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Mill Characterization:

British Columbia Forest Products Limited, Crofton Pulp and Paper Division

December 1973

74-6

Manuscript Report 74-6
Pacific Region

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MILL CHARACTERIZATION:
BRITISH COLUMBIA FOREST PRODUCTS LIMITED
CROFTON PULP AND PAPER DIVISION

December, 1973

by

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and

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Environment Canada
Environmental Protection Service
Pollution Abatement Branch
Pacific Region

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ABSTRACT

This report was prepared from technical data provided by British Columbia Forest Products Limited, Crofton Pulp and Paper Division. The report provides supplemental information for establishing a water pollution abatement program to meet the requirements of the Federal Pulp and Paper Effluent Regulations. The report will be used as a guide when determining the progress and changes made by the mill to achieve the requirments of the Federal Pulp and Paper Effluent Regulations.

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1. INTRODUCTION

The following assessment of British Columbia Forest Products Ltd., Crofton Mill, was carried out in December 1973. The project was initiated with a number of purposes in mind. Firstly, an attempt was made to become familiar with individual mill processes in order to gain insight into sources of particular effluent streams. Also, an up-to-date inventory of sampling methods, testing techniques and abatement facilities was compiled. During this period a good working relationship was established with the Mill personnel involved in water pollution abatement programs.

2. MILL DESCRIPTION

2.1 Location

Crofton Pulp and Paper Division is located near the village of Crofton on Vancouver Island. Effluent is discharged to Stuart Channel.

2.2 Organizational Structure

Mill Manager	F.J. Frisch
Technical Services Super.	E.C. Metherell
Assistant Technical Services Super.	D. Hill

The Technical Department is responsible for assessing pollution problems. Within this group an environmental engineer, D. Smiley, and four technicians are devoted full time to air and water pollution abatement programs. A union pollution committee has not been formed.

2.3 Operation Information

2.3.1 Production. The Crofton Pulp and Paper Mill produces Newsprint and Bleached Kraft Pulp. Table 1 shows October 1973 average production data.

TABLE 1. PRODUCTION, OCTOBER 1973.

PRODUCTS	ADT/D
Newsprint	750
Groundwood	594
Kraft Pulp (Fully and Semi Bleached)	1,020
Total Saleable Product	1,545

2.3.2 Water Supply. A weir at the mouth of Cowichan Lake controls storage and lake discharge rate. Process water is drawn from the Cowichan River. The intake is protected by four 1/8 inch chain belt travelling water screens.

In the past, problems have arisen with as many as 6,000 fry per day being trapped in the water screening system. Improvements over the past few years have apparently reduced fry entrapment to negligible levels.

Water treatment is required before use in the process because of water quality variations in the Cowichan River. Water treatment consists of:

(a) chlorination and alum addition,

(b) settling (two 6,000,000 gal. capacity ponds),

(c) downflow microfloc filtration (12 separate beds).

Treated water is stored in two clear wells (capacity 1,600,000 gal.).

The filters are backwashed daily. Depending on the raw water conditions, this might amount to 8,000 gpm over 14 minutes six times per day (or roughly 500 gpm over the day). This discharge flows onto mud flats about 1 mile north of the mill site. The S.S. and BOD_5 of this effluent stream should be characterized as part of the total mill discharge.

Mill water usage over October 1973 averaged 55 x 10^6 GPD or 36,000 USG/ADT.

2.3.3 Chip Supply. 697,000 BDT of chips are consumed per year. About 93% of these are purchased while the remainder are manufactured on site.

Chips are stored in the mill yard according to species; there are separate piles of Hem-bal, Fir and Cedar. The total storage capacity is 100,000 units. Drainage from the piles runs to the Wood Mill settling ponds.

Wood species composition to the digesters is shown in Table 2.

TABLE 2. SPECIES TO DIGESTERS

SPECIES	BATCH DIGESTERS	KAMYR CONTINUOUS
Fir	38	75
Hemlock	43	25
Cedar	19	--

2.3.4 Mill Processes. A complete Mill Equipment List is shown in Appendix I. The following is a brief characterization of major processes.

2.3.4.1 Wood mill. (Average production: 450 cunits/day). Major equipment is listed below:

- 30 inch Nicholson ring barker
- Bellingham barker
- 1 Gruendier Chipper
- 1 Hansel 112 inch Chipper
- 1 Nicholson 112 inch Chipper
- Hog dewatering; Tyroc Screen

2.3.4.2 Groundwood. The major equipment utilized in the Groundwood Process is listed below:

(a) Stone Groundwood:

- 8 Kohering Wateroos Great Northern Grinders, 6,000 HP per pair.
- 4 Great Northern Grinders, 8,000 HP per pair.
- Coarse Screens; four Jonsson Screens.
- Fine Screens; 4 Cowan KX-400 Primary Screens and 1 Cowan KX-300 Secondary Screen.
- Bleach Tower (Sodium Hydro); 20 ADT capacity at 4% Cs.
- Bleach Washers; 3 D.O.L. 8 ft. dia. x 16 ft. type 1611.
- Hi Density Storage; one 260 Ton unit.

(b) Refiner Groundwood:

- Refiners; 3 Stage Bauer 480 (48 inch) Twin Disc Refiners.
- Fine Screens; 3 Cowan KX-300's.
- Cleaning; 56 Primary Bauer centricleaners,
  28 Secondary Bauer centricleaners,
  12 Tertiary Bauer centricleaners.
- Bleach Tower; 10 ton capacity at 4% Cs.
- Bleach Washer; 1 D.O.L. 8 ft. dia. x 16 inch Type ISF11.
- Hi Density Storage; one washed stock chest.

(c) Common Equipment: The following equipment is common to both the Stone and Refiner Groundwood processes.

- Tailings Chest,
- Refiners; Two Bauer 411 Double Disk,
- Drainers; Twin Screw ESCO presses,
- Cleaners; Six Bauer 606 centricleaners (bypassed).

2.3.4.2 Sheet Formation.

(a) Newsprint (Machine No. 1 and No. 2);

- Brake Refiner; Jones Stockmaster
- Cleaners; Primary, 28 Bauer 623 Cleaners
  Secondary, 5 Bauer 623 Cleaners
  Tertiary, 2 Nichols Freeman 610 Vorjects
- Screens; Primary, 5 pressure screens
  2 Black Clawson Model 30P
  3 Bird Screen Model 14L
  Secondary, Jonsson screen.
- Paper Machine; Beloit Walmsley 3,000 FPM
- Fourdrinier wire; 272 inch wide x 152 feet

(b) No. 1 Pulp Machine;

- 550 T/day at 95% AD
- Design Speed 500 FPM
- Dominion Fourdrinier Wire; 178 in. x 95 ft.
- Dryer; Dominion (Minton-vacuum) 68 - 60" dia. x 178"
  CI dryers 75 psi stream.

(c) No. 2 Pulp Machine;

- 400 T/day at 95% AD
- Design Speed 500 FPM, Actual 300 FPM
- Dominion Fourdrinier wire, 178 in. x 95 ft.
- Dryer; SF Flakt type L.
  17 Decks
  150 psi steam.

2.3.4.4 Pulping. Bleached kraft production over October 1973 averaged 1,020 ADT/D.

(a) Digesters; major equipment is summarized below:

i. No. 1 Line;

- 8 Batch digesters; 6,125 ft^3 ea.
- 80 ADT/day capacity each
- Blow Tank; 50 Ton Capacity

ii. No. 2 Line;

- 1 kamyr continuous digester; design rating = 360 ADT/day, operated at 440 ADT/day. (Internal Diffusion Washer).
- Blow Tank; 60 Ton Capacity.

(b) Washers and Knotters; major equipment is listed below:

i. A Side;

- Knotters; 6 CIR Johnson Screens with 5/16" perforations.
- Brown Stock Washers; (3), 11' 6" dia. x 20' Sherbrooke vacuum washers.
- Seal Tanks; No. 1A 414,000 U.S. Gal.
  No. 2A 321,000 U.S. Gal.
  No. 3A 256,000 U.S. Gal.
- Brown stock Hi Density Storage; 3 at 30 tons each
- Brown stock washer soda loss; 25 lb. Na_2SO_4 per ADT.

ii. B. Side;

- Knotters; 5 CIR Johnson 1/4" perforation.
- Brown Stock Washers; (2) 11' 6" dia. x 20' Sherbrooke vacuum washers.
- Seal Tanks; No. 1B 321,000 U.S. Gal.
  No. 2B 256,000 U.S. Gal.
- Hi Density Storage; 2 at 100 ADT each.
- Brown stock washer soda loss; 10 lb. Na_2SO_4 per ADT.

iii. Common Equipment;

- Foam Tank; 100,000 U.S. Gal.
- BCRC oxidation tower
- Troebeck Ahlen Oxidation system.

(c) Brown Stock Screening;

i. No. 1 Side:

- Screens; primary, 4 MKA cowan,
  secondary, 1 MKA cowan,
  tertiary, 1 MKA cowan.

- Cleaners; 5 Bauer 623-4 cleaners
  1 610 Vorject cleaner
  2 640 Magna cleaners
  1 Sprout Waldron No. 40 Flat Bed Drainer
  1 Bauer 551 Flat Bed Drainer
  1 Sprout Waldron 36-2 Refiners
- Decker; 1 Sherbrooke 11.5 ft. dia. x 20 ft. vacuum decker,
  1 Bird #6A Saveall (converted to Slusher)

ii. No. 2 Side; (differences noted)
- Screens; primary, 3 KX 400 cowan
  1 MKA cowan
  secondary, 1 KX 300 cowan

2.3.4.5 <u>Recovery, Steam Plant</u>.

(a) Evaporators;
- No. 1 Horton Conkey Sextuple effect, capacity 356,000 lb/hr
- No. 2 Jacoby Dominion Bridge Sextuple effect, capacity 330,000 lb/hr.

(b) Liquor Storage;
- W.B.L., 2 tanks at 345,000 U.S. Gal. ea.
- S.B.L., 2 tanks at 93,000 U.S. Gal. ea.

(c) Recovery Boiler (2);
- No. 1; C.E. 1,600,000 lb BLS/day with Koppers 2 field dry bottom precipitator
- No. 2; C.E. 1,600,000 lb BLS/day with Joy Cottrell 2 field dry bottom precipitator.

(d) Power Boilers (3);
- No. 1 and No. 2; Foster Wheeler hog/oil
  200,000 lb steam/hr ea. oil
  140,000 lb/hour hog and oil

- No. 3; Foster Wheeler oil
  300,000 lb steam/hour

2.3.4.6 Recausticizing.

(a) No. 1;

- Mud Filter; DOL 6' x 10', Nash L-A vacuum pump
- Kiln; 10' x 250' Traylor Kiln
- Scrubber; Peabody
- Slaker; DOL #10
- Causticizers; 3 in series DOL #15, 15' dia x 10' deep
- W.L. Clarifier; DOL 35 ft dia x 25 ft deep
- Mud Washers; DOL 35 ft dia x 25 ft deep
- Green Liquor Clarifier; DOL 40 ft dia x 15 ft deep

(b) No. 2; Same as No. 1 except 10 ft dia x 250 ft Smidth Kiln

(c) Common Equipment;

- Raw G.L. Storage; 35 ft dia x 22 ft deep, 158,000 U.S. Gal.
- Clear G.L. Storage; 35 ft dia x 22 ft deep, 158,000 U.S. Gal.
- Series Dregs Washing;
  No. 1, Dregs Washer 20 ft dia x 10 ft deep
  No. 2, Dregs Washer 22 ft dia x 10 ft deep
- W.L. Storage;
  No. 1, 32 ft dia x 30 ft high, 180,000 U.S. Gal.
  No. 2, 33 ft dia x 30 ft high, 190,000 U.S. Gal.
- Weak Wash Storage; 35 ft dia x 30 ft high, 215,000 U.S. Gal.

2.3.4.7 Kraft Bleach Plant. A and B Side, capacity 500 ADT per side.

(a) A side; Full Bleach CEHDED

- Towers; T10 (Chlorination) 50 min retention at 3% Cs.
  T20 (caustic extraction) 2 hrs at 11% Cs.

T30 (hypochlorite) 2 hrs at 11% Cs.
T40 (ClO_2) 3 hrs at 12% Cs.
T50 (2nd C.E.) 2 hrs at 11% Cs.
T60 (2nd ClO_2) 3 hrs at 12% Cs.
Semibleach for news extracted after T30.

- Washers; W15, W25, W35, W45, W55, W65. Sherbrooke 11.5 ft dia x 20 ft vacuum washers.
- Hi density storage; 3 at 30 Tons ea.
- Screens; primary, 1 cowan MKA
  secondary, 1 cowan MKE
  tertiary, 1 cowan KX 100
- Cleaners; primary, 800 - 3" Bauer
  secondary, 144 - 600E-1 3" Bauer
  tertiary, 7 - 606-110 Bauer with stocksavers.

(b) B side; Full Bleach CEHDED
- Towers; see Side A
- Washers; see Side A
- Hi Density storage; 2 at 100 tons each
- Screens; primary, 3 CIR Model 14L centriscreens
- Cleaners; primary, 5 Primary, Radiclone 40-400 units
  secondary, 2 secondary tertiary, Radiclone 40-300 VK3.

(c) Common Chemical Plant;
- Two 8 T/d Mathieson Primary ClO_2 generator,
- One continuous sodium hypochlorite manufacturing system,
- One Lundberg Ahlen Molton Sulphur Burning System.

2.3.5 Water Reuse. No. 1 and No. 2 side evaporator clean warm water is reused in the following areas:

(a) Bleach washers,
(b) A Side Brown Stock Washers.
(c) B Side Brown Deckers.

The No. 1 Evaporator contaminated condensate is reused on the Brown Stock washers while the No. 2 Evaporator contaminated condensate is reused in the Recaust area; the foul condensate stream is sewered. Brown white water is reused on the Block flume at a rate of 900 gpm.

The Digester condensate, after heat recovery, overflows directly to sewer. This low flow stream (200 gpm) represents a very high percentage of the total mill BOD_5 output (14%, see BOD_5 balance, page 16) and is probably also highly toxic. Air or steam stripping is being considered as a means of lowering the BOD_5 of this stream and making it suitable for reuse.

3. SEWER SYSTEM AND EFFLUENT CHARACTERISTICS.

3.1 Sewer Layout

A layout of the Sewer System is shown in Figure 1. In brief, the Groundwood and News area along with the B Pulping group discharge to the North (N) sewer. The A pulping group and the remainder of the Kraft Mill discharge to the South (S) line. The woodmill effluent discharges at a separate point.

3.2 Spill Detection

Continuous pH probes are located on the N and S main outfalls, while conductivity probes are located on the Recovery and Digester sewers. Temperature detection probes are located on the following storage tanks:

(a) Recaust Area
- W.L. Storage
- Mud Washers
- Receiving Tanks (retention tanks following the causticizers).

(b) Recovery Area
- S.B.L. Storage
- W.B.L. Storage
- Precipitator Mix Tanks

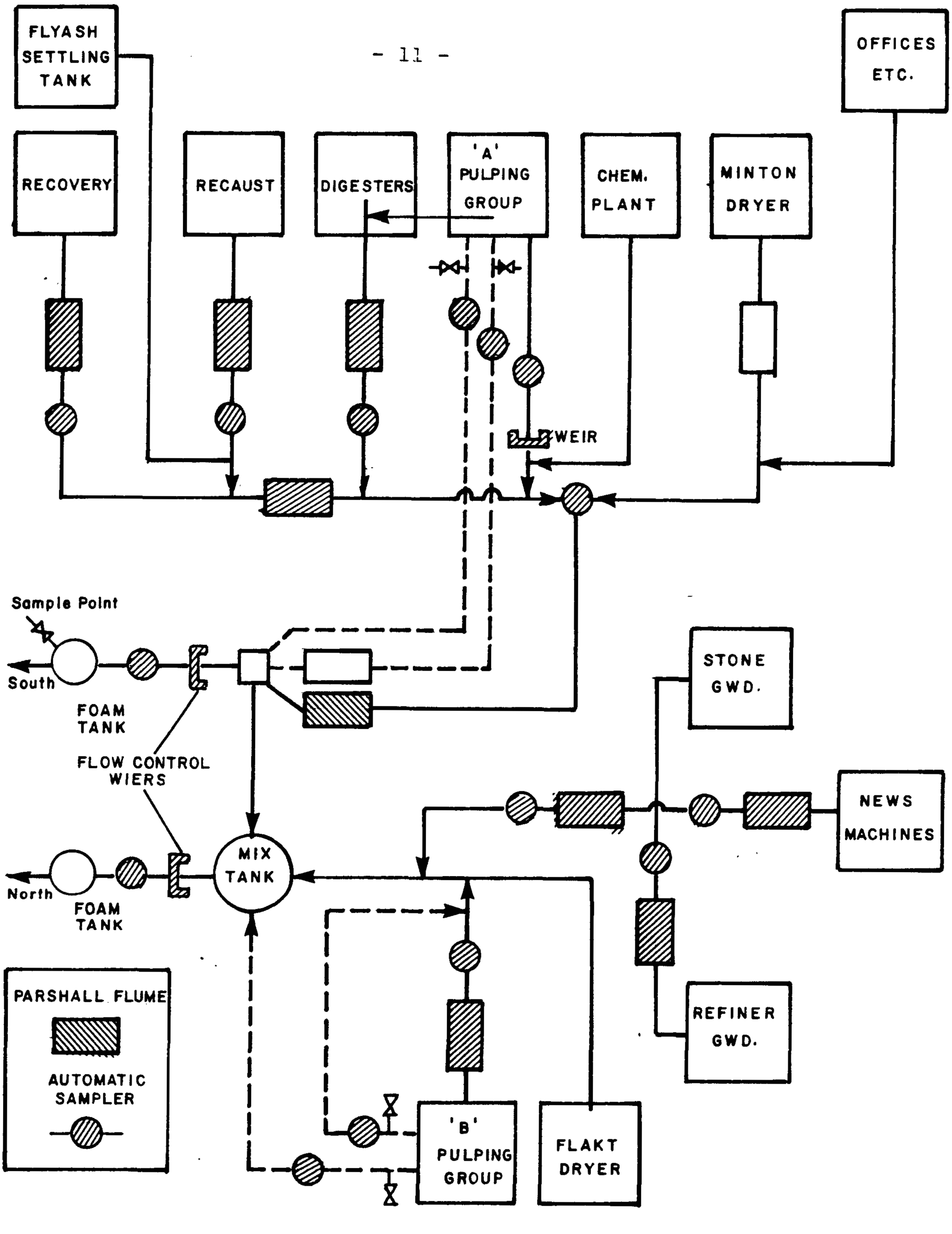


FIGURE I SEWER LAYOUT

3.3 Sewer Sampling

Sampler locations are shown in Figure 1. Continuous samplers are either chain or vacuum driven. Neither type samples on a flow proportional basis. Both types appear to be simple and reliable, although the plastic air lines of the air driven samplers are subject to leaks.

The Woodmill effluent is not sampled continuously. However, this is a budgeted item; installation is awaiting a P.C.B. decision as to whether the Woodmill effluent is to be piped over the mudflats or combined with the main effluent streams. If the woodmill effluent is to remain a separate discharge, a continuous sampler will be installed.

The following tests are carried out daily on North and South composite samples and on the woodmill grab sample:

- Suspended Solids (S.S.)
- Volatile S.S.
- Settlable Solids
- Calcium
- Sodium

BOD_5 analysis is carried out twice weekly on daily composite samples from the N and S effluent lines and on grab samples from the Woodmill discharge.

3.4 Final Effluent Discharge

3.4.1 Provincial and Federal Effluent Quality Requirements. Crofton Pulp and Paper Division has applied for a P.C.B. Level B discharge permit. The effluent characteristics stipulated are shown in Table 3.

As an existing mill, the Federal Pulp and Paper Effluent Regulations stipulate that Crofton Division would be required to meet standards more stringent for suspended solids and toxicity. The federal requirements are shown in Table 4.

TABLE 3. PROVINCIAL OBJECTIVES (P.C.B., LEVEL B)

(a) Kraft and Groundwood Pulping

Characteristic	Value
pH Range	6.5-8.5
Temperature	95°F
Floatable Solids	Negligible
Total Suspended Solids	30 lb/ADT
Settleable Solids	2.5 mℓ/ℓ
BOD_5	60 lb/ADT
Toxicity (TLm96)	12.5%
Mercaptans	< 2.0 mg/ℓ
Sulphides	< 1.0 mg/ℓ
Dissolved Oxygen	> 2.0 mg/ℓ
Residual Chlorine	< 0.1 mg/ℓ

(b) Woodmill Hydraulic Debarker

Total Suspended Solids	4.0 lb/cunit
Settlable Solids	2.5 mℓ/ℓ
BOD_5	4.0 lb/cunit
Floatable Solids	Negligible
pH Range	6.5-8.5
Toxicity (TLm96)	12.5%

TABLE 4. FEDERAL REQUIREMENTS.

Process		Allowable Discharge S.S.	BOD_5
Hydraulic Debarking		5 lb/ODT of wood	
Kraft Pulping		7 lb/ADT	64 lb/ADT
Kraft Bleaching		6 lb/ADT	27 lb/ADT
Kraft Sheet Formation		2 lb/ADT	
Groundwood Pulp Sheet Formation	Kraft	3 lb/Product Ton	
	Gwd	5 lb/Product Ton	
Groundwood Pulping		13 lb/ADT	
Groundwood Brightening		2 lb/ADT	

Toxicity - 80% survival at 65% V/V concentration over 96 hours.

3.4.2 Current Crofton Final Effluent Discharge.

3.4.2.1 BOD_5 and S.S. The October 1973 (considered a typical month) average mill S.S. and BOD_5 discharge has been shown in Table 5. The Crofton discharge has been contrasted with the P.C.B. Objectives and the Federal Effluent Requirements.

TABLE 5. OCTOBER (1973) DISCHARGE.

(a) Pulp and Paper Mill

	Crofton Discharge	Federal Allowable	PCB Level B
S.S.	69,600 lb/D	31,320 lb/D	48,300 lb/D
BOD_5	89,600 lb/D	No specification	87,800 lb/D

(b) Woodmill

	Crofton Discharge	Federal Allowable	PCB Level B
S.S.	750 lb/D	2,880 lb/D	1,520 lb/D
BOD_5	756 lb/D	No specification	1,520 lb/D

3.4.2.2 Toxicity. Little toxicity data is available. Work carried out at B.C. Research in 1971 indicated that there was 0% survival of coho salmon in a 45% (V/V) mixture of either N or S effluent and fresh water. Tests carried out by EPS on the Woodmill effluent showed this stream to have a TLm96 value of about 40%.

3.4.2.3 Miscellaneous effluent characteristics. The pH of the N effluent is generally lower than pH of the S line. Over October 1973 the S line averaged pH 4.3 while the N effluent averaged pH 3.7. The temperatures of both sewers averaged 91°F. Colour measurements have not as yet been carried out on the Crofton effluent.

3.4.3 Process Losses. In plant loss measurements have received high priority at Crofton. The resulting balances indicate sources of effluents within the processes.

3.4.3.1 Flow. A flow balance is shown in Figure 2: Estimated as opposed to measured flows have been indicated. It should be pointed out that direct flow measurement on the N and S effluent lines does not exist (see page).

3.4.3.2 Suspended solids. A S.S. balance for October 1973 is shown in Figure 3. The mill S.S. loss minus the Recaust S.S. loss (which is mainly inorganic material) can be equated with fiber loss. It is interesting to note that the Kraft Mill losses for October were 0.6% of the total production (1,020 ADT/D). In the Groundwood area, fiber loss accounted for 1.8% of the total production. In this area, fiber loss averaged 2.0% of the production over 1972. It should be noted that the S.S. load of the Bleach Acid and Alkali sewers have not been measured and so are not included in the S.S. Balance.

3.4.3.3 BOD_5. A BOD_5 balance prepared from October 1972 to December 1972 data is shown in Figure 2. It can be seen that the Evaporator foul condensate and the Hot Water Accumulator overflow constitute 18% of the total mill BOD_5 output while amounting to only 0.6% of the total mill flow.

3.4.3.4 Sodium. A sodium balance over October 1973 is shown in Figure 3. Only the sodium associated with the liquor cycle has been shown. Sodium losses via the Bleach sewers has been omitted. The total output of sodium from the liquor system was measured at 39,194 lb Na/D. The total input (saltcake makeup and spent acid addition) was estimated to be 36,800 lb Na/D.

3.4.3.5 Boron. Zn hydro has recently (October) been replaced by sodium hydrosulphite. The Borol process is used to manufacture sodium hydro. This requires the use of $NaBH_4$, which by actual measurement results in 1 mg/ℓ of Boron in the north sewer.

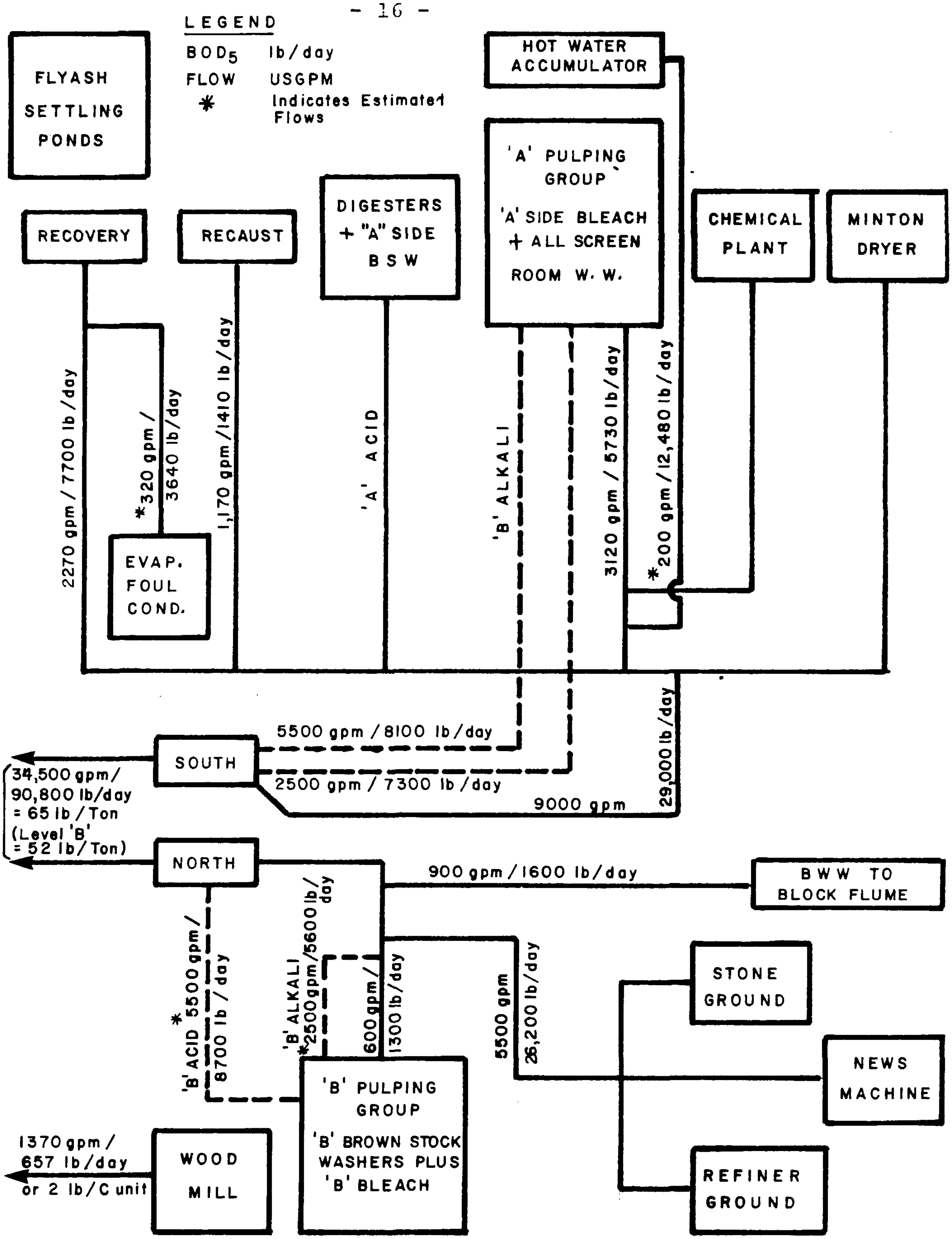


FIGURE 2 BOD_5 AND FLOW BALANCE

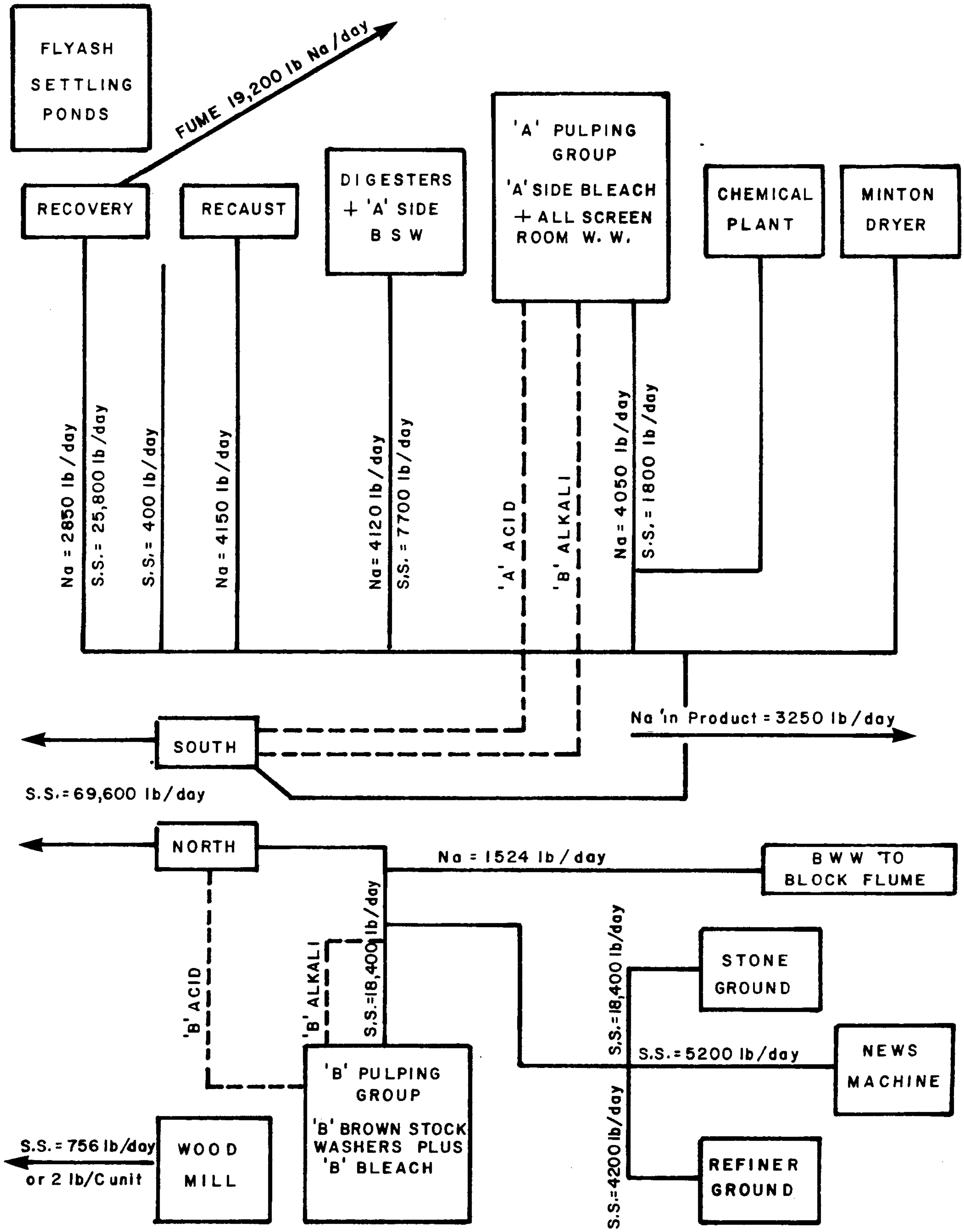


FIGURE 3 Na AND S.S. BALANCE

This is in agreement with the calculated amount of boron in the sewer as $NaBO_2$. Assuming a weekly $Na_2S_2O_4$ production of 90,000 lb and knowing that 1 mole of $NaBO_2$ is sewered for every 4 moles of $Na_2S_2O_4$ produced, it can be shown that the Boron content in the N sewer (20,000 gpm) is about 1 mg/ℓ and the Boron concentration at the main outfall (35,000 gpm) is about 0.6 mg/ℓ. The discharge of Boron is between 200 and 300 lb/day.

3.4.3.6 Slimicide. Slimicide usage (mainly RX17 and Nalco 243) over October 1973 averaged 115 lb/D. Usage rates may increase because of the replacement of Zn hydro. The slimicide is stored in bulk with no spill catchment facilities.

3.4.3.7 Calcium. Recaust lime losses averaged 25,800 lb $CaCO_3$ per day over October 1973. The dregs sewered amounted to 13,700 lb/day (6.8 T/D).

3.5 Effluent Monitoring Procedures

Detailed procedures for S.S., BOD_5 and total solid analysis have been included in Appendix II.

3.5.1 Solids. Crofton Division uses 12.5 cm Reeve Angel 202 and a 500 ml sample for S.S. determinations. This filter paper is advertised as a very rapid, low retention paper and so is not equivalent to Whatman GF/C. The Lab has attempted to use GF/C but found it to be unsuitable for V.S.S.

3.5.2 BOD_5. A Y.S.I. Model 54 D.O. meter is used for all dissolved oxygen measurements. This meter is calibrated in oxygen saturated water but is not routinely checked against the Winkler Method.

Distilled water is prepared from a Corning AG-1 glass still with a glass covered element. Still feed is pretreated Cowichan River water.

The sample undergoes tests for oxidizing or reducing agents; pH adjustment is carried out before the BOD_5 determination is made.

3.5.2.1 Dilution water preparation and BOD_5 calculation. Distilled water is aerated for 24 hours prior to use. Nutrient chemicals and seed are added to make dilution water.

Nutrients = 1 mℓ/ℓ

Seed = 1 mℓ/ℓ

Distilled water, dilution water and diluted samples are incubated at 20°C for 5 days. The distilled water depletion is usually < 0.2 mg/ℓ, whereas the dilution water usually shows a seed activity which results in a depletion of about 0.3 mg/ℓ, "D". The sample BOD is then calculated from the diluted sample depletion "A" and the dilution factor "f":

$$BOD_5 = (A - D) \times \frac{1}{f} .$$

3.5.2.2 Seed preparation. 4 liters of "N" effluent and 4 liters of "S" effluent are mixed and neutralized. 10 ml of raw sewage are added and the culture is continuously fed the mixed effluent and continuously aerated.

3.5.2.3 Miscellaneous observations. All BOD apparatus, solutions, etc. are stored in a room maintained at 20°C. BOD_5 samples are incubated in a separate 20°C incubator. Generally this technique was found to give consistent results. The glucose standard averaged 196 mg/ℓ ± 12 mg/ℓ over 100 determinations, and samples carried out at different dilutions gave similar results. However, it was noticed that the distilled water sample often showed a significant depletion; usually greater than the dilution water sample.

Example: (actual trial)

Distilled water = 0.6 mg/ℓ

Dilution water = 0.0 mg/ℓ

This anomaly could be due to the 24 hour aeration (with Mill-Air) of the distilled water. This possibility was suggested by a trial carried out the week of November 19. A distilled water sample aerated in the usual manner showed a depletion of nearly 1 mg/ℓ (initial D.O. 9 mg/ℓ) while a non-aerated sample (initial D.O. 7 mg/ℓ) showed no depletion over 5 days. This anomaly should be pursued by the BOD technician. Also, the Y.S.I. meter should be routinely checked against the Winkler method.

3.5.3 Flow. Parshall Flume sites are shown in Figure 1. Daily average flows are calculated from continuous recording circular charts with the use of a planimeter (rather than "eyeball" estimation). There is no direct flow measurement on the main outfalls. To estimate total outflow, Mill water input is measured over one day. Tracer studies have shown that there is roughly a 55:45 split between the "N" and "S" outfalls. From separate concentration measurements of "N" and "S" sewers, the total output can be measured in pounds per day. Lack of direct flow measuring devices introduces a high degree of uncertainty into the lb/day measurement. This problem makes interpretation of balances very difficult. Tracer studies have been used to directly measure flows at the main outfall. The method utilizes KOH, which gives K^+ concentrations in the range of 200,000 mg/ℓ. This makes KOH much more versatile than LiCl, which only gives Li^+ concentrations of about 80,000 mg/ℓ.

4. POLLUTION ABATEMENT FACILITIES

4.1 Inplant Modifications

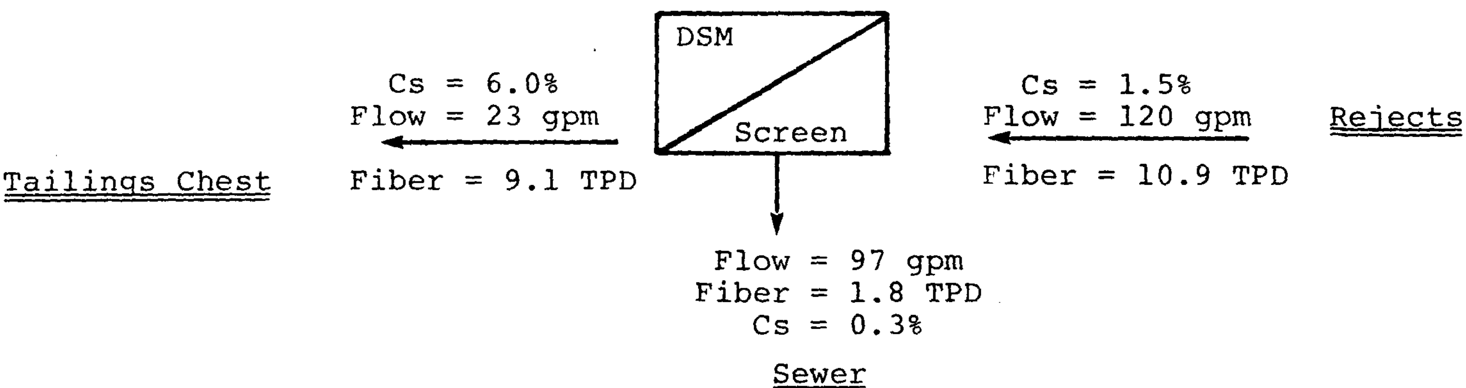
4.1.1 Groundwood Area. Major changes are indicated in Figure 4. In summary:

(a) Drainer effluent is returned to refiner dilution chest.

(b) Sawdust washer overflow is returned as sluicing water for the Jonsson screen rejects.

(c) Tertiary refiner groundwood cleaner rejects go to the tailings chest.

(d) Machine cleaner tertiary rejects and Jonsson screen rejects are returned to tailings chest via a 45^{o} DSM screen. The DSM screen thickens the rejects from 1.5% to 6.0% Cs, thereby lowering the flow of water to the tailings chest. Also 80% of the grit in the reject stream is sewered at this point. A fiber balance around the DSM screen is shown below.



These in-plant modifications have lowered News Fiber losses from 6% of production to about 1.5% to 3% of production.

(e) Use of $Na_2S_2O_4$ rather than $Zn_2S_2O_4$ may have caused substantial reductions in the toxicity of the News sewer. A study is under way to measure the effect of this change.

Further in-plant modifications are planned for the News area.

i. A third 411 refiner is to be added after the tailings chest.

ii. High consistency dilution water is to be utilized on the washers. At present three choices of dilution water exist for lowering the consistency of the stock from 3.5% in the Bleach tower to 1% at the washer vat.

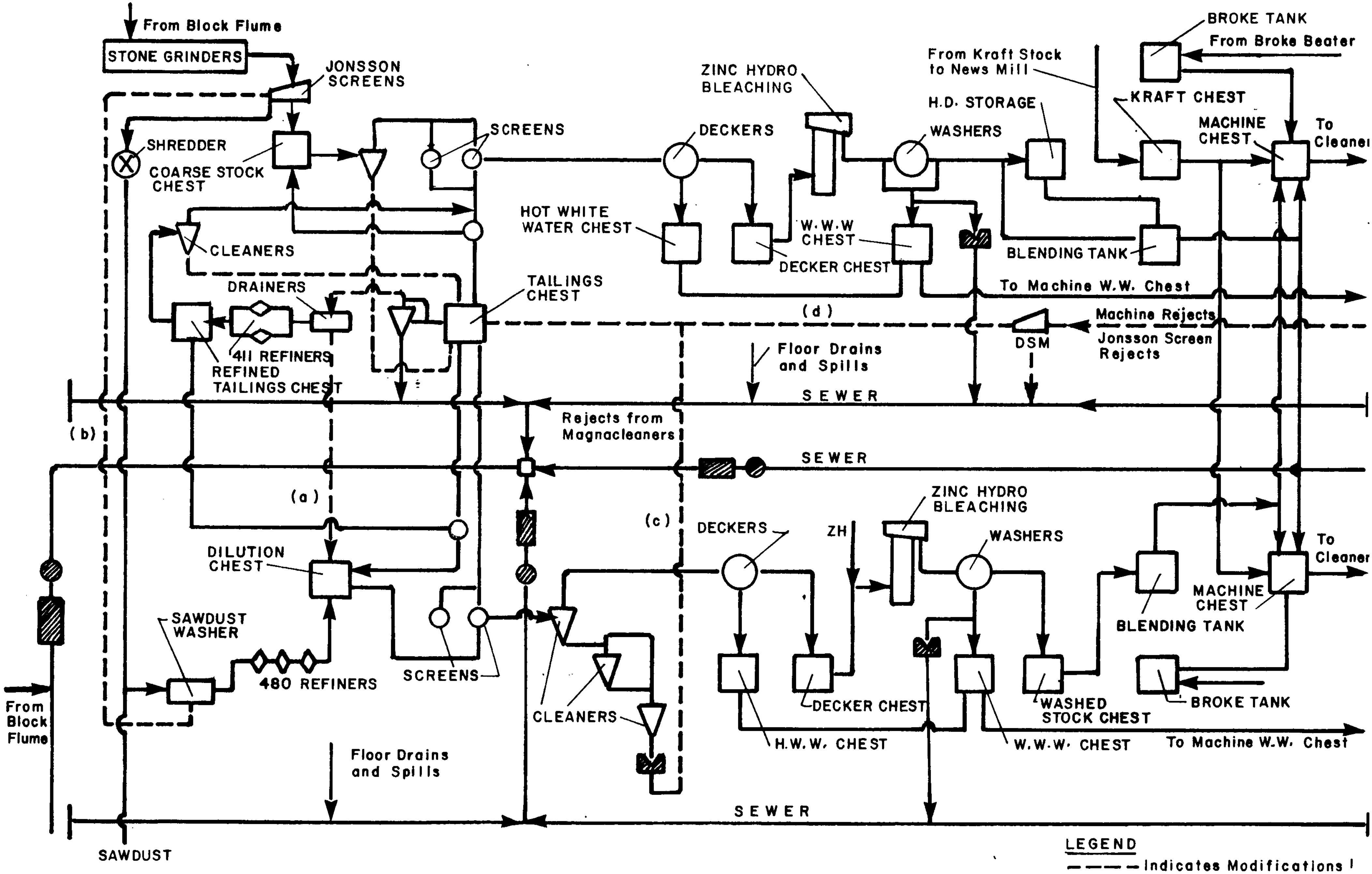


FIGURE 4 GROUNDWOOD MODIFICATIONS (a), (b), (c) and (d)

(1) News machine W.W. Cs = 0.12%

(2) Washer effluent Cs = 0.02%

(3) Freshwater

By giving priority to the use of excess News W.W. the washer is used as a saveall, sewering News W.W. at 0.02% Cs instead of 0.12% Cs. (Appendix III) It is predicted that with these modifications, losses could be reduced to about 0.95% of production. (Table 6).

TABLE 6. REMAINING LOSSES AFTER ADDITIONAL MODIFICATIONS

Source	Remaining Losses
Paper Mill - 3rd press	0.1 TPD
- vacuum pump to seal pit	0.8 TPD
Refiner Mill - DSM screen	1.8 TPD
- Washer seal pit	0.7 TPD
Stone Gdwd. - #1 and #2 washer seal pit	0.9 TPD
- #3 washer seal pit	1.0 TPD
- warm W.W.	1.8 TPD
Total Loss:	7.3 TPD

At 750 TPD production, this loss represents about 1% of production.

4.1.2 Kraft Area.

(a) The bleached cleaner rejects have been diverted from sewer to the News Hi-density. This represents a saving of about 8 TPD fiber. It also introduces much grit into the News system.

(b) Overflows on the Brown Stock Washers have been rerouted to the Brown Mix Chest. Work is proceeding to direct spills from Bleach Washers to the Mix Chest also.

(c) A DSM screen to remove fiber from the Digester sewer is under study.

(d) Operation of the Recaust Dregs Washer in series rather than in parallel has resulted in 50% lower saltcake losses in the Dregs. (Appendix IV)

(e) The expansion in progress should lead to marked reductions in the kraft mill pollution output. Basically the kraft expansion involves:

(1) a 100 ADT/D sawdust digester
(2) additional Brown Stock Washers
(3) a new set of evaporators
(4) a new 2,400,000 lbs B.L.S./D Recovery Boiler.

At present, Brown Stock washer soda losses average 25 lb Na_2SO_4/ADT for A side, and 10 lb Na_2SO_4/ADT for B (kamyr) side. After the expansion the kamyr digester is to be followed by a new Diffusion washer, while the sawdust digester plus one of the 80 T/day Batch digesters are to be followed by the original B side drum washers (2) plus a new drum washer, the 7 Batch digesters remaining will be followed by A side washers. The increased washing capacity should result in lower soda losses and therefore less contaminated screen room white water.

At the present time the recovery boilers are operated at about 30% over design capacity, while the evaporators are operating at their design rating. This conclusion was based on the assumption that 4,200 lb BLS are produced per ADT and that the boilers are rated at 3,200,000 lb BLS per day and the evaporators have a design rating of 686,000 lb/hr.

The expansion under progress should relieve the bottleneck at recovery. This additional capacity should make spill collection equipment more flexible, as lower Baume liquor will more easily be fed back into the system.

(f) The Recovery spill control system under construction involves a 360,000 gal. spill control tank. This will significantly reduce losses due to spills at the W.B.L., S.B.L., and precipitation mix tanks and during recovery washdowns.

4.1.3 Wood-Mill. Tyroc screens are used for bark dewatering. At present this system accepts about 11.7 ADT/D; 7.1 ADT/D of Hog are produced and 4.6 ADT/D of waste go to external treatment. Floor drains pass an additional 4.2 ADT/D directly to external treatment. A bull screen is being installed to handle the floor load. It is expected that this addition will lower the total Wood Mill solids output from 8.8 ADT/D to 5.9 ADT/D.

4.2 External Treatment

4.2.1 Flyash Settling Pond. The flyash treatment system consists of two ponds (40 ft x 50 ft x 8 ft ea.) operated alternatively. S.S. removal is about 90%. The overflow to sewer is 400 gpm and represents 300 to 500 lb of solids per day.

4.2.2 Wood Mill Settling Pond. This system also consists of two ponds operated alternatively. The east pond has a surface area of 55,200 ft^2, while the west pond has a surface area of 72,000 ft^2; both ponds are 12 ft deep. The inflow from the hydraulic debarker averages about 1,500 gpm. The 12 hour retention time results in a S.S. removal of 90% and a BOD_5 removal of perhaps 30% to 40%. Pond maintenance requires dredging about once every 5 to 6 months and results in about 900 BDT per year of landfill material. Some leakage was noted through the pond walls.

4.2.3 Oil Storage. The 50,000 Bbl oil storage tank is contained by an earth spill catchment dyke.

4.2.4 Domestic Sewage. The mill sewage is directed to a system of septic tanks which overflow to the general sewer. The woodmill septic tank, however, overflows to a separate drain field. Two of the dock lunchrooms have septic tanks, while the third dock lunchroom is equipped with a Bio-Pure sewage treatment unit.

4.2.5 Solid Waste. Flyash, wood mill pond dredgate, contaminated hog, slaker grits, etc. are trucked to two solid waste sites immediately south of the mill. These sites are operated under P.C.B. permit and have no obvious leaching or runoff problems.

APPENDIX I.

A complete equipment list is included in the Crofton Division file.

APPENDIX II.

A detailed account of the BOD_5, S.S. and T.S. test procedures used at Crofton can be found in the Crofton Division file.

APPENDIX III.

The Crofton Division report, "The Control of Newsmill Sewer Losses", (November 1973) by D. Morris and B. Marshall can be found in the Pulp and Paper file.

APPENDIX IV.

See the Crofton Technical Report assessing series vs. parallel operation of two dregs washers (TDM 68-65) in the Crofton Division Pulp and Paper file.