95		9.80		11.30
TOT P	15.65		13.75		11.35
PH	7.30	6.65	7.17	7.10	7.22
ALKALINITY	182	103	52	52	55
TC					0
FC					
Ec					

Date	Sample #				
10/13/95	1	2	3	4	5
TEMP	24.9	25.9	26.2		
O2	0.13	3.81	3.08		
CBOD	109		6.9		3.1
SETT SOL		350			
TSS	170		70		2.8
VSS	132		53.3		1.6
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.24	6.68	7.06		7.12
ALKALINITY	158	94	39		52
TC					
FC					
Ec					

Daily Report

Date	Sample #				
10/16/95	1	2	3	4	5
TEMP	27.1	28.6	28.7		
O2	0.17	1.86	2.01		
CBOD	145		5.1		3.1
SETT SOL		700			
TSS	140		100		0
VSS	139		98		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.10	6.30	7.20		7.20
ALKALINITY	120	119	33		46
TC					
FC					
Ec					

Date	Sample #				
10/17/95	1	2	3	4	5
TEMP	22	28.9	29.3		
O2	2.12	4.80	4.82		
CBOD	137		5.17	5	2.64
SETT SOL		670			
TSS	233	4867	12	8.2	2
VSS	180	3617	11	7.9	0.8
TDS					
NO3	1.8		12.4		10.7
NO2	2		2		4
NH3	23.50		0.13		0.14
ORTHO P	6.95		11.65		11.55
TOT P	7.65		12.20		11.65
PH	7.65	6.53	7.08	7.00	6.98
ALKALINITY	185	100	37	37	35
TC					0
FC					
Ec					

Date	Sample #				
10/18/95	1	2	3	4	5
TEMP	26	28.8	28.6		
O2	0.17	2.10	1.91		
CBOD	132		4.2		2.5
SETT SOL		700			
TSS	150	2724	24		1.8
VSS	113	1958	22.5		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	8.00	7.60	8.10		8.10
ALKALINITY	198	175	65		54
TC					
FC					
Ec					

Daily Report

Date	Sample #				
10/19/95	1	2	3	4	5
TEMP	25.1	28.6	28.9		
O2	0.18	1.90	1.98		
CBOD	145		8.2	5.4	2.46
SETT. SOL		700			
TSS	193	3619			1.9
VSS	169	3310			
TDS					
NO3	1.0		9.5		8.1
NO2	2		2		2
NH3	17.90		0.24		0.20
ORTHO P	10.80		12.55		12.15
TOT. P	12.80		14.50		13.75
PH	7.01	6.40	6.74	6.70	6.82
ALKALINITY	147	88	32	30	30
TC					0
FC					
Ec					

Date	Sample #				
10/20/95	1	2	3	4	5
TEMP	28.7	29.1	29.2		
O2	1.20	4.40	2.70		
CBOD	102		5.1		2
SETT. SOL		680			
TSS	210	2910	14		0
VSS	201	1828	13.1		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	7.20	6.60	7.00		7.10
ALKALINITY	135	92	36		38
TC					
FC					
Ec					

Date	Sample #				
10/23/95	1	2	3	4	5
TEMP	28.2	29.1	29.1		
O2	1.30	3.80	3.10		
CBOD	121		10.4		3
SETT. SOL		780			
TSS	127	2210	24		0
VSS	107	1569	16		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.90	6.80	7.30		7.30
ALKALINITY	144	94	36		29
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
10/24/95	1	2	3	4	5
TEMP	25.2	29.5	29		
O2	0.20	2.55	3.40		
CBOD	95		9.1	5.2	2.9
SETT SOL		625			
TSS	196	3429	73.5		0
VSS	116	2050	56.7		0
TDS					
NO3	0.7		11.0		7.4
NO2	2		2		4
NH3	21.70		0.40		0.80
ORTHO P	8.10		5.75		7.53
TOT P	8.39		10.54		11.17
PH	7.35	6.49	6.87	6.90	7.01
ALKALINITY	180	91	39	39	50
TC					0
FC					
Ec					

Date:	Sample #				
10/25/95	1	2	3	4	5
TEMP	24.2	29.2	29.3		
O2	0.40	3.40	3.45		
CBOD	102		3.8		2.5
SETT SOL		600			
TSS	181	3796	51.2		2
VSS	139	2128	48.3		0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.90	6.50	6.80		6.90
ALKALINITY	139	90	26		34
TC					
FC					
Ec					

Date:	Sample #				
10/26/95	1	2	3	4	5
TEMP	23.4	29.4	29.4		
O2	0.80	4.20	4.10		
CBOD	122		5.45	4.5	1.77
SETT SOL		550			
TSS	146	3429	12	8.3	1.2
VSS	116	2050	9.1	7.1	1
TDS					
NO3	1.1		11.8		9.1
NO2	2		2		4
NH3					
ORTHO P	6.30		9.00		9.20
TOT P	6.28		11.02		11.03
PH	7.13	6.68	7.08	7.10	7.20
ALKALINITY	135	93	31	32	41
TC					0
FC					
Ec					

Daily Report

Date:	Sample #				
10/27/95	1	2	3	4	5
TEMP	27.1	29.1	29.1		
O2	0.18	3.49	4.20		
CBOD	103		3.9		1.5
SETT SOL		650			
TSS	123	1832	24		0.5
VSS	110	1332	22.2		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.10	6.60	7.10		7.10
ALKALINITY	147	112	32		42
TC					
FC					
Ec					

Date:	Sample #				
10/30/95	1	2	3	4	5
TEMP	25.2	28.9	28.8		
O2	0.12	3.10	2.60		
CBOD	110		4.3		2
SETT SOL		700			
TSS	110	2656	70		0.8
VSS	70	1808	48		0.8
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.00	6.80	7.20		7.10
ALKALINITY	150	115	45		41
TC					
FC					
Ec					

Date:	Sample #				
10/31/95	1	2	3	4	5
TEMP	23.4	28.9	29.1		
O2	0.16	5.52	5.70		
CBOD	151		9		1.9
SETT SOL		460			
TSS	150	2724	24		1.8
VSS	113	1958	6		0
TDS					
NO3	1.4		2.1		5.0
NO2	4		1		2
NH3	29.90		20.00		0.50
ORTHO P	9.58		3.50		10.08
TOT P	9.64		7.30		10.29
PH	7.14	6.61	7.49		7.10
ALKALINITY	182	80	58		51
TC					0
FC					
Ec					

Daily Report

Date 11/01/95	Sample # 1	2	3	4	5
TEMP	24	29	29		
O2	0.17	4.52	4.77		
CBOD	189		2.6		1.5
SETT SOL		500			
TSS	152	2274	46		6.3
VSS	118	1959	26		6
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.70	6.60	7.10		7.10
ALKALINITY	160	48	40		39
TC					
FC					
Ec					

Date 11/02/95	Sample # 1	2	3	4	5
TEMP	24.5	29.5	29.5		
O2	0.11	5.09	5.70		
CBOD	152		4.6	3.9	2.8
SETT SOL		330			
TSS	110	2810	36.2	8.9	2.9
VSS	106	1819	33.8	7.1	0.8
TDS					
NO3	1.2		6.5		4.5
NO2	3		1		1
NH3	17.40		0.20		0.00
ORTHO P	9.85		12.50		14.40
TOT P	17.40		13.05		14.95
PH	6.92	6.66	7.08	7.00	6.99
ALKALINITY	126	82	35	36	42
TC					1
FC					
Ec					

Date 11/03/95	Sample # 1	2	3	4	5
TEMP	24	28.9	28.9		
O2	0.17	3.40	3.20		
CBOD	228		10.6		4.6
SETT SOL		400			
TSS	97	3862	26		1.1
VSS	70	2251	25		0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.90	6.80	7.00		6.90
ALKALINITY	141	59	41		40
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
11/06/95	1	2	3	4	5
TEMP	24	28.8	28.1		
O2	0.17	4.10	4.50		
CBOD	141		7.8		2.5
SETT SOL		400			
TSS	200	2504	66	4.5	4.5
VSS	183.3	1818	59		4.2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.90	6.80	7.10		6.90
ALKALINITY	133	67	38		41
TC					
FC					
Ec					

Date:	Sample #				
11/07/95	1	2	3	4	5
TEMP	25	25.7	25.8		
O2	0.20	3.19	3.00		
CBOD	229		13.1	6.2	4.7
SETT SOL		460			
TSS	200	3120	18	11.1	6.4
VSS	183	2119	15.1	9.8	5.6
TDS					
NO3	1.9		7.6	7.7	7.9
NO2	2		2	2	1
NH3	31.00		0.50	0.50	0.50
ORTHO P	18.50		9.70	9.60	9.00
TOT P	25.50		12.30	12.10	11.90
PH	7.20	6.30	6.90	6.90	7.00
ALKALINITY	164	49	24	25	32
TC					0
FC					
Ec					

Date:	Sample #				
11/08/95	1	2	3	4	5
TEMP	22.5	25.8	25.8		
O2	0.27	5.16	5.10		
CBOD	145.5		25.5		2.6
SETT SOL		480			
TSS	138	2725			
VSS	122	1949			
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.20	6.80	6.90		7.00
ALKALINITY	152	95	24		21
TC					
FC					
Ec					

Daily Report

Date 11/09/95	Sample # 1	2	3	4	5
TEMP	20.2	24.1	24.1		
O2	0.25	4.10	4.20		
CBOD	131		4.2	4	2.5
SETT SOL		425			
TSS	127	2210	44	12	0
VSS	107	2166	26	9	0
TDS					
NO3	1.6		6.6	6.8	6.9
NO2	3		2	2	1
NH3	19.30		0.00	0.00	0.00
ORTHO P	7.75		6.20	6.10	6.50
TOT P	11.30		8.15	8.10	8.80
PH	7.16	6.51	7.11	7.00	7.11
ALKALINITY	154	63	43	40	38
TC					2
FC					
Ec					

Date 11/10/95	Sample # 1	2	3	4	5
TEMP	20.1	24.2	24.3		
O2	0.22	4.02	4.13		
CBOD	98		4		1.9
SETT SOL		500			
TSS	139	2209			0
VSS	117	1569			0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.50	7.70	7.10		7.20
ALKALINITY	178	129	75		54
TC					
FC					
Ec					

Date 11/13/95	Sample # 1	2	3	4	5
TEMP	20.7	21.5	21.6		
O2	0.23	4.40	4.40		
CBOD	220		10.1		3.1
SETT SOL		750			
TSS	143.3	1811	34		1.3
VSS	126.6	799	29.2		0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.80	6.50	6.90		6.90
ALKALINITY	132	114	30		34
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
11/14/95	1	2	3	4	5
TEMP	20.6	21.6	21.6		
O2	0.28	4.20	3.90		
CBOD	154		13.1	9.2	3.9
SETT. SOL		520			
TSS	143	1811	74	9.2	1.2
VSS	126	799	20		1
TDS					
NO3	1.0		2.6	5.0	5.6
NO2	0.9		1	2	2
NH3	1.00		7.20	1.10	0.20
ORTHO P	5.00		4.65	4.20	4.20
TOT. P	6.30		6.10	5.90	5.70
PH	7.02	7.90	6.94	7.00	7.19
ALKALINITY	141	95	60	51	42
TC					0
FC					
Ec					

Date:	Sample #				
11/15/95	1	2	3	4	5
TEMP	20.3	21.2	21.4		
O2	0.28	3.90	4.10		
CBOD	141		7.8		2.4
SETT. SOL		650			
TSS	120	2083	32		0
VSS	103	1976	30.1		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	7.11	6.90	6.90		7.00
ALKALINITY	143	92	32		48
TC					
FC					
Ec					

Date:	Sample #				
11/16/95	1	2	3	4	5
TEMP	20.3	21.4	21.6		
O2	0.21	3.30	3.90		
CBOD	135		6.8	4.5	2.9
SETT. SOL		600			
TSS	107	2158	42	11.3	1
VSS	87	1501	36.6	9.9	0
TDS					
NO3	1.9		7.6	7.9	7.9
NO2	2.1		2	1.5	1
NH3	33.00		0.50	0.00	0.00
ORTHO P	17.10		9.70	9.00	9.10
TOT. P	20.20		12.30	11.80	11.50
PH	7.15	6.98	6.91	6.95	7.20
ALKALINITY	149	90	41	41	43
TC					0
FC					
Ec					

Daily Report

Date:	Sample #				
11/17/95	1	2	3	4	5
TEMP	19.5	21.3	21.6		
O2	0.29	3.00	3.50		
CBOD	103		4.3		3
SETT SOL		600			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.10	6.88	7.00		7.20
ALKALINITY	138	88	41		45
TC					
FC					
Ec					

Date:	Sample #				
11/20/95	1	2	3	4	5
TEMP	20.7	21.9	22		
O2	0.27	3.15	3.75		
CBOD	111		8.8		2.9
SETT SOL		600			
TSS	139	2487	37		0
VSS	133.5	1878	36.2		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.04	6.84	6.90		7.09
ALKALINITY	123	94	64		48
TC					
FC					
Ec					

Date:	Sample #				
11/21/95	1	2	3	4	5
TEMP	19.5	20.9	20.9		
O2	0.30	3.10	3.10		
CBOD	178		5.5	4.5	2.5
SETT SOL		600			
TSS	108	1982	21.3	10.3	1.4
VSS	103	1108	19.8	9.9	1.2
TDS					
NO3	1.1				5.2
NO2	2				3
NH3	10.50				0.90
ORTHO P	4.95				5.50
TOT P	6.25				6.10
PH	7.10	6.80	6.91	7.00	7.20
ALKALINITY	130	104	63	48	48
TC					0
FC					
Ec					

Daily Report

Date: 11/22/95	Sample # 1	2	3	4	5
TEMP	19.8	20.8	20.8		
O2	0.30	3.20	3.30		
CBOD	129		4.8		2.2
SETT. SOL		700			
TSS	127	2680	58		0.8
VSS	123.2	2678	51.2		0.8
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.00	6.80	7.10		7.30
ALKALINITY	125	77	49		43
TC					
FC					
Ec					

Date: 11/27/95	Sample # 1	2	3	4	5
TEMP	18.2	20.1	20.1		
O2	0.30	3.95	4.10		
CBOD	98		10.5		4.1
SETT. SOL		600			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.10	6.60	7.10		7.10
ALKALINITY	133	79	51		50
TC					
FC					
Ec					

Date: 11/28/95	Sample # 1	2	3	4	5
TEMP	18	20.1	20.1		
O2	0.40	4.20	4.10		
CBOD	103		4.4	4.1	3
SETT. SOL		800			
TSS	162	1732	48	20	0
VSS	151	1432	43	18.1	0
TDS					
NO3	1.1		4.0		4.4
NO2	1		6		2
NH3	15.50		0.30		0.00
ORTHO P	6.20		3.90		5.50
TOT P	7.10		4.20		5.20
PH	7.10	6.80	7.20	7.20	7.30
ALKALINITY	123	78	50	50	45
TC					1
FC					
Ec					

Daily Report

Date:	Sample #				
11/29/95	1	2	3	4	5
TEMP	17.9	21.2	21.2		
O2	0.15	6.40	6.70		
CBOD					
SETT SOL		500			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.10	6.40	6.80		7.10
ALKALINITY	186	103	56		53
TC					
FC					
Ec					

Date:	Sample #				
11/30/95	1	2	3	4	5
TEMP	17.8	21.3	21.2		
O2	0.30	5.50	5.80		
CBOD	150		4.6	4	1.9
SETT SOL		440			
TSS		2504	42		1.6
VSS		1818	30		0
TDS					
NO3	2.1		9.5		8.4
NO2	7		5		1
NH3	21.00		0.30		0.90
ORTHO P	11.80		8.45		8.25
TOT P	15.60		9.45		8.90
PH	6.96	6.35	5.20		6.90
ALKALINITY	122	74	51		52
TC					1
FC					
Ec					

Date:	Sample #				
	1	2	3	4	5
TEMP					
O2					
CBOD					
SETT SOL					
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH					
ALKALINITY					
TC					
FC					
Ec					

Daily Report

Date: 12/01/95	Sample # 1	2	3	4	5
TEMP	17.8	20.2	20.2		
O2	0.60	3.40	3.50		
CBOD	175		7.9		3.9
SETT. SOL		325			
TSS	93	1504	22		0
VSS	63	1311	14		0
TDS					
NO3	1.7		4.5		3.3
NO2	4		1		0
NH3					
ORTHO. P					
TOT. P					
PH	7.10	6.61	7.11		6.89
ALKALINITY	126	64	44		43
TC					
FC					
Ec					

Date: 12/04/95	Sample # 1	2	3	4	5
TEMP	18.1	20.1	20.2		
O2	0.50	4.30	4.20		
CBOD	155		14		2.9
SETT. SOL		275			
TSS	63	1819	30		1
VSS	27	1731	27		1
TDS					
NO3					
NO2					
NH3					
ORTHO. P					
TOT. P					
PH	7.72	6.78	7.07		7.00
ALKALINITY	110	46	35		33
TC					
FC					
Ec					

Date: 12/05/95	Sample # 1	2	3	4	5
TEMP	16.9	17.7	17.7		
O2	0.26	4.80	4.40		
CBOD	142		4.6	4.1	1.9
SETT. SOL		280			
TSS	200	3120	28	18.1	4.4
VSS	183	2119	25.1	11.1	3.6
TDS					
NO3	1.2		10.9	9.8	8.1
NO2	2		1	1	1
NH3	29.00		0.50	0.50	0.00
ORTHO. P	7.84		8.44		10.17
TOT. P	8.34		8.13		8.15
PH	7.29	6.11	6.89		7.18
ALKALINITY	165	34	22		39
TC					2
FC					
Ec					

Daily Report

Date:	Sample #				
12/06/95	1	2	3	4	5
TEMP	16.8	17.7	17.6		
O2	0.40	4.90	4.80		
CBOD	122		4.5		2
SETT. SOL		350			
TSS	152	2120	41.5		0.9
VSS	134	1981	37.1		0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.90	6.30	6.50		6.60
ALKALINITY	216	58	31		43
TC					
FC					
Ec					

Date:	Sample #				
12/07/95	1	2	3	4	5
TEMP	15.9	17.3	17.2		
O2	0.40	5.10	5.00		
CBOD	196		9.6	4.1	2.3
SETT. SOL		400			
TSS	129	3586	23.2		0
VSS	108	2980	16.5		0
TDS					
NO3	1.4		9.7	9.0	8.3
NO2	6		4	4	4
NH3	20.00		0.20	0.01	0.10
ORTHO P	9.30		8.89	8.80	8.78
TOT. P	10.05		9.20	9.30	10.48
PH	6.79	6.39	6.86	6.80	6.84
ALKALINITY	137	51	35	41	40
TC					0
FC					
Ec					

Date:	Sample #				
12/08/95	1	2	3	4	5
TEMP	15.9	17.5	17.3		
O2	0.50	5.20	4.90		
CBOD	146		6.8		3.1
SETT. SOL		400			
TSS	177	2521	88		0
VSS	127	1806	50		0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.90	6.10	6.80		6.80
ALKALINITY	157	62	39		40
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
12/11/95	1	2	3	4	5
TEMP	15.9	17.5	17.6		
O2	0.60	4.90	5.00		
CBOD	120		5.5		3.1
SETT. SOL		550			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.70	6.60	6.90		7.00
ALKALINITY	136	55	40		40
TC					
FC					
Ec					

Date:	Sample #				
	1	2	3	4	5
TEMP					
O2					
CBOD					
SETT. SOL					
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH					
ALKALINITY					
TC					
FC					
Ec					

Date:	Sample #				
	1	2	3	4	5
TEMP					
O2					
CBOD					
SETT. SOL					
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH					
ALKALINITY					
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
01/16/96	1	2	3	4	5
TEMP	27	21.1	21.2		
O2	0.27	6.30	7.10		
CBOD	142				2.9
SETT SOL		800			
TSS	200	3120			4.4
VSS					3.6
TDS					
NO3	1.3				8.1
NO2	2				1
NH3	21.80				0.30
ORTHO P	12.10				17.20
TOT P	15.00				18.70
PH	6.90	6.00			6.60
ALKALINITY	128	45			21
TC					
FC					
Ec					

Date:	Sample #				
01/17/96	1	2	3	4	5
TEMP	27.9	21.6	21.6		
O2	0.42	7.00	7.00		
CBOD	86				3
SETT SOL		725			
TSS	98	1982			1.2
VSS	93	1111			1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.00	6.00			6.60
ALKALINITY	93	44			17
TC					
FC					
Ec					

Date:	Sample #				
01/18/96	1	2	3	4	5
TEMP	28.3	22	21.9		
O2	6.29	7.07	6.41		
CBOD	130				2.4
SETT SOL		880			
TSS	139	2109			0
VSS	117	1569			0
TDS					
NO3	0.6				8.3
NO2	0				2
NH3	10.80				0.40
ORTHO P	4.20				12.10
TOT P	5.30				11.85
PH	7.03	5.97			6.60
ALKALINITY	87	48			17
TC					2
FC					
Ec					

Daily Report

Date: 01/19/96	Sample #				
	1	2	3	4	5
TEMP	27.01	20.7	20.8		
O2	0.18	6.29	6.84		
CBOD	98				1.9
SETT. SOL		650			
TSS	127	2210			0
VSS	107	2166			0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.98	6.02			6.84
ALKALINITY	123	41			18
TC					
FC					
Ec					

Date: 01/23/96	Sample #				
	1	2	3	4	6
TEMP	27	21.1	21.2		
O2	0.20	6.50	6.60		
CBOD	210		50	43	20
SETT. SOL		650			
TSS	168	2200	85	40	19
VSS	140	1469	61	31	15
TDS					
NO3	1.4		10.0	6.8	7.6
NO2	2		1	3	3
NH3	9.20		0.00	0.20	0.40
ORTHO P	4.85		11.10	11.50	13.00
TOT. P	5.95		12.50	12.75	14.00
PH	7.12		6.32	6.55	6.57
ALKALINITY	2		13	28	29
TC					20
FC					
Ec					

Date: 01/24/96	Sample #				
	1	2	3	4	5
TEMP	18.8	20.7	20.7		
O2	0.31	6.54	7.18		
CBOD	128		18.7	7.4	3.3
SETT. SOL		700			
TSS	138	3860	22	8.2	2.1
VSS	136.1	2250	21	7.8	0.8
TDS					
NO3	1.7		10.1	10.1	16.3
NO2	7		2	3	1
NH3					
ORTHO P					
TOT. P					
PH	6.83	5.97	6.30	6.44	6.54
ALKALINITY	128	32	12	30	31
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
01/25/96	1	2	3	4	5
TEMP	18.5	21	21		
O2	0.17	7.40	7.20		
CBOD	135		17.8	5.4	2.9
SETT SOL		700			
TSS	109	2159	42	11.3	1.9
VSS	88	1511	38.8	9.8	0.9
TDS					
NO3	3.0		24.1	11.8	7.4
NO2	1		1	1	2
NH3	8.70		0.00	0.30	0.20
ORTHO P	4.50		11.00	10.80	10.90
TOT P	8.00		11.35	11.80	11.20
PH	6.85	6.52	6.60	6.50	6.80
ALKALINITY	109	37	12	30	29
TC					2
FC					
Ec					

Date:	Sample #				
01/26/96	1	2	3	4	5
TEMP	17.1	19.5	19.6		
O2	0.11	7.60	7.90		
CBOD	110			7.1	3.2
SETT SOL		450			
TSS	139	3961		8.2	2
VSS	135.1	2251		7.7	0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.92	6.15		6.37	6.77
ALKALINITY	125	59		20	24
TC					
FC					
Ec					

Date:	Sample #				
01/29/96	1	2	3	4	5
TEMP	20.7	22.4	22.3		
O2	6.53	8.10	8.13		
CBOD	86			4	3
SETT SOL		750			
TSS	109			7.2	1.9
VSS	99.8			6.1	0.5
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.34	6.10		6.90	
ALKALINITY	125	45		39	
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
01/30/96	1	2	3	4	5
TEMP	16.8	19.8	19.9		
O2	1.08	7.59	7.88		
CBOD	151		16.6	3.9	2.9
SETT. SOL		730			
TSS	110	2910	38.2	8.9	2.9
VSS	105	1821	34.8	7.1	0.8
TDS					
NO3	1.3		10.1	8.8	7.1
NO2	3		0	1	1
NH3	9.80		0.50	0.60	0.70
ORTHO P	57.50		10.85	12.00	8.10
TOT. P	62.90		11.90	12.85	9.35
PH	7.19	6.33	6.62	6.51	6.52
ALKALINITY	112	50	24	29	30
TC					0
FC					
Ec					

Date:	Sample #				
01/31/96	1	2	3	4	5
TEMP	16.5	20	20		
O2	0.20	7.00	7.49		
CBOD	140		8.9	4.9	2.7
SETT. SOL		675			
TSS	125	2504	67	9.7	1.9
VSS	103	1818	58	7.4	0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.99	6.27	6.58	6.46	6.64
ALKALINITY	128	55	23	27	31
TC					
FC					
Ec					

Date:	Sample #				
	1	2	3	4	5
TEMP					
O2					
CBOD					
SETT. SOL					
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH					
ALKALINITY					
TC					
FC					
Ec					

Daily Report

Date: 02/01/96	Sample # 1	2	3	4	5
TEMP	18.6	17.2	17.9		
O2	1.72	6.79	7.28		
CBOD	128		7.8	3.7	3.3
SETT SOL		720			
TSS	127	2209	49	12	0
VSS	107	1568	28	9	0
TDS					
NO3	3.6		10.4	9.0	8.3
NO2	4		1	3	2
NH3					
ORTHO P	7.35		7.09	6.68	6.94
TOT P	13.10		0.30	0.30	0.70
PH	6.82	6.22	6.71	6.68	6.89
ALKALINITY	124	64	25	30	31
TC					0
FC					
Ec					

Date: 02/02/96	Sample # 1	2	3	4	5
TEMP	25.7	19.6	19.6		
O2	1.30	7.37	7.53		
CBOD	155		23.1	9.2	3.8
SETT SOL		750			
TSS	148	1911	74	11	1.2
VSS	126	803	24	9	1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.98	6.44	6.77	6.60	6.85
ALKALINITY	120	57	29	32	31
TC					
FC					
Ec					

Date: 02/05/96	Sample # 1	2	3	4	5
TEMP	28.5	20.8	20.8		
O2	0.30	6.40	6.40		
CBOD	142		6.9	4.1	1.9
SETT SOL		780			
TSS	170	3102	29	18.2	3.6
VSS	151	2119	25.2	11.8	2.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.60	6.30	6.70	6.50	6.80
ALKALINITY	111	61	32	37	34
TC					
FC					
Ec					

Daily Report

Date: 02/06/96	Sample # 1	2	3	4	5
TEMP	18.6	18.7	19		
O2	0.35	7.50	7.10		
CBOD	125		15		
SETT. SOL		790			
TSS	134	2119	41.5		
VSS	112	1988	36.1		
TDS					
NO3	0.8		10.6		
NO2	1		1		
NH3	10.80		0.10		
ORTHO P	5.50		9.10		
TOT. P	6.35		9.15		
PH	7.47	6.40	6.65		
ALKALINITY	141	60	23		
TC					
FC					
Ec					

Date: 02/07/96	Sample # 1	2	3	4	5
TEMP	24.7	19.7	19.7		
O2	2.74	6.67	7.29		
CBOD	146		18.8	6.8	2.1
SETT. SOL		700			
TSS	167	2525	68	14.9	
VSS	127	1816	42	11.8	
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.83	6.33	6.52	6.66	6.84
ALKALINITY	105	72	36	64	40
TC					
FC					
Ec					

Date: 02/08/96	Sample # 1	2	3	4	5
TEMP	18.7	20.7	20.7		
O2	0.21	7.06	7.66		
CBOD	159		17	8	4
SETT. SOL		610			
TSS	99	3762	26	1.11	1.3
VSS	71	2150	25	9.1	0.9
TDS					
NO3	0.9		12.0	7.9	7.7
NO2	1		1	1	0
NH3	13.20		0.20	0.80	0.05
ORTHO P					
TOT. P					
PH	6.92	6.47	6.85	6.79	7.14
ALKALINITY	124	63	30	44	43
TC					1
FC					
Ec					

Daily Report

Date:	Sample #				
02/09/96	1	2	3	4	5
TEMP	19.1	20.9	21		
O2	0.18	5.70	5.90		
CBOD	159		7	3	2.9
SETT SOL		810			
TSS	198	2505	68	4.5	1.9
VSS	182	1819	56	4.2	0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.00	6.10	6.70	6.70	6.90
ALKALINITY	120	77	36	34	38
TC					
FC					
Ec					

Date:	Sample #				
02/12/96	1	2	3	4	5
TEMP	16.5	18.9	18.3		
O2	0.16	4.80	4.60		
CBOD	109		10.6	4.6	1.5
SETT SOL		875			
TSS	97	3762	25	6.6	1.4
VSS	72	2151	22.5	4.6	0.8
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.20	5.80	6.10	6.20	6.50
ALKALINITY	165	39	10	11	7
TC					
FC					
Ec					

Date:	Sample #				
02/13/96	1	2	3	4	5
TEMP	18.6	16.5	17.2		
O2	0.40	7.00	6.90		
CBOD	119		13.8	6.9	2.7
SETT SOL		800			
TSS	200	3110	19	11.1	2.4
VSS	184	2119	15.5	9.8	2
TDS					
NO3	1.3		14.6	14.4	15.1
NO2	2		1	2	1
NH3	23.10		0.90	0.70	0.70
ORTHO P	9.20		10.40	8.90	10.00
TOT P	11.30		10.80	9.30	10.80
PH	6.90	5.70	5.90	5.20	6.30
ALKALINITY	155	31	6	10	9
TC					0
FC					
Ec					

Daily Report

Date: 02/14/96	Sample # 1	2	3	4	5
TEMP	19.6	18.6	18.6		
O2	0.70	7.10	7.10		
CBOD	135		25	9.8	2.2
SETT. SOL		800			
TSS	135	2275		10.2	1.9
VSS	122	1449		7.9	1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.90	5.80	6.00	6.10	6.30
ALKALINITY	146	41	9	12	12
TC					
FC					
Ec					

Date: 02/15/96	Sample # 1	2	3	4	5
TEMP	19.2	18.2	18.2		
O2	0.24	6.51	6.53		
CBOD	145		15.9	7.9	2.9
SETT. SOL		810			
TSS	140	3617	20.2		0
VSS	139	2712	18.9		0
TDS					
NO3	0.9		12.3	11.7	14.0
NO2	1		1	3	1
NH3	27.90		1.30	0.50	0.60
ORTHO P	9.55		9.75	9.45	9.75
TOT. P	10.30		10.25	9.50	10.60
PH	7.27	5.66	5.77	6.41	6.26
ALKALINITY	146	28	10	15	11
TC					1
FC					
Ec					

Date: 02/16/96	Sample # 1	2	3	4	5
TEMP	16.6	17.8	17.8		
O2	0.24	6.09	5.74		
CBOD	121		12.4	3.9	1.8
SETT. SOL		810			
TSS	128	2211	24	12.1	2.2
VSS	107	1565	16	9.8	1.5
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.98	5.40	5.37	5.76	5.95
ALKALINITY	152	22	4	8	8
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
02/19/96	1	2	3	4	5
TEMP	20.2	18.9	18.4		
O2	0.60	6.20	6.20		
CBOD	102		15.1	5.1	2
SETT SOL		630			
TSS	151	2911	19	4.1	0
VSS	148	1829	17.8	3.8	0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.80	6.00	5.90	5.10	5.50
ALKALINITY	191	46	9	5	5
TC					
FC					
Ec					

Date:	Sample #				
02/20/96	1	2	3	4	5
TEMP	21.2	18.7	18.9		
O2	0.55	6.20	6.00		
CBOD	145.5		25.5	8.5	1.6
SETT SOL		620			
TSS	148	2755	18	10.1	1.6
VSS	132	1969	15.2	8.9	1.2
TDS					
NO3	1.4		15.4	17.7	15.5
NO2	1		1	2	2
NH3	34.30		2.10	0.80	0.90
ORTHO P	15.10		13.40	13.30	14.30
TOT P	17.10		13.50	13.50	14.50
PH	6.90	5.90	5.90	5.10	5.90
ALKALINITY	199	55	5	3	5
TC					0
FC					
Ec					

Date:	Sample #				
02/21/96	1	2	3	4	5
TEMP	19.8	18.9	18.9		
O2	0.60	7.00	6.90		
CBOD	128		17.8	3.7	3.3
SETT SOL		315			
TSS	109	2160	42	11.3	1.1
VSS	87	1501	35.6	9.8	0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.10	5.20	5.90	5.80	6.00
ALKALINITY	133	51	1	8	9
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
02/22/96	1	2	3	4	5
TEMP	17.9	20.5	20.3		
O2	0.21	8.12	8.52		
CBOD	85		4	3	
SETT SOL		250			
TSS	99	1569	14	3	0
VSS	91	1442	13.2	2.1	0
TDS					
NO3	0.9		17.0	16.4	15.0
NO2	1		0	2	2
NH3	19.10		1.50	1.20	1.20
ORTHO P	7.75		13.85	17.05	14.85
TOT P	9.15		15.10	15.25	15.15
PH	6.90	5.34	4.76	5.24	5.80
ALKALINITY	139	10	1	5	6
TC					0
FC					
Ec					

Date:	Sample #				
02/23/96	1	2	3	4	5
TEMP	19.1	21.4	21.5		
O2	0.23	7.70	7.80		
CBOD	98		5.1	3.4	1.9
SETT SOL		275			
TSS	88	1661	11	2.2	0
VSS	80	1543	10.1	2	0
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.00	6.20	5.80	5.90	6.00
ALKALINITY	121	20	6	13	14
TC					
FC					
Ec					

Date:	Sample #				
02/26/96	1	2	3	4	5
TEMP	18.2	25.1	25.7		
O2	0.15	6.90	6.10		
CBOD	128		20.6	4.6	2.2
SETT SOL		425			
TSS	183	1818	66	14.2	4.5
VSS	161	1098	59	13.6	4.2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.90	6.50	6.60	6.40	6.50
ALKALINITY	140	52	32	36	41
TC					
FC					
Ec					

Daily Report

Date	Sample #				
02/27/96	1	2	3	4	5
TEMP	17.8	22.1	22.1		
O2	0.28	6.20	6.50		
CBOD	159		17	3	
SETT SOL		550			
TSS	107	2268	42	10.5	1
VSS	87	1601	34	9.7	0
TDS					
NO3	0.9		5.7	4.5	4.7
NO2	0		1	2	1
NH3	16.70		0.10	0.00	0.00
ORTHO P	10.10		7.70	10.10	9.05
TOT P	10.40		7.90	10.20	9.70
PH	6.90	6.30	6.80	6.80	6.80
ALKALINITY	133	60	32	37	41
TC					0
FC					
Ec					

Date	Sample #				
02/28/96	1	2	3	4	5
TEMP	19.2	23	23		
O2	0.20	6.40	7.00		
CBOD	119		18	4.8	2.2
SETT SOL		375			
TSS	127	2860	58	10.5	0.8
VSS	122	2768	51.5	9.8	0.7
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.80	6.40	6.70	6.50	6.90
ALKALINITY	126	47	32	34	44
TC					
FC					
Ec					

Date	Sample #				
02/29/96	1	2	3	4	5
TEMP	18.4	22.9	22.9		
O2	0.22	7.10	7.10		
CBOD	120		22	4.9	1.9
SETT SOL		250			
TSS	103	1892	21.3	8.3	1.4
VSS	98	1018	19.8	7.8	1.2
TDS					
NO3	0.7		8.2	6.1	5.7
NO2	0		4	2	1
NH3	14.20		0.20	0.10	0.00
ORTHO P	10.10		7.50	8.90	9.70
TOT P	10.30		9.40	9.10	10.20
PH	6.80	6.70	7.10	6.70	6.90
ALKALINITY	120	58	31	41	40
TC					0
FC					
Ec					

Daily Report

Date	Sample #				
03/01/96	1	2	3	4	5
TEMP	18.5	20.7	20.6		
O2	0.30	6.40	6.46		
CBOD	130		25.5		2.6
SETT SOL		620			
TSS	133	3666	22		2
VSS	90	2420	20		1.1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.80	6.50	6.90		6.80
ALKALINITY	123	60	45		37
TC					
FC					
Ec					

Date	Sample #				
03/04/96	1	2	3	4	5
TEMP	14.3	20	20		
O2	0.43	7.15	7.15		
CBOD	127		4.9	4.1	1.4
SETT SOL		460			
TSS	190	2234	58		0.4
VSS	166	1254	44		0.2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.98	6.66	6.84	6.89	6.88
ALKALINITY	158	45	42	40	41
TC					
FC					
Ec					

Date	Sample #				
03/05/96	1	2	3	4	5
TEMP	14.4	20.1	20.1		
O2	0.41	7.52	7.48		
CBOD	178		6.9	4.2	1.9
SETT SOL		375			
TSS	108	1982	21.3	9.3	1.4
VSS	103	1108	19.8	8.8	1.2
TDS					
NO3	1.2		5.6	8.0	5.8
NO2	3		2	2	0
NH3	12.60		0.40	0.10	0.00
ORTHO P	9.90		7.25	7.50	7.15
TOT P	10.50		7.40	7.80	7.75
PH	6.69	6.52	6.87	6.78	7.24
ALKALINITY	119	48	35	44	45
TC					10
FC					
Ec					

Daily Report

Date	Sample #				
03/06/96	1	2	3	4	5
TEMP	14.8	20.2	20.2		
O2	0.46	7.12	7.10		
CBOD	191		8.65	4.13	2.9
SETT SOL		430			
TSS	66.6	2275	14	5.4	2.4
VSS	36.6	1969	6	3.2	0.5
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.91	6.41	6.74	6.67	6.83
ALKALINITY	126	54	42	51	40
TC					
FC					
Ec					

Date	Sample #				
03/07/96	1	2	3	4	5
TEMP	14.5	20.9	20.9		
O2	0.24	6.85	7.40		
CBOD	102		4.6	4.1	1.3
SETT SOL		475			
TSS	100	3120	18	8.1	1.9
VSS	83	2119	15.1	5.2	0.9
TDS					
NO3	0.5		7.2	6.5	6.6
NO2	1		1	2	0
NH3	23.20		1.30	0.60	0.70
ORTHO P	9.35		8.40	9.25	8.25
TOT P	10.70		9.40	9.55	9.25
PH	7.40	6.23	6.78	6.81	6.81
ALKALINITY	149	52	31	41	43
TC					3
FC					
Ec					

Date	Sample #				
03/08/96	1	2	3	4	5
TEMP	19.9	21.6	21.7		
O2	0.41	8.13	8.49		
CBOD	105		4.8	4.1	1.9
SETT SOL		400			
TSS	98	2504	42	10.3	1.6
VSS	97	1999	35	9.9	0.3
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.24	6.23	6.55	6.53	6.76
ALKALINITY	179	33	30	28	27
TC					
FC					
Ec					

Daily Report

Date	Sample #				
03/11/96	1	2	3	4	5
TEMP	18.5	20.5	20.4		
O2	0.33	6.80	6.85		
CBOD	109		4	3	2
SETT SOL		450			
TSS	156.6	2159	32	11.3	1.8
VSS	133.3	1819	31.1	9.9	1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.18	5.91	6.45	6.49	6.52
ALKALINITY	140	59	30	28	26
TC					
FC					
Ec					

Date	Sample #				
03/12/96	1	2	3	4	5
TEMP	10.2	20.2	20.2		
O2	5.23	7.34	7.31		
CBOD	108		7	3	1.9
SETT SOL		780			
TSS	198	2505	58	4.5	1.9
VSS	182	1919	56	4.2	0.8
TDS					
NO3	0.6		14.3	12.8	13.8
NO2	0		1	1	2
NH3	26.30		0.00	0.20	0.00
ORTHO P	5.30		10.50	10.70	9.65
TOT P	6.10		11.35	11.20	11.15
PH	7.07	5.66	5.93	6.24	6.32
ALKALINITY	154	26	7	15	17
TC					5
FC					
Ec					

Date	Sample #				
03/13/96	1	2	3	4	5
TEMP	18.7	20.3	20.3		
O2	0.27	8.70	9.53		
CBOD	95		15.9	7.9	2.1
SETT SOL		580			
TSS	140	3617	20.2	4.5	2.1
VSS	139	2713	18.9	4.2	1.5
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.20	6.22	6.65	6.70	6.71
ALKALINITY	166	48	39	38	38
TC					
FC					
Ec					

Daily Report

Date: 03/14/96	Sample # 1	2	3	4	5
TEMP	18.1	20.1	20.2		
O2	0.30	7.10	7.10		
CBOD	85		9.9	4.2	1.5
SETT. SOL		610			
TSS	93	2714	14.9	4.2	1.1
VSS	90	1999	13.1	3.9	0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.12	6.28	6.56	6.18	6.21
ALKALINITY	138	32	25	22	29
TC					
FC					
Ec					

Date: 03/15/96	Sample # 1	2	3	4	5
TEMP	21.4	22.6	21.7		
O2	0.26	6.89	7.08		
CBOD					
SETT. SOL		510			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.91	5.86	5.72	6.14	6.20
ALKALINITY	120	34	18	12	20
TC					
FC					
Ec					

Date: 03/18/96	Sample # 1	2	3	4	5
TEMP	7.8	22.3	22.3		
O2	0.64	8.06	8.25		
CBOD					
SETT. SOL		700			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.55	5.95	6.30	6.17	6.50
ALKALINITY	137	50	35	33	35
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
03/19/96	1	2	3	4	5
TEMP	9	19.2	19.4		
O2	0.46	7.11	7.76		
CBOD	128		18.5	7.2	2.3
SETT SOL		670			
TSS	138	3680	22	8.2	2.1
VSS	136	2251	21	7.8	0.9
TDS					
NO3	1.5		5.8	7.9	5.6
NO2	3		2	2	0
NH3	12.50		0.60	0.10	0.00
ORTHO P	9.90		8.25	8.50	8.50
TOT P					
PH	6.90	6.41	6.70	6.60	6.83
ALKALINITY	130	55	41	51	38
TC					10
FC					
Ec					

Date:	Sample #				
03/20/96	1	2	3	4	5
TEMP	17	17.6	17.6		
O2	0.37	7.20	7.30		
CBOD	130		17.9	5.4	2.9
SETT SOL		850			
TSS	109	2169	42	11.3	1.9
VSS	94	1531	38.8	9.9	1.1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.63	6.01	6.35	6.51	6.49
ALKALINITY	103	53	30	31	29
TC					
FC					
Ec					

Date:	Sample #				
03/21/96	1	2	3	4	5
TEMP	18.3	16.5	16.6		
O2	1.10	7.62	8.13		
CBOD	88		8.8	5.1	
SETT SOL		600			
TSS	109		38	12.1	
VSS	99.9		34.5	9.9	
TDS					
NO3	1.3		8.0	8.3	
NO2	1		1	1	
NH3	11.80		0.00	1.30	
ORTHO P	4.55		6.70	7.15	
TOT P	6.05		7.50	7.30	
PH	6.83	6.35	6.69	6.64	
ALKALINITY	117	74	30	36	
TC					
FC					
Ec					

Daily Report

Date: 03/22/96	Sample # 1	2	3	4	5
TEMP	7.9	16.1	16.1		
O2	0.38	9.72	9.97		
CBOD	119		13.9	6.9	2.2
SETT SOL		660			
TSS	101	3110	21	11.1	2.4
VSS	89	2118	18.1	9.9	2.1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.74	6.45	6.73	7.21	6.81
ALKALINITY	113	84	47	41	48
TC					
FC					
Ec					

Date: 03/25/96	Sample # 1	2	3	4	5
TEMP	9.1	17.4	17.5		
O2	6.12	7.31	7.39		
CBOD					
SETT SOL		540			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.89	6.12	6.69	6.71	6.75
ALKALINITY	159	50	30	38	37
TC					
FC					
Ec					

Date: 03/26/96	Sample # 1	2	3	4	5
TEMP	9.1	18.4	18.5		
O2	0.93	7.95	8.23		
CBOD	145		15.8	7.9	2.2
SETT SOL		570			
TSS	140	3612	20.2	9.8	0
VSS	139	2789	18.9	7.9	0
TDS					
NO3	0.7		13.3	11.2	12.6
NO2	0		1	0	1
NH3	12.10		0.30	0.00	0.00
ORTHO P	10.95		7.75	7.75	7.60
TOT P	12.20		8.55	8.40	8.30
PH	7.13	6.13	6.67	6.92	7.03
ALKALINITY	153	33	20	27	22
TC					10
FC					
Ec					

Daily Report

Date	Sample #				
03/27/96	1	2	3	4	5
TEMP	8.9	16.5	16.7		
O2	7.00	6.37	6.21		
CBOD	103		16.1	5.1	2.1
SETT SOL		790			
TSS	151	2911	19.1	4.1	1.1
VSS	149	1831	17.8	3.8	1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.01	5.61	6.22	6.39	6.54
ALKALINITY	165	37	16	19	20
TC					
FC					
Ec					

Date	Sample #				
03/28/96	1	2	3	4	5
TEMP	9.8	15.9	16		
O2	6.07	7.58	7.71		
CBOD	144		24.6	8.9	1.6
SETT SOL		730			
TSS	148	2755	18	10.1	1.6
VSS	138	2145	15.4	8.9	1.2
TDS					
NO3	0.5		16.1	14.8	15.3
NO2	0		1	3	2
NH3	22.30		0.60	0.50	0.40
ORTHO P	8.60		9.85	9.85	9.50
TOT P	9.15		9.90	10.25	9.95
PH	7.10	5.62	6.04	6.18	6.47
ALKALINITY	142	16	7	7	8
TC					2
FC					
Ec					

Date	Sample #				
03/29/96	1	2	3	4	5
TEMP	9.4	16.2	16.2		
O2	6.30	7.40	7.95		
CBOD	121		9	2.9	2.1
SETT SOL		530			
TSS	140	2725	24	2.4	1.8
VSS	129	1988	22	2	0.8
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.11	4.73	5.22	6.63	5.86
ALKALINITY	168	6	3	5	7
TC					
FC					
Ec					

Daily Report

Date 04/01/96	Sample # 1	2	3	4	5
TEMP	9.8	16.2	16.3		
O2	5.17	6.02	5.94		
CBOD					
SETT SOL		790			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.93	4.77	5.64	5.46	5.97
ALKALINITY	121	7	5	4	6
TC					
FC					
Ec					

Date 04/02/96	Sample # 1	2	3	4	5
TEMP	9.9	15.9	16		
O2	5.55	6.58	7.52		
CBOD	109		10.6	5.6	5.2
SETT SOL		720			
TSS	97	2158	42	11.8	10.8
VSS	89	1801	36.9	9.9	8.9
TDS					
NO3	0.7		21.1	18.7	19.1
NO2	0		0	1	0
NH3	8.40		1.20	0.50	0.20
ORTHO P	9.60		10.60	10.15	10.20
TOT P	9.70		10.65	10.20	10.70
PH	7.14	4.71	5.52	5.58	6.00
ALKALINITY	140	4	5	3	5
TC					10
FC					
Ec					

Date 04/03/96	Sample # 1	2	3	4	5
TEMP	9.1	15.9	15.9		
O2	0.40	5.71	5.07		
CBOD					
SETT SOL		790			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	8.19	6.89	6.65	6.87	7.09
ALKALINITY	179	93	15	22	20
TC					
FC					
Ec					

Daily Report

Date: 04/04/96	Sample # 1	2	3	4	5
TEMP	9.9	16.3	16.4		
O2	0.50	6.71	6.99		
CBOD	189		12.6	5.8	1.5
SETT SOL		700			
TSS	152	2274	46	10.9	6.3
VSS	138	1989	36	9.8	6.1
TDS					
NO3	1.3		16.6	15.2	15.2
NO2	1		1	0	0
NH3	10.20		0.40	0.30	0.20
ORTHO P	9.20		9.80	10.30	9.90
TOT P	9.80		10.30	10.50	10.20
PH	7.08	5.96	5.87	5.78	6.23
ALKALINITY	140	42	3	7	11
TC					20
FC					
Ec					

Date: 04/05/96	Sample # 1	2	3	4	5
TEMP	8.5	19.8	19.8		
O2	1.36	7.78	7.82		
CBOD	57		5.9	4.5	4.1
SETT SOL		780			
TSS	36.6	1497	6	1.2	1.1
VSS	33.9	1399	5.8	1	0.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.76	6.19	6.17	6.24	6.66
ALKALINITY	142	34	10	13	11
TC					
FC					
Ec					

Date: 04/08/96	Sample # 1	2	3	4	5
TEMP	10.6	22.1	22.1		
O2	5.99	8.68	8.81		
CBOD	116		7.3	4.5	3.1
SETT SOL		600			
TSS	53.3	1230	22	3.2	2.5
VSS	51.2	1151	20.8	2.9	2.35
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.35	6.26		6.31	6.74
ALKALINITY	154	46		35	31
TC					
FC					
Ec					

Daily Report

Date: 04/09/96	Sample # 1	2	3	4	5
TEMP	10.2	18.4	18.6		
O2	3.78	6.81	6.83		
CBOD	71		6.5	4.9	
SETT SOL		710			
TSS	150	3023	16	1.6	
VSS	135	2346	14.1	1.1	
TDS					
NO3	1.1		7.6	6.3	
NO2	1		1	2	
NH3	21.70		0.00	0.35	
ORTHO P	11.05		9.15	11.30	
TOT P	15.25		12.75	13.55	
PH	6.98	5.99	6.57	6.57	
ALKALINITY	160	41	20	32	
TC					
FC					
Ec					

Date: 04/10/96	Sample # 1	2	3	4	5
TEMP	9.1	16.9	16.9		
O2	0.39	6.65	6.55		
CBOD	81		4.1	3.8	3.9
SETT SOL		790			
TSS	133	3124	12	2.8	0.5
VSS	130	2036	10.9	1.8	0.4
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.95	5.63	6.31	6.35	6.50
ALKALINITY	155	35	17	20	24
TC					
FC					
Ec					

Date: 04/11/96	Sample # 1	2	3	4	5
TEMP	10.4	16.3	16.9		
O2	5.06	3.60	2.85		
CBOD	146		6.1	2.8	2.1
SETT SOL		720			
TSS	100	3281	28.1	4.8	2.6
VSS	97	2552	26.5	4.1	2.15
TDS					
NO3	1.3		10.4	10.5	10.8
NO2	12		10	4	7
NH3	16.90		0.50	0.20	0.00
ORTHO P	6.38		7.21	7.49	7.69
TOT P	6.65		8.54	8.57	7.83
PH	6.72	6.28	6.27	6.10	6.35
ALKALINITY	133	65	13	13	15
TC					5
FC					
Ec					

Daily Report

Date: 04/12/96	Sample # 1	2	3	4	5
TEMP	10.8	16.3	16.6		
O2	3.95	4.50	0.78		
CBOD	88			5.5	3.7
SETT SOL		800			
TSS	105	3222		6.6	3.2
VSS	99.2	2899		5.1	2.5
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.95	6.07		6.19	6.65
ALKALINITY	158	43		11	15
TC					
FC					
Ec					

Date: 04/15/96	Sample # 1	2	3	4	5
TEMP	15.6	20.2	20.2		
O2	0.30	6.90	6.90		
CBOD					
SETT SOL		580			
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.86	6.09		5.76	5.91
ALKALINITY	149	11		10	8
TC					
FC					
Ec					

Date: 04/16/96	Sample # 1	2	3	4	5
TEMP	10.6	19.4	19.4		
O2	5.50	7.85	8.04		
CBOD	110		5.4	3.1	2.2
SETT SOL		450			
TSS	107			2.8	1.8
VSS	100			1.9	0.8
TDS					
NO3	2.1		7.7	8.0	10.1
NO2	3		1	2	4
NH3	11.10		0.00	1.30	0.80
ORTHO P	10.55		8.75	8.50	9.65
TOT P	12.75		10.10	11.20	10.40
PH	6.63	6.51	6.62	6.53	6.14
ALKALINITY	140	42	21	29	24
TC					0
FC					
Ec					

Daily Report

Date:	Sample #				
04/17/96	1	2	3	4	5
TEMP	13.3	19.9	19.8		
O2	0.81	6.10	6.30		
CBOD	67.8		4.04	1.96	1.08
SETT SOL		580			
TSS	123	3124	16.1	2.8	1.8
VSS	103	2470	14.3	2	1.45
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.79	6.69	6.71	6.39	6.41
ALKALINITY	120	59	24	26	27
TC					
FC					
Ec					

Date:	Sample #				
04/18/96	1	2	3	4	5
TEMP	11.3	16.9	17		
O2	0.73	5.52	5.77		
CBOD	102		5.9	3.6	
SETT SOL		590			
TSS	66.5	3025	16.6	5.6	
VSS	50.1	2575	14.5	4.8	
TDS					
NO3	0.9		5.9	5.8	
NO2	1		1	2	
NH3	15.30		0.20	0.20	
ORTHO P	5.85		5.85	7.30	
TOT P	7.35		6.65	9.40	
PH	6.73	6.55	6.99	6.72	
ALKALINITY	138	58	40	38	
TC					
FC					
Ec					

Date:	Sample #				
04/19/96	1	2	3	4	5
TEMP	11.3	16.9	17		
O2	4.73	5.52	5.77		
CBOD	54		4.6	1.58	1.5
SETT SOL		680			
TSS	67.5	2144	16	2.9	2.8
VSS	51.8	1985	14.6	2.4	2.4
TDS					
NO3	1.3		5.8	7.9	7.9
NO2	3.5		2	1	0
NH3	12.80		0.80	0.10	0.00
ORTHO P	9.80		7.26	7.80	7.13
TOT P	10.40		7.80	7.90	7.76
PH	6.77	5.90	6.51	6.64	6.90
ALKALINITY	161	55	29	37	37
TC					
FC					
Ec					

Daily Report

Date	Sample #				
04/22/96	1	2	3	4	5
TEMP	11.8	19.7	19.7		
O2	0.28	3.80	2.90		
CBOD	107		4.6	2.5	2
SETT. SOL		710			
TSS	101.8	3015	18.5	4.1	2.9
VSS	98.3	2599	17.1	3.2	2.4
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.82	5.71	6.16	6.14	6.61
ALKALINITY	164	43	10	16	18
TC					
FC					
Ec					

Date	Sample #				
04/23/96	1	2	3	4	5
TEMP	13.2	20	20.5		
O2	0.28	1.79	1.03		
CBOD	159		4.8	3.1	1.9
SETT. SOL		710			
TSS	150	2761	16.6	2.4	1.2
VSS	136	2291	14.1	1.6	1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.59	6.06	6.22	6.34	6.54
ALKALINITY	145	85	17	18	18
TC					
FC					
Ec					

Date	Sample #				
04/24/96	1	2	3	4	5
TEMP	11.8	19.7	20.3		
O2	0.29	2.05	0.24		
CBOD	140		4	2.8	2.1
SETT. SOL		680			
TSS	160	2889	21	4.8	2.1
VSS	129	2133	18.9	3.5	2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT. P					
PH	6.91	6.48	6.73	6.53	6.76
ALKALINITY	124	97	33	34	37
TC					
FC					
Ec					

Daily Report

Date 04/25/96	Sample # 1	2	3	4	5
TEMP	12.4	19.5	19.5		
O2	0.32	2.33	0.93		
CBOD	190		9.1	5.1	2.8
SETT SOL		650			
TSS	127	2859	18.1	4.8	3.1
VSS	87	2545	14.3	3.9	2.8
TDS					
NO3	1.6		3.0	2.9	2.8
NO2	2		1	1	0
NH3	17.90		0.10	0.00	0.00
ORTHO P	8.50		7.65	7.80	7.85
TOT P	9.75		8.30	8.30	8.30
PH	6.61	6.19	6.58	6.56	6.89
ALKALINITY	134	105	56	56	57
TC					3
FC					
Ec					

Date 04/26/96	Sample # 1	2	3	4	5
TEMP	13.6	22.7	22.7		
O2	0.80	7.30	7.20		
CBOD	77		4.5	2.9	2.4
SETT SOL		600			
TSS	66	3190	24.1	4.5	3.3
VSS	62	2205	20.2	3.8	3
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.44	6.41	6.63	6.62	7.05
ALKALINITY	128	91	60	59	61
TC					
FC					
Ec					

Date 04/29/96	Sample # 1	2	3	4	5
TEMP	12.8	25.8	25.8		
O2	0.78	7.11	5.94		
CBOD	77		6.5		
SETT SOL		710			
TSS	110	2945	78		
VSS	101	1601	62		
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.48	6.65	6.75		
ALKALINITY	179	116	72		
TC					
FC					
Ec					

Daily Report

Date	Sample #				
04/30/96	1	2	3	4	5
TEMP	13.3	22.1	22.1		
O2	0.35	5.92	6.09		
CBOD	36		4	3	2
SETT SOL		660			
TSS	128	3105	45	26	7
VSS	128	2665	44	25	7
TDS					
NO3	0.8		2.5	1.5	1.6
NO2	0		0.01	0	0
NH3	9.64		0.40	0.60	0.40
ORTHO P	3.30		9.60	9.50	10.00
TOT P	4.30		9.65	10.20	10.55
PH	6.59	6.35	6.68	6.50	6.94
ALKALINITY	99	104	62	69	72
TC					
FC					
Ec					

Date	Sample #				
	1	2	3	4	5
TEMP					
O2					
CBOD					
SETT SOL					
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH					
ALKALINITY					
TC					
FC					
Ec					

Date	Sample #				
	1	2	3	4	5
TEMP					
O2					
CBOD					
SETT SOL					
TSS					
VSS					
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH					
ALKALINITY					
TC					
FC					
Ec					

Daily Report

Date:	Sample #				
05/01/96	1	2	3	4	5
TEMP	10.5	22.7	22.8		
O2	0.52	7.08	7.35		
CBOD	77		4	3.5	2.9
SETT SOL		4.25			
TSS	80.1	2631	16.6	14.8	9.1
VSS	65.1	1986	14.1	13.1	8.2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.57	6.58		6.95	6.94
ALKALINITY	123	85		71	70
TC					
FC					
Ec					

Date:	Sample #				
05/02/96	1	2	3	4	5
TEMP	12.4	20.4	20.5		
O2	0.28	4.23	4.37		
CBOD	81		14.1	2.8	2.1
SETT SOL		700			
TSS	109	3195	21.5	12.5	6.1
VSS	99.5	2503	19.8	10.8	4.9
TDS					
NO3	1.2		2.7	1.8	1.5
NO2	1		2	1	0
NH3	9.40		0.00	0.00	0.00
ORTHO P	2.80		6.80	7.10	7.10
TOT P	3.70		7.30	7.30	7.30
PH	6.76	6.38	7.29	6.94	6.92
ALKALINITY	133	107	63	66	65
TC					60
FC					
Ec					

Date:	Sample #				
05/03/96	1	2	3	4	5
TEMP	12.8	23.2	23.4		
O2	6.86	8.99	8.75		
CBOD	143		4.8	2.8	2.1
SETT SOL		590			
TSS	95	3190	22	4.5	3.1
VSS	85.8	2661	20.1	3.9	2.2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.68	6.64	7.11	6.97	7.33
ALKALINITY	139	101	66	68	66
TC					
FC					
Ec					

Daily Report

Date: 05/07/96	Sample # 1	2	3	4	5
TEMP	11.9	18.8	18.9		
O2	0.85	6.45	6.73		
CBOD	219		14.5	12.2	12.1
SETT SOL		610			
TSS	160	2884	82	41	41
VSS	128	2198	62	27	30
TDS					
NO3	2.9		1.3	2.0	1.2
NO2	5		2	2	1
NH3	21.00		6.70	4.20	2.70
ORTHO P	9.80		10.05	11.40	14.25
TOT P	11.05		10.35	11.55	14.15
PH	6.59	6.35	6.99	6.85	6.86
ALKALINITY	135	100	106	94	99
TC					
FC					
Ec					

Date: 05/08/96	Sample # 1	2	3	4	5
TEMP	13.2	18.6	18.6		
O2	0.31	2.14	2.17		
CBOD	150		25	5.5	5.3
SETT SOL		600			
TSS	127	2551	21	14.5	12.5
VSS	103	2222	20.5	13.9	10.9
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.70	6.36	6.60	6.70	6.87
ALKALINITY	122	107	61	64	66
TC					
FC					
Ec					

Date: 05/09/96	Sample # 1	2	3	4	5
TEMP	14	18.6	18.6		
O2	0.56	3.69	4.98		
CBOD	145		12.1	4.1	3.1
SETT SOL		600			
TSS	109	2815	15.6	4.5	3.4
VSS	98.5	2022	12.1	3.9	2.9
TDS					
NO3	1.6		3.7	3.6	3.3
NO2	1		1	1	0
NH3	20.80		1.70	0.65	0.70
ORTHO P	10.05		4.25	4.05	4.15
TOT P	11.15		8.60	4.60	4.80
PH	6.68	6.27	6.56	6.67	6.81
ALKALINITY	140	90	54	55	55
TC					40
FC					
Ec					

Daily Report

Date:	Sample #				
05/10/96	1	2	3	4	5
TEMP	14.1	18.5	18.8		
O2	0.19	2.91	0.51		
CBOD	146		3.1	2.8	2
SETT SOL		695			
TSS	67	3155	8	3.2	2
VSS	49.5	2287	6.1	2.5	1.2
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	7.11	6.51	6.62	6.64	6.74
ALKALINITY	166	121	46	49	52
TC					
FC					
Ec					

Date:	Sample #				
05/13/96	1	2	3	4	5
TEMP	12.9	18.1	18.1		
O2	0.51	8.00	8.62		
CBOD	130		5.8	3.1	2.8
SETT SOL		560			
TSS	107	3150	8.5	3.8	2.3
VSS	95.8	2237	6.1	2.9	2.1
TDS					
NO3					
NO2					
NH3					
ORTHO P					
TOT P					
PH	6.68	6.54	6.71	6.61	6.95
ALKALINITY	148	104	58	57	56
TC					
FC					
Ec					

Date:	Sample #				
05/14/96	1	2	3	4	5
TEMP	13.2	17.9	18.3		
O2	4.43	3.99	4.33		
CBOD	140		5.1	4.1	3.1
SETT SOL		700			
TSS	89	3746	40	4.8	3.85
VSS	76.5	2599	36.5	4.1	2.91
TDS					
NO3	1.7		3.5	3.0	3.1
NO2	0		2	1	1
NH3	11.40		0.30	0.00	0.10
ORTHO P	6.35		8.15	7.60	8.40
TOT P	7.65		8.50	8.00	8.55
PH	6.58	6.49	7.06	7.12	7.22
ALKALINITY	155	107	50	65	64
TC					
FC					
Ec					

Appendix III

Monthly Summaries of Mean ± SD and Sample Sizes for Cromaglass Project

Monthly Statistics

September 1995

number

	Sample #				
	1	2	3	4	5
TEMP	8	8	8		
O2	8	8	8		
CBOD	4		4	2	4
SETT SOL		8			
TSS	4	4	4	1	4
VSS	4	4	4	1	4
TDS					
NO3	1		1		1
NO2	1		1		1
NH3	1		1		
ORTHO P			1		1
TOT P			1		1
PH	4	9	4		4
ALKALINITY	4	9	4		4
TC					2
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	25.98	26.19	26.43		
O2	0.32	2.27	2.20		
CBOD	152.25		7.63	5.60	3.23
SETT SOL		645.00			
TSS	156.50	2524.75	47.00	18.20	2.55
VSS	135.75	1950.00	40.00	17.10	1.65
TDS					
NO3	2.80		7.60		6.80
NO2	2.00		1.00		1.00
NH3	21.20		0.18		0.00
ORTHO P	ERR		5.50		6.60
TOT P	ERR		6.10		6.80
PH	7.10	6.78	7.06		7.02
ALKALINITY	159.25	160.56	66.75		60.25
TC					0.50
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	0.56	0.54	0.38		
O2	0.08	0.31	0.17		
CBOD	23.43		1.18	0.50	0.40
SETT SOL		57.23			
TSS	44.24	639.67	13.67	0.00	1.22
VSS	26.96	675.22	15.94	0.00	1.25
TDS					
NO3	0.00		0.00		0.00
NO2	0.00		0.00		0.00
NH3	0.00		0.00		0.00
ORTHO P			0.00		0.00
TOT P			0.00		0.00
PH	0.12	0.14	0.18		0.13
ALKALINITY	13.90	43.69	2.38		2.77
TC					0.50
FC					
Ec					

Monthly Statistics
October 1995

number

	Sample #				
	1	2	3	4	5
TEMP	21	21	21		
O2	21	21	21		
CBOD	21		21	8	21
SETT SOL		21			
TSS	21	18	19	3	21
VSS	21	18	19	3	20
TDS					
NO3	10		10	1	10
NO2	10		10	1	10
NH3	8		8	1	8
ORTHO P	10		10	1	10
TOT P	10		10	1	10
PH	21	21	21	8	21
ALKALINITY	21	21	21	8	21
TC					1
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	25.91	28.54	28.60		
O2	0.50	3.48	3.32		
CBOD	133.62		6.84	5.01	2.64
SETT SOL		609.52			
TSS	165.21	3306.11	43.58	8.47	1.09
VSS	135.84	2451.72	36.76	7.73	0.38
TDS					
NO3	1.66		8.51	4.10	7.18
NO2	2.70		1.50	2.00	2.40
NH3	23.68		3.67	1.20	0.49
ORTHO P	8.05		8.65	9.40	9.54
TOT P	9.21		10.15	9.50	10.21
PH	7.22	6.74	7.14	7.00	7.14
ALKALINITY	160.87	114.51	47.03	45.75	49.76
TC					0.00
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	1.75	0.95	0.90		
O2	0.49	0.96	0.91		
CBOD	24.70		2.02	0.35	0.52
SETT SOL		104.78			
TSS	35.98	893.65	25.82	0.31	0.95
VSS	30.46	984.67	23.10	0.46	0.50
TDS					
NO3	0.82		3.66	0.00	2.54
NO2	1.62		0.67	0.00	1.43
NH3	3.88		6.49	0.00	0.34
ORTHO P	2.36		2.75	0.00	2.18
TOT P	2.79		3.03	0.00	2.68
PH	0.25	0.27	0.27	0.14	0.25
ALKALINITY	20.43	29.90	15.70	12.31	14.04
TC					0.00
FC					
Ec					

Monthly Statistics
November 1995

number

	Sample #				
	1	2	3	4	5
TEMP	20	20	20		
O2	20	20	20		
CBOD	19		19	8	19
SETT SOL		20			
TSS	16	17	15	8	16
VSS	16	17	15	6	16
TDS					
NO3	8		7	4	8
NO2	8		7	4	8
NH3	8		7	4	8
ORTHO P	8		7	4	8
TOT P	8		7	4	8
PH	20	20	20	7	20
ALKALINITY	20	20	20	7	20
TC					8
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	20.88	23.47	23.48		
O2	0.24	4.09	4.26		
CBOD	149.24		8.06	5.05	2.89
SETT SOL		542.75			
TSS	138.27	2409.53	41.63	10.91	1.78
VSS	122.48	1743.47	32.07	10.63	1.34
TDS					
NO3	1.49		6.34	6.85	6.35
NO2	2.63		2.71	1.88	1.50
NH3	18.59		1.29	0.40	0.31
ORTHO P	10.14		7.87	7.23	7.81
TOT P	13.71		9.36	9.48	9.13
PH	7.05	6.80	6.91	7.01	7.08
ALKALINITY	142.65	84.02	45.38	41.57	42.88
TC					0.63
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	2.27	3.21	3.14		
O2	0.07	0.88	0.94		
CBOD	41.10		5.15	1.72	0.86
SETT SOL		120.20			
TSS	28.95	520.06	15.04	4.07	2.08
VSS	29.22	485.21	11.48	3.48	1.96
TDS					
NO3	0.41		2.16	1.15	1.52
NO2	1.81		1.83	0.22	0.71
NH3	9.71		2.42	0.45	0.38
ORTHO P	4.95		2.86	2.19	3.00
TOT P	6.69		3.15	2.60	3.23
PH	0.16	0.38	0.41	0.09	0.13
ALKALINITY	17.91	20.26	13.32	8.53	7.68
TC					0.70
FC					
Ec					

Monthly Statistics

December 1995

number

	Sample #				
	1	2	3	4	5
TEMP	7	7	7		
O2	7	7	7		
CBOD	7		7	2	7
SETT SOL		7			
TSS	6	6	6	1	6
VSS	6	6	6	1	6
TDS					
NO3	3		3	2	3
NO2	3		3	2	3
NH3	2		2	2	2
ORTHO P	2		2	1	2
TOT P	2		2	1	2
PH	7	7	7	1	7
ALKALINITY	7	7	7	1	7
TC					2
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	16.76	18.29	18.26		
O2	0.47	4.66	4.54		
CBOD	150.86		7.56	4.10	2.74
SETT SOL		368.57			
TSS	135.67	2445.00	38.78	18.10	1.05
VSS	107.00	1988.00	28.28	11.10	0.92
TDS					
NO3	1.43		8.37	9.40	6.57
NO2	4.00		2.00	2.50	1.67
NH3	24.50		0.35	0.26	0.05
ORTHO P	8.57		8.67	8.80	9.48
TOT P	9.20		8.67	9.30	9.32
PH	7.06	6.41	6.88	6.80	6.90
ALKALINITY	149.53	52.87	35.14	41.00	39.64
TC					1.00
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	0.85	1.19	1.24		
O2	0.11	0.58	0.51		
CBOD	25.42		3.13	0.00	0.66
SETT SOL		87.62			
TSS	47.01	724.14	22.90	0.00	1.56
VSS	50.40	509.70	12.27	0.00	1.27
TDS					
NO3	0.21		2.78	0.40	2.31
NO2	1.63		1.41	1.50	1.70
NH3	4.50		0.15	0.25	0.05
ORTHO P	0.73		0.23	0.00	0.70
TOT P	0.86		0.53	0.00	1.17
PH	0.33	0.24	0.19	0.00	0.17
ALKALINITY	31.91	9.61	6.62	0.00	3.03
TC					1.00
FC					
Ec					

Monthly Statistics

January 1996

number

	Sample # 1	2	3	4	5
TEMP	11	11	11		
O2	11	11	11		
CBOD	11		5	7	11
SETT. SOL		11			
TSS	11	10	5	7	11
VSS	10	9	5	7	11
TDS					
NO3	6		4	4	6
NO2	6		4	4	6
NH3	5		3	3	5
ORTHO P	5		3	3	5
TOT. P	5		3	3	5
PH	11	10	5	7	10
ALKALINITY	11	10	5	7	10
TC					4
FC					
Ec					

mean

	Sample # 1	2	3	4	5
TEMP	22.33	20.90	20.93		
O2	1.43	7.04	7.25		
CBOD	128.73		22.40	10.81	4.38
SETT. SOL		700.91			
TSS	132.91	2701.50	50.84	13.36	3.39
VSS	112.40	1774.00	42.72	10.99	2.22
TDS					
NO3	1.55		13.58	9.38	9.13
NO2	2.50		1.00	2.00	1.67
NH3	12.06		0.17	0.37	0.40
ORTHO P	16.63		10.98	11.43	12.26
TOT. P	19.43		11.92	12.47	13.02
PH	7.01	6.13	6.48	6.53	6.65
ALKALINITY	105.41	45.60	16.80	29.00	24.70
TC					6.00
FC					
Ec					

standard deviation

	Sample # 1	2	3	4	5
TEMP	4.80	0.86	0.81		
O2	2.36	0.57	0.53		
CBOD	33.56		14.23	13.20	4.95
SETT. SOL		102.04			
TSS	28.31	695.86	22.35	10.94	5.07
VSS	17.78	373.53	14.95	8.24	4.14
TDS					
NO3	0.73		6.08	1.83	3.23
NO2	2.22		0.71	1.00	0.75
NH3	4.92		0.24	0.17	0.17
ORTHO P	20.65		0.10	0.49	2.97
TOT. P	22.01		0.47	0.47	3.21
PH	0.15	0.18	0.14	0.16	0.11
ALKALINITY	35.62	7.59	5.49	5.18	5.68
TC					8.12
FC					
Ec					

Monthly Statistics

February 1996

number

	Sample #				
	1	2	3	4	5
TEMP	21	21	21		
O2	21	21	21		
CBOD	21		21	20	18
SETT. SOL.		21			
TSS	21	21	20	19	19
VSS	21	21	20	19	19
TDS					
NO3	9		9	8	8
NO2	9		9	8	8
NH3	8		8	7	7
ORTHO P	8		8	7	7
TOT P	8		8	7	7
PH	21	21	21	20	20
ALKALINITY	21	21	21	20	20
TC					8
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	19.82	19.96	20.02		
O2	0.55	6.71	6.77		
CBOD	129.88		15.16	5.45	2.46
SETT. SOL.		616.43			
TSS	136.10	2523.90	36.75	9.26	1.38
VSS	119.33	1763.24	28.27	8.13	0.96
TDS					
NO3	1.27		11.80	10.96	10.75
NO2	1.22		1.22	2.13	1.25
NH3	19.91		0.80	0.59	0.49
ORTHO P	9.33		9.85	10.63	10.66
TOT P	11.00		9.55	9.59	10.24
PH	6.95	6.06	6.26	6.16	6.45
ALKALINITY	138.62	48.26	18.98	23.93	23.45
TC					0.25
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	2.90	2.06	2.07		
O2	0.62	0.71	0.83		
CBOD	20.44		6.26	2.16	0.73
SETT. SOL.		208.70			
TSS	32.55	647.54	20.03	4.47	1.19
VSS	32.49	483.48	14.09	3.20	1.08
TDS					
NO3	0.85		3.36	4.55	4.29
NO2	1.13		1.03	0.60	0.66
NH3	7.52		0.72	0.39	0.45
ORTHO P	2.64		2.43	3.20	2.66
TOT P	2.92		4.14	4.38	4.38
PH	0.18	0.41	0.57	0.58	0.46
ALKALINITY	23.44	17.37	12.78	16.50	15.32
TC					0.43
FC					
Ec					

Monthly Statistics

March 1996

number

	Sample #				
	1	2	3	4	5
TEMP	21	21	21		
O2	21	21	21		
CBOD	18		18	17	17
SETT SOL		21			
TSS	18	17	18	16	17
VSS	18	17	18	16	17
TDS					
NO3	7		7	7	6
NO2	7		7	7	6
NH3	7		7	7	6
ORTHO P	7		7	7	6
TOT P	6		6	6	5
PH	21	21	21	20	20
ALKALINITY	21	21	21	20	20
TC					6
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	13.79	19.20	19.20		
O2	1.81	7.44	7.66		
CBOD	122.67		12.04	5.18	2.05
SETT SOL		587.14			
TSS	128.84	2808.12	28.04	7.92	1.62
VSS	116.32	1998.35	24.75	6.84	0.91
TDS					
NO3	0.90		10.04	9.93	9.95
NO2	1.14		1.29	1.57	0.83
NH3	17.26		0.46	0.40	0.18
ORTHO P	8.36		8.39	8.67	8.44
TOT P	9.12		9.02	9.08	9.28
PH	6.97	6.09	6.46	6.57	6.63
ALKALINITY	140.86	45.19	28.62	30.30	30.35
TC					6.67
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	4.50	2.07	1.97		
O2	2.45	0.75	0.88		
CBOD	27.66		6.56	1.83	0.45
SETT SOL		130.67			
TSS	32.97	559.66	13.45	3.11	0.63
VSS	34.24	424.30	12.21	2.83	0.48
TDS					
NO3	0.39		4.06	2.82	4.04
NO2	1.25		0.45	0.90	0.90
NH3	5.89		0.41	0.42	0.27
ORTHO P	2.28		1.26	1.22	0.91
TOT P	2.32		1.38	1.38	1.20
PH	0.21	0.42	0.42	0.28	0.31
ALKALINITY	20.46	17.61	12.52	13.29	11.53
TC					3.45
FC					
Ec					

Monthly Statistics
April 1996

number

	Sample #				
	1	2	3	4	5
TEMP	22	22	22		
O2	22	22	22		
CBOD	19		18	18	16
SETT SOL		22			
TSS	19	18	17	18	16
VSS	19	18	17	18	16
TDS					
NO3	9		9	9	7
NO2	9		9	9	7
NH3	9		9	9	7
ORTHO P	9		9	9	7
TOT P	9		9	9	7
PH	22	22	19	21	19
ALKALINITY	22	22	19	21	19
TC					5
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	11.33	18.95	19.07		
O2	2.15	5.69	5.29		
CBOD	104.04		6.14	3.72	2.60
SETT SOL		681.82			
TSS	107.04	2714.78	26.01	5.76	3.31
VSS	95.76	2180.11	22.65	4.88	2.88
TDS					
NO3	1.23		8.96	8.53	9.64
NO2	2.61		1.89	1.44	1.57
NH3	13.77		0.40	0.39	0.23
ORTHO P	8.25		8.43	8.90	8.92
TOT P	9.55		9.42	9.98	9.39
PH	6.83	6.11	6.40	6.29	6.54
ALKALINITY	143.75	57.93	26.87	26.24	26.05
TC					7.60
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	1.74	2.58	2.54		
O2	2.19	1.88	2.54		
CBOD	42.86		2.35	1.26	1.09
SETT SOL		86.06			
TSS	34.96	586.71	17.08	5.63	2.54
VSS	32.01	454.92	13.92	5.47	2.32
TDS					
NO3	0.41		5.85	5.23	5.81
NO2	3.51		2.92	1.17	2.61
NH3	4.20		0.37	0.37	0.27
ORTHO P	2.41		1.44	1.37	1.20
TOT P	3.06		1.71	1.64	1.25
PH	0.36	0.53	0.38	0.37	0.36
ALKALINITY	19.04	32.02	20.75	17.89	18.68
TC					7.00
FC					
Ec					

Monthly Statistics

May 1996

number

	Sample #				
	1	2	3	4	5
TEMP	9	9	9		
O2	9	9	9		
CBOD	9		9	9	9
SETT SOL		9			
TSS	9	9	9	9	9
VSS	9	9	9	9	9
TDS					
NO3	4		4	4	4
NO2	4		4	4	4
NH3	4		4	4	4
ORTHO P	4		4	4	4
TOT P	4		4	4	4
PH	9	9	8	9	9
ALKALINITY	9	9	8	9	9
TC					2
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	12.78	19.64	19.78		
O2	1.61	5.28	5.31		
CBOD	136.78		9.83	4.54	3.94
SETT SOL		562.14			
TSS	104.79	3035.22	26.13	11.51	9.26
VSS	89.08	2301.67	21.92	9.12	7.26
TDS					
NO3	1.85		2.80	2.60	2.28
NO2	1.75		1.75	1.25	0.50
NH3	15.65		2.18	1.21	0.88
ORTHO P	7.25		7.31	7.54	8.48
TOT P	8.39		8.69	7.86	8.70
PH	6.71	6.46	6.87	6.83	6.96
ALKALINITY	140.11	102.44	63.00	65.44	65.89
TC					50.00
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	1.04	1.89	1.89		
O2	2.24	2.27	2.66		
CBOD	39.25		6.82	2.83	3.03
SETT SOL		203.54			
TSS	25.74	341.80	21.65	11.36	11.69
VSS	21.76	225.44	16.62	7.63	8.59
TDS					
NO3	0.63		0.94	0.73	0.93
NO2	1.92		0.43	0.43	0.50
NH3	5.30		2.69	1.75	1.09
ORTHO P	2.96		2.11	2.61	3.67
TOT P	3.05		1.09	2.48	3.42
PH	0.15	0.12	0.26	0.17	0.18
ALKALINITY	13.55	9.87	17.41	12.05	13.03
TC					10.00
FC					
Ec					

Cumulative Statistics

09/19/95 - 5/14/96

number

	Sample #				
	1	2	3	4	5
TEMP	140	140	140		
O2	140	140	140		
CBOD	129		122	91	122
SETT SOL		140			
TSS	125	120	113	82	119
VSS	124	119	113	80	118
TDS					
NO3	57		54	39	53
NO2	57		54	39	53
NH3	52		49	37	48
ORTHO P	53		51	36	50
TOT P	52		50	35	49
PH	136	140	126	93	130
ALKALINITY	136	140	126	93	130
TC					46
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	18.59	21.80	21.86		
O2	1.06	5.38	5.37		
CBOD	130.74		10.05	5.28	2.84
SETT SOL		603.14			
TSS	133.90	2743.16	35.79	9.17	2.48
VSS	115.66	2020.34	29.35	7.82	1.79
TDS					
NO3	1.42		8.98	8.52	8.04
NO2	2.22		1.65	1.76	1.51
NH3	17.99		1.26	0.53	0.38
ORTHO P	9.40		8.63	9.08	9.32
TOT P	11.14		9.52	9.63	9.88
PH	6.99	6.37	6.67	6.51	6.79
ALKALINITY	142.40	75.11	35.76	33.61	37.17
TC					4.61
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	5.93	4.05	4.04		
O2	1.74	1.96	2.18		
CBOD	35.41		6.90	4.40	1.94
SETT SOL		152.63			
TSS	38.61	708.15	21.00	6.84	4.39
VSS	34.44	621.99	16.76	5.40	3.46
TDS					
NO3	0.70		4.79	4.31	4.17
NO2	2.18		1.60	0.95	1.44
NH3	7.27		3.14	0.73	0.48
ORTHO P	7.38		2.34	2.38	2.74
TOT P	8.32		2.76	2.73	3.14
PH	0.27	0.49	0.50	0.47	0.39
ALKALINITY	25.89	41.48	20.14	18.87	18.28
TC					10.95
FC					
Ec					

App. III - p12
Cumulative Statistics
09/19/95 - 4/12/96

number

	Sample #				
	1	2	3	4	5
TEMP	119	119	119		
O2	119	119	119		
CBOD	109		102	72	104
SETT SOL		119			
TSS	105	101	94	63	101
VSS	104	100	94	61	100
TDS					
NO3	48		45	30	45
NO2	48		45	30	45
NH3	43		40	28	40
ORTHO P	44		42	27	42
TOT P	43		41	26	41
PH	115	119	107	73	111
ALKALINITY	115	119	107	73	111
TC					42
FC					
Ec					

mean

	Sample #				
	1	2	3	4	5
TEMP	19.63	22.12	22.17		
O2	1.00	5.41	5.43		
CBOD	133.17		10.59	5.69	2.82
SETT SOL		603.19			
TSS	138.93	2701.04	37.65	9.33	1.84
VSS	120.14	1966.37	30.69	8.06	1.23
TDS					
NO3	1.40		9.97	9.86	8.77
NO2	2.29		1.71	1.92	1.64
NH3	18.74		1.29	0.45	0.34
ORTHO P	9.80		8.85	9.47	9.47
TOT P	11.66		9.73	9.95	10.06
PH	7.04	6.37	6.66	6.49	6.79
ALKALINITY	142.83	73.34	33.45	29.38	34.96
TC					2.60
FC					
Ec					

standard deviation

	Sample #				
	1	2	3	4	5
TEMP	5.82	4.22	4.21		
O2	1.69	1.92	2.08		
CBOD	32.64		7.06	4.73	1.86
SETT SOL		153.32			
TSS	38.18	752.00	20.66	5.73	2.40
VSS	34.06	653.79	16.59	4.58	2.04
TDS					
NO3	0.71		4.56	3.83	3.92
NO2	2.26		1.72	0.97	1.42
NH3	7.53		3.34	0.39	0.35
ORTHO P	7.94		2.39	2.41	2.71
TOT P	8.96		2.96	2.87	3.21
PH	0.26	0.52	0.54	0.50	0.40
ALKALINITY	27.05	43.15	18.78	15.58	16.41
TC					4.88
FC					
Ec					

5.0 CONCLUSIONS

Based on data from the 7-day *Ceriodaphnia dubia* survival and reproduction test and the 7-day fathead minnow larval survival and growth test, the following conclusions are drawn:

1. Cromaglass effluent did not exhibit acute toxicity to *Ceriodaphnia dubia*: The 48-hour LC_{50} and 95 percent confidence intervals are >100 (100 - +100) percent effluent.

2. Cromaglass effluent did not exhibit chronic toxicity to *Ceriodaphnia dubia*: The NOEC and LOEC based on survival are 100 and >100 percent effluent, respectively.

3. Cromaglass effluent did not exhibit acute toxicity to the fathead minnow: The 48-hour LC_{50} and 95 percent confidence intervals are >100 (100-+100) percent effluent.

4. Cromaglass effluent did not exhibit chronic toxicity to the fathead minnow: The NOEC and LOEC based on survival are 100 and >100 percent effluent, respectively.

5. The test fall outside EPA guidelines for performing chronic toxicity testing because of the lack of a 3rd sample to be used for renewal. However, all indications are that the Cromaglass effluent is neither acutely nor chronically toxic to the *Ceriodaphnia dubia* or the fathead minnow.

Appendix V

Dr. David Long's Letters

Evaluation/Approval of Cromaglass
CA-5 Wastewater Treatment System

REPORTS
DESIGN
OPERATION
SUPERVISION

DAVID A. LONG & ASSOCIATES
Consulting Environmental Engineers
1009 METZ AVENUE
STATE COLLEGE, PA. 16801
PHONE: 814 237-2271

WASTEWATER TREATMENT
WASTEWATER COLLECTION
HYDRAULICS & WATER WORKS

May 6, 1997

Mr. James M. Seif, Secretary
PA Department of Environmental Protection
P. O. Box 2063
Harrisburg, PA 17105-2063

RE: Evaluation/Approval of Cromaglass CA-5 Wastewater Treatment System

Dear Secretary Seif:

This letter report is submitted in accordance with the protocol outlined in your letter of March 25, 1997 to Representative Thomas Dempsey regarding Department approval of the Cromaglass treatment system. I have tried to address the subject approval in the manner outlined as I understand it. The following discussion speaks specifically to the process evaluation portions Section 9 of NSF Standard 40, ANSI/NSF 40-1996. Hence, it does not address the requirements of Sections 1-8 and 10.

I believe it would be helpful to review the purpose of the testing that was initiated by Dr. Mel Zimmerman under a grant from the Northern Tier Ben Franklin Technology Center (Project No. 1176). A joint proposal between Lycoming College and Cromaglass Corporation entitled, "Testing of a Wastewater Recycle/Reuse System," was submitted to the NET Ben Franklin Technology Center in August, 1993. The specific objective of the study was to allow Cromaglass to develop and seek NSF certification for the system in lieu of NSF Standard 41 because NSF had previously declared Standard 41 not applicable to "open loop" systems like the Cromaglass system. The effect of this ruling made the Ben Franklin study necessary. The project was funded by Ben Franklin and after a period of process development, testing of the system was started in September, 1995. Because it finally was determined that NSF currently does not have a protocol for testing "open loop" Recycle/Reuse Systems such as that developed by Cromaglass, it was decided to proceed with testing the system under a modified NSF Standard 40 protocol so as to meet the project objectives with the goal of having the system certified for use in Pennsylvania. The testing was continued until May, 1996 at which time it was necessary to terminate the project as will be discussed below.

As a result, the evaluation procedures used, data collected, etc., did not follow the NSF Standard 40 protocol exactly but they did provide the data necessary to assess the ability of the CA-5/filter treatment system to meet NSF Standard 40 Class I effluent limitations under both normal and simulated stress loading conditions.

The final report on the evaluation presents the study protocol followed and the data that were collected for the various parameters that were evaluated. It is important to note that the data collection included several parameters in addition to those required under NSF Standard 40 so the results obtained give a more complete picture of the treatment capability of the system than would have been obtained under strict adherence to NSF Standard 40 requirements. The nitrogen and phosphorus data should be of particular interest in those situations where nutrient management is of concern. Additionally, the toxicity data show the excellent overall quality of the effluent in terms of environmental impact.

Unfortunately, it was necessary to terminate the evaluation before completion of all of the stress test protocols required under NSF Standard 40 because the Borough of Jersey Shore requested that the project installation be removed so they could proceed with necessary construction. The original schedule called for an additional six weeks of testing beyond the date of termination. However, the loss of the raw wastewater source obviously meant that the project had to be concluded at that point even though it had not been possible to obtain all of the data required under NSF Standard 40. It should be noted that severe weather conditions during the month of January, 1996, including extremely cold temperature and the flooding that occurred on January 19, 1996, placed abnormal stress on the treatment system. The effluent data collected during this period showed excellent results demonstrating the resiliency of the system.

It is my professional opinion that the evaluation procedures used, the amount of data collected, and the results obtained show clearly that the Cromaglass treatment system, as evaluated, will meet the NSF Standard 40 Class I effluent limitations on a consistent basis under both normal and stress loading conditions. In fact, the effluent $CBOD_5$ and TSS concentrations achieved (averages of 6 mg/L and 8 mg/L during normal loading conditions) are outstanding and would serve to prolong the life expectancy for any soil absorption systems used for final effluent disposal. Furthermore, after necessary disinfection, this effluent would be suitable for direct discharge to most streams in the Commonwealth in my opinion. It was interesting to note that there was no significant difference in effluent quality compared to "normal" both during the limited stress test period from April 19-May 14, 1996 and the weather related stressing in January, 1996 so the conditions simulated during the stress tests, etc., did not cause upsets in the treatment systems that would create problems under normal household use conditions

In summary, while I cannot certify that the testing procedures used for this study were in strict accordance with the requirements of NSF Standard 40, I can certify that the performance obtained using the modified procedures shows clearly that the effluent significantly exceeds Standard 40 Class I requirements. Therefore, I conclude that the testing and results can be considered to be equivalent to testing under NSF Standard 40.

I would be happy to address any questions regarding my report that you or members of yours staff may have. A copy of the final report has been furnished to the Department previously. Please contact me at the above address if you wish. Questions concerning specific aspects of the testing procedures or data analysis should be directed to Dr. Zimmerman at 717/321-4004.

Respectfully submitted,

DAVID A. LONG & ASSOCIATES

David A. Long, Ph.D., P.E., DEE
Environmental Engineer

cc: Gary Obleski
Bureau of Water Quality Management

A. N. Young, Jr.
Cromaglass Corporation

REPORTS
DESIGN
OPERATION
SUPERVISION

DAVID A. LONG & ASSOCIATES
Consulting Environmental Engineers
1009 METZ AVENUE
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WASTEWATER TREATMENT
WASTEWATER COLLECTION
HYDRAULICS & WATER WORKS

June 9, 1997

Mr. Gary Obleski
Bureau of Water Quality Management
PA Department of Environmental Protection
P.O. Box 8465
Harrisburg, PA 17105-8465

RE: Evaluation/Approval of Cromaglass CA-5 Wastewater Treatment System

Dear Gary:

This memo is a follow-up to our earlier telephone conversation regarding the evaluation of the Cromaglass CA-5 system that was evaluated by Dr. Mel Zimmerman. I hope this information will provide some additional clarification of the information provided in my letter of May 6 to Secretary Seif.

It is my opinion that the testing/evaluation was conducted in accordance with NSF Standard 40 except as noted below:

- The test period followed did not conform exactly to Sections 9.2.2 and 9.2.2.2 of Standard 40. Instead of testing for a total of 26 weeks (16 weeks design loading, 7.5 weeks of stress loading, and an additional 2.5 weeks of design loading), the CA-5 evaluation was conducted over a total of 35 weeks from early fall 1995 to late spring 1996. As noted in my letter of May 6 (and shown in the Summary Loading Log in Appendix I of the Report), the stress test loading periods did not conform exactly to the Standard 40. However, the system was stressed as noted and performance did not suffer. A total of 141 data days were obtained which exceeds the minimum of 96 data days (Section 9.3.1.1) by approximately 50 percent. Therefore, it is my opinion that the testing was equivalent to that required under Standard 40.

- The testing protocol did not include tests for color, odor, foam, and oily film as required under Sections 9.2.4 and 9.4.2 of Standard 40. However, data were collected on nitrogen, phosphorus, and effluent toxicity as reported in the Project Final Report. It is my opinion that these data are of significance and value in evaluating the impact of the effluent, and consider them to be an acceptable "substitute" for the data on color, etc., given the

Mr. Gary Obleski
June 9, 1997
page 2

circumstances over which the project evolved. Please, recall that the original intent was to evaluate a "recycle system" and Standard 41 does not require testing for these parameters. Dr. Zimmerman has stated in correspondence to me that while no samples were sent out for evaluation of color, etc., he noted that there was no foam or oil in the effluent. Also, he noted that the effluent was clear and odor was normal.

After considering all aspects of the CA-5 evaluation that was conducted, it is my conclusion that the testing and results obtained can be considered to be equivalent to testing under NSF Standard 40 as noted in my letter of May 6. Most certainly, the intent of Standard 40 has been met so that I am confident that the CA-5 will perform satisfactorily. Furthermore, it is important to note that all Cromaglass systems sold include the "Cromawatch" monitoring system that automatically reports system "alarm" conditions that show system malfunctions.

I would be happy to address any questions regarding this matter that you or members of your staff may have.

Thanks for your continued assistance is resolving this matter

Very truly yours,

DAVID A. LONG & ASSOCIATES

David A. Long, Ph.D., P.E., DEE
Environmental Engineer

cc: A. N. Young, Jr.

Appendix VI

Mike Gerardi

Microscopic Analyses of Floc Characterization
Filamentous Organisms, Protozoan Count and Profile

Water Pollution Biology
P.O. Box 1372 - Williamsport, PA 17703
(717) 323-9237
FAX (717) 320-0125

17 May 1996

Melvin C. Zimmerman, Ph.D.
Associate Professor of Biology
Lycoming College
Williamsport, PA 17701

RE: Cromaglass ML Analyses

Dear Mel:

Microscopic analyses for floc characterization, filamentous organisms, and protozoan count and profile were performed for the May 9, 1996 Cromaglass mixed liquor (ML). Also, microscopic analyses for particulates and dispersed growth were performed for the May 9, 1996 Cromaglass CF Effluent and Effluent after C-5 and Sand Filter.

The results of these analyses are presented in the accompanying report. If you should have any questions concerning the analyses or the report, please do not hesitate to contact me.

Sincerely,

Michael H. Gerardi
Wastewater Biologist

Enclosure

CROMAGLASS MIXED LIQUOR ANALYSES
SAMPLE DATE: MAY 09, 1996

Floc Characterization & Filamentous Organisms

The range in sizes of the floc particles was 50 to 600 um. Most floc particles were medium (150 to 500 um) in size; the majority being approximately 200 um in length. Due to the presence of numerous filamentous organisms, most floc particles were irregular in shape.

As revealed through phase contrast microscopy and methylene blue staining, most floc particles were firm in structure, i.e., the floc-forming bacteria were tightly adjoined.

Neither interfloc bridging nor open floc formation was observed in any significant amount. The majority of filamentous organisms consisted of free-floating trichomes and extended trichomes. Most free-floating trichomes were 50 to 300 um in length, while most extended trichomes were < 100 um in length. More free-floating filamentous organisms than extended filamentous organisms were observed.

The relative abundance of the filamentous organisms was rated as "3" on a scale of "0" to "6" with "0" being "none" and "6" being "excessive." A rating of "3" is "common" or "filamentous organisms observed in all floc particles at low density, e.g., 1 to 5 filamentous organisms per floc particle." At this rating the relative abundance of the filamentous organisms not adversely affect solids settleability.

There were six significant filamentous organisms within the mixed liquor. These organisms in order of dominance (rank) and their relative abundance are presented in the following table:

Organism	Rank	Relative Abundance
Haliscomenobacter hydrossis	1	"3"
Type 021N	2	"2"
Type 1701	3	"2"
Type 0092	4	"2"
Beggiatoa sp.	5	"2"
Nocardia sp.	6	"1"

Environmental or operational factors associated with the rapid growth or proliferation of these organisms within activated sludge processes are presented in the following table:

Organism	Low DO	Low F/M	Low N/P	Septicity	Oils/Greases
H. hydrossis	X	X	X		
Type 021N		X	X	X	
Type 1701	X		X		
Type 0092		X			X
Beggiatoa sp.				X	
Nocardia sp.		X	X		X

The presence of type 021N and *Beggiatoa* sp. within the mixed liquor is suggestive of a significant change in the environment of the treatment process, e.g., perhaps the wastewater stored in the holding day may become septic during elevated temperatures, or the anoxic period within the treatment process may be too long in duration.

Although little dispersed growth was observed within the mixed liquor, much particulate material was found. The relative abundance rating for dispersed growth was "0" or "insignificant" on a scale of "0" to "2," while the relative abundance rating for particulate material was "1" or "significant" on a scale of "0" to "1." The presence of "significant" particulate material within the mixed liquor is suggestive of the interruption of proper floc formation. Factors responsible for this interruption include low dissolved oxygen and excessive turbulence or shearing action.

Little Zoogloeal growth was observed, and most floc particles tested negatively to the India ink reverse stain. This stain is used to determine the presence of a probable nutrient (N or P) deficiency.

Protozoan Count & Profile

Although the protozoan community was dominated by the stalked ciliates, the community was sparsely populated. The relative abundance of the community was 300 protozoa per milliliter. The profile or percent composition of the community is presented in the following table:

Protozoan Group	Composition
Amoebae	6%
Flagellates	6%
Free-swimming ciliates	13%
Crawling ciliates	1%
Stalked ciliates	74%

The majority of the stalked ciliates were sluggish in activity or inactive, and nearly 25% of the stalked ciliates were sheared, i.e., the enlarged anterior portion of the organism was broken free of its slender posterior portion. The sluggishness or inactivity of the stalked ciliates may be reflective of a low dissolved oxygen level or a prolonged anoxic time period, while the sheared stalked ciliates may be reflective of excessive turbulence within the treatment process.

In addition to this protozoan population a relatively large community of rotifers was observed. Although the relative abundance of the community was nearly 300 per milliliter, most of the rotifers were inactive and damaged (dispersed). Such damage may occur in the presence of surfactants, cell bursting agents, or a prolonged anoxic time period.

CROMAGLASS EFFLUENT after C-5 & SAND FILTER
SAMPLE DATE: MAY 09, 1996

The effluent sample contained very little dispersed growth and much particulate material. The relative abundance rating for dispersed growth was "0" or "insignificant," while the relative abundance rating for particulate material was "1" or "significant."

The particulate material consisted mostly of small (< 50 um) chucks and an occasional short (< 100 um) fibrous structure. Infrequently, a small (< 100 um) floc particle was observed, and a few short (< 200 um) free-floating filamentous organisms also were observed.

CROMAGLASS CF EFFLUENT
SAMPLE DATE: MAY 09, 1996

The solids contents within the effluent consisted mostly of particulate material. The relatively abundance rating of the particulate material was "1" or "significant." The particulate material consisted of small and large chunks and fibrous structures ranging in lengths from 20 um to several hundred microns.

CROMAGLASS MIXED LIQUOR ANALYSES

SAMPLE DATE: September 19, 1995

FLOC CHARACTERIZATION & FILAMENTOUS ORGANISMS

Most floc particles were small (< 150 um) and medium (150 to 500 um) in size; the majority being 100 to 250 um in length. Most small floc particles were spherical in shape due to a sparse growth of filamentous organisms, while most medium floc particles were irregular in shape due to the significant growth of filamentous organisms.

As revealed through phase contrast microscopy and methylene blue and India ink stainings most floc particles were firm in structure, i.e., the floc-forming bacteria were tightly adjoined. No significant sign of shearing was observed with any floc particles.

Little open floc formation or interfloc bridging was observed. Open floc formation is the scattering of floc-forming bacteria in many small groups along the lengths of the filamentous organisms within the floc particles, while interfloc bridging is the joining in the bulk medium of the extended filamentous organisms from two or more floc particles. The relatively small amount of open floc formation and interfloc bridging undoubtedly was due to the short length of most filamentous organisms (< 100 um) and the small population size of the filamentous organisms.

The relative abundance of the population size of the filamentous organisms was rated as a "3" on a scale of "0" to "6" with "0" being "none" and "6" being "excessive." A rating of "3" is "common" or "filamentous organisms observed in most floc particles at low density, e.g., 1 to 5 filamentous organisms per floc particle." At this rating the relative abundance of the filamentous organism population would not adversely affect solids settleability.

The were four significant filamentous organisms. These organisms in order of dominance were *Halsicomenobacter hydrossis*, type 0092, type 1701, and *Nocardia* sp. Of these organisms type 0092 and *Nocardia* sp. are foam-producers.

The proliferation of *H. hydrossis* within activated sludge processes has been associated with low dissolved oxygen, low

F/M, and, possibly, low nutrients. The proliferation of type 0092 within activated sludge processes has been associated with low F/M. The proliferation of type 1701 within activated sludge processes has been associated with low dissolved oxygen and low nutrients (nitrogen or phosphorus). The proliferation of *Nocardia* sp. within activated sludge processes has been associated with many environmental and operational conditions, particularly the presence of excessive oils and greases.

The floc particles possessed no significant Zoogloeal growth, i.e., the rapid proliferation of floc-forming bacteria, and the floc particles tested negatively to the India ink reverse stain. This stain is used to determine the presence of a probable nutrient deficiency.

Much particulate material was observed free-floating between the floc particles, and a copious amount of dispersed growth was present. The relative abundance of the dispersed growth was rated as "significant" or "1" on a scale of "0" to "2" and is indicative of the interruption of proper floc formation. It is suspected that the presence of the much particulate material and significant dispersed growth is due to a "start-up" condition.

PROTOZOAN PROFILE & COUNT

The protozoan community was dominated by the lower life forms, e.g., flagellates and free-swimmers. These protozoa displayed much activity and no structural damage.

The count for the community was less than 100 protozoa per milliliter of mixed liquor. It is suspected that this relatively sparse population size of the community is due to a "start-up" condition.

CROMAGLASS MIXED LIQUOR ANALYSES

SAMPLE DATE: NOVEMBER 16, 1995

FLOC CHARACTERIZATION & FILAMENTOUS ORGANISMS

Most floc particles were small (< 150 um) to medium (150 to 500 um) in size; the majority being 100 to 400 um in length. Due to a significant growth of filamentous organisms, most floc particles were irregular in shape. However, an occasional oval-shaped floc particle was observed.

As revealed through phase contrast microscopy and methylene blue and India ink stainings most floc particles were firm in structure, i.e., the floc-forming bacteria were tightly adjoined. No significant sign of shearing was observed with any floc particle.

Neither interfloc bridging nor open floc formation was observed in any significant amount. The range in lengths of most filamentous organisms was 100 to 200 um.

The relative abundance of the population of the filamentous organisms was rated as "3" on a scale of "0" to "6' with "0" being "none" and "6" being "excessive." A rating of "3" is "common" or "filamentous organisms observed in most floc particles at low density, e.g., 1 to 5 filamentous organisms per floc particle." At this rating the relative abundance of the filamentous organism population would not adversely affect solids settleability.

The majority of the filamentous organisms was found extending into the bulk medium from the perimeter of the floc particles, and copious amount of relatively short, < 100 um, filamentous organisms was observed free-floating in the bulk medium.

There were four significant filamentous organisms. These organisms in order of dominance were *Haliscomenobacter hydrossis*, type 0092, type 1701, and *Nocardia* sp.

An occasional growth of Zoogloeal was observed. This growth was amorphous.

A significant amount of particulate material was observed free-floating in the bulk medium and protruding from floc particles. The relative abundance of the dispersed growth was rated as "significant" or "1" on a scale of "0" to "2."

PROTOZOAN COUNT & PROFILE

The count or relative abundance of the protozoan community was 1500 protozoa per milliliter of mixed liquor. This community was dominated by the Spirotrichia or crawling ciliates. The profile or percent composition of the community was:

Protozoan Group	Percent
Amoebae	06
Flagellates	09
Free-swimming ciliates	04
Crawling ciliates	70
Stalked ciliates	11

SUBJECTIVE SCORING OF FILAMENTOUS ORGANISM ABUNDANCE

0 ..... NONE

1 .... FEW

filamentous organisms present but only observed in an occasional floc particle

2 .... SOME

filamentous organisms commonly observed but not present in all floc particles

3 .... COMMON

filamentous organisms observed in all floc particles at low density, e.g., 1 - 5 filamentous organisms per floc particle

4 ..... VERY COMMON

filamentous organisms observed in all floc particles at medium density, e.g., 6 - 20 filamentous organisms per floc particle

5 .... ABUNDANT

filamentous organisms observed in all floc particles at high density, e.g., > 20 filamentous organisms per floc particle

6 .... EXCESSIVE

filamentous organisms observed in all floc particles; appears more filamentous organisms than floc particles and/or filamentous organisms growing in high abundance in bulk solution